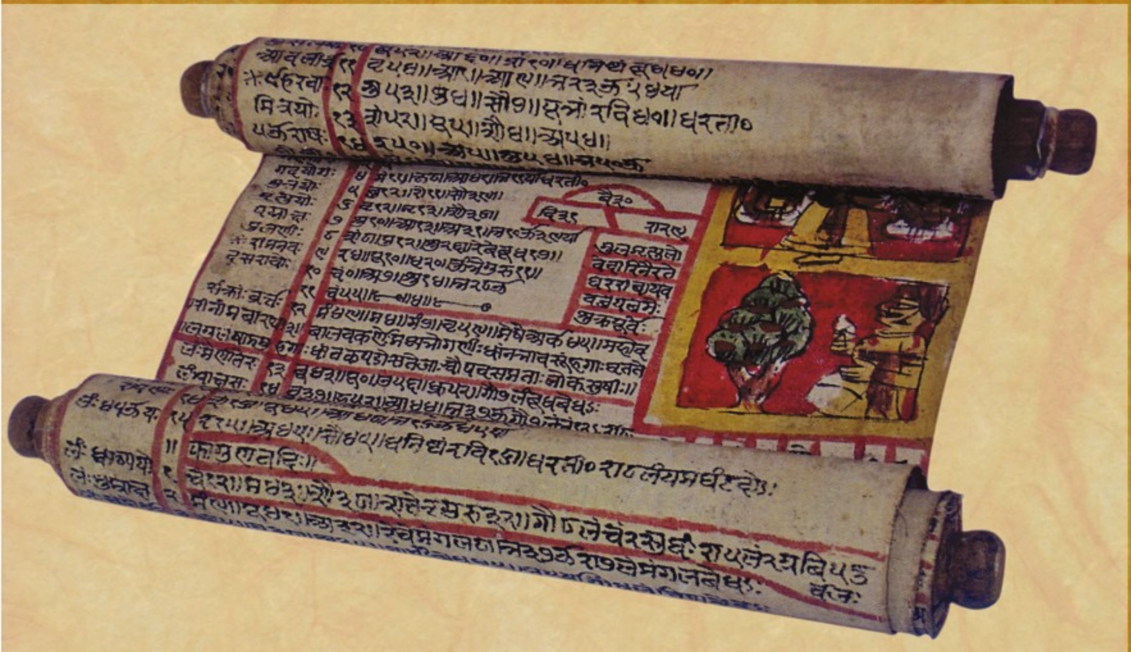
Samīkṣikā

Series 12

Manuscript Heritage on ASTRONOMY



National Mission for Manuscripts

This volume covers a wide range of topics such as astronomy, astrology, Indian mathematics and mathematicians, astro identities in Vedas, Vedic Jyotiṣa, contribution of *Āryabhaṭīyam*, rituals and religious observances associated with many astronomical developments, methods of disaster predictions, and the application of astronomy in varied contexts among many other topics, revealing the knowledge hidden in our old scriptures.

This volume should invoke the keen interest of many a scholar and should turn out to be of good use to the ongoing research in the field of astronomy and astrology.

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The experiences and knowledge from our past are recorded in manuscripts which have been handed down to us over several thousand years. The Government of India, through the Department of Culture, took note of the importance of this vast tangible heritage and, in order to preserve and conserve as well as to make access to this wealth easy, established the National Mission for Manuscripts (NMM). In order to disseminate the knowledge content of manuscripts, the Mission has taken up several programmes such as lectures, seminars and workshops. The Mission has published the proceedings of the above-said programmes under the following series: "Samrakshika" (on conservation), "Tattvabodha" (papers of Tattvabodha lectures delivered by eminent scholars), "Samiksika" (research-oriented papers presented in the seminars), "Kritibodha" (transcribed and edited texts prepared at advanced level manuscriptology workshops conducted by NMM) and "Prakashika" (publication of rare important unpublished manuscripts).

Manuscript Heritage on Astronomy is an outcome of a seminar organized by NMM and the Oriental Research Institute, Sri Venkateswara University, Tirupati, and is being published as No. 12 of Samiksika series. It carries contributions from thirty-eight well-known scholars and scientists of high repute covering varied topics on Indian astronomy and astrology. This trilingual book has seventeen papers in English and twenty-one articles in Sanskrit and Telugu (in Devanāgarī script).

Cover Photos:
Front: *Pañcāṅga* – Astrological Scroll, cloth, early 20th century, Gujarat.
(Collection: Sanskriti Museum of Everyday Art, New Delhi)
Back: Folios from the *Saṁgrahaṇī Sūtra*, 18th century CE, Rajasthan.
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Source (for both):
B.N. Goswamy, The Word is Sacred, Sacred is the Word

₹ 500

978-93-80829-44-9

Manuscript Heritage on Astronomy

Samīkṣikā - 12

General Editor
Veena Joshi

The Samīkṣikā Series is aimed at compiling the research papers presented by the distinguished scholars and specialists in the seminars organized by the National Mission for Manuscripts. The seminars provide an interactive forum for scholars to present to a large audience, ideas related to the knowledge contained in India's textual heritage.

Manuscript Heritage on Astronomy

Editor

V. Venkataramana Reddy

राष्ट्रीय पाण्डुलिपि मिशन
॥ विज्ञानमुपास्व ॥
National Mission for Manuscripts

PRINTWORLD
Publishers of Indian Traditions

Cataloging in Publication Data — DK

[Courtesy: D.K. Agencies (P) Ltd. <docinfo@dkagencies.com>]

National Seminar on "Manuscripts Heritage on Astronomy" (2012 : Oriental Research Institute, Sri Venkatesvara University)
Heritage on astronomy / editor: V. Venkataramana Reddy.
pages cm (Samīkṣikā; no. 12)
English and Sanskrit.
Papers presented at a National Seminar on "Manuscripts Heritage on Astronomy" during 2-4 February 2012.
Includes bibliographical references.
ISBN: 9789380829449

1. Hindu astronomy — Congresses. 2. Astronomy — India — History — Congresses. 3. Manuscripts, Sanskrit — Congresses. I. Reddy, V. Venkataramana, editor. II. Sri Venkatesvara University. Oriental Research Institute, organizer. III. Title.

QB18.N38 2012 DDC 520.954 23

ISBN: 978-93-80829-44-9

First published in India, 2017

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Published by:
National Mission for Manuscripts
No. 11 Mansingh Road
New Delhi - 110 001
Phone: (011) 2338 3894; *Fax:* 2307 3340
e-mail: director.namami@nic.in
Website: www.namami.nic.in

Co-published by:
D.K. Printworld (P) Ltd.
Regd. Office: Vedaśrī, F-395, Sudarshan Park
(Metro Station: Ramesh Nagar), New Delhi - 110 015
Phones: (011) 2545 3975; 2546 6019; Fax: (011) 2546 5926
e-mail: indology@dkprintworld.com
Website: www.dkprintworld.com

Printed by: D.K. Printworld (P) Ltd., New Delhi.

Foreword

ASTRONOMY caught the keen attention of all major civilizations of the past, be it Indian, Greek, Mesopotamian, Egyptian or Roman. India's contribution to this study was enormous and at the same time fabulous. Its well documented legacy started with Lagadha of the first millennium BCE, though there are numerous citations about astronomy in the Vedas, and continued through great scientists like Āryabhaṭa, Varāhamihira, Brahmagupta, Bhāskara I and II, Lalla, Śrīpati, Mahendra Sūri, Nīlakaṇṭha, Somayājī and Acyuta Piśarāti across centuries. In the process, we gave some unique contributions to the world in mathematics, physics and philosophy, and unveiled many a mystery about the universe. In addition to the great personalities listed above and numerous titles accredited to them, many of their manuscripts and other "not so famous" scientists' works on astrology are yet to be unveiled and put to scrutiny. The National Mission for Manuscripts is making an untiring and commendable effort to retrieve all such hidden treasures across different topics and is making serious attempts to disseminate such knowledge to the entire world through seminars, conferences, and publications, in addition to various other plans and programmes.

This book *Manuscript Heritage on_Astronomy* is the proceedings of a three-day seminar organized by the National Mission for Manuscripts in collaboration with the Oriental Research Institute of Sri Venkateswara University, Tirupati under the supevision of Prof. V.R. Reddy. It saw many an outstanding scholar presenting their papers on varied aspects of astronomy and astrology. The relevance of the astronomical and astrological knowledge is hidden in our

old scriptures. Fortunately we have scholars who can still locate and interpret this knowledge to the current generation, enabling the society to inculcate ethical, scientific and moral standards to preserve and sustain our universe.

Sadguru K. Sivananda Murty, in his keynote address has mentioned that *pañcāṅga*, a religious calendric record of planetary motions, was developed from the purely academic astronomy in India. But in last two centuries different *pañcāṅga*s, containing notable differences in the fixing of a religious event or for observance of religious festival, are creating confusion in people's mind. This situation in the Hindu religion-oriented astronomy has to be sorted out for the benefit of the practising Hindu.

He also brings forth the major difference between the Indian theory and Western theory regarding oscillation of the equinox. He requested the very eminent astronomers present in the conference not to reject the Indian theory, which was propounded by our ancestors, without going through an intensive examination.

Y.V. Subba Rao introduces to us all the towering personalities of Indian astronomy. He meticulously details their theories and inventions, and the uniqueness of their findings. He sketches all veterans from Lagadha to Acyuta Piśarāti. He, in another paper, delves into the moving zodiac in ancient Indian astronomy wherein he attempts to show that the astronomers and astrologers including Varāhamihira were fully aware of the "precession of the equinoxes". The astrological references can be fully utilized for determining the precise dates of several historical events in the cultural history of India for which the epigraphical and archaeological evidences have not been found.

In his paper K. Ramasubramanian makes one travel through the history of Indian mathematics and its implications in imparting mathematical education. It deliberates on various aspects such as how to construct a square that is *n* times a given square, how to transform a square into a circle, how did the *śulbakāra*s specify the

value of √2 and its expression and approximation.

M.D. Srinivas discusses about the contribution of the astronomers and mathematicians of the Kerala School. According to him, there are about 450 Sanskrit works in the domain, in addition to over 150 in Malayalam. He presents a chronological listing of the important members of the Kerala School and their works, pertaining to a period CE 1350–1850.

Karaṇapaddhati is a unique work of Putumana Somayāji. M.S. Sriram and R. Venketeswara Pai take us around the continued fractions in *Karaṇapaddhati*. Somayāji's concepts of *valayupasaṁhāra*, *alpaguṇakāra* and *alpahāra* are well accounted.

The moon asserts great influence on time calculations. Karanam L. Ramakumar and Vemuri V. Ramakrishna consider moon as the chronometre for rectification of birth time. They discuss in detail the *daśā* and *antardaśā* period.

P. Visalakshy talks about how year and time are reckoned in *jyotiṣa* manuscripts. It analyses the *kacaṭapayādi*, *kaṭapayādi*, *aṅkapalli*, *akṣarapalli*, *nannanyādi*, *vyañjanākṣarasaṁkhyāpaddhati*, *mālāsaṁkhyā* and *bhūtasaṁkhyā* systems.

Vedic *sūkta*s link deities with the cosmos. The various *mantra*s of the Vedas figure the deities, their activities and the scope of their application in the sacrifices. C.L. Prabhakar opines that these *mantra*s add up to the knowledge of Vedic astronomy.

According to K. Vasudeva Moorthy, P.B. Raghavaiah and K. Sitaramayya, the Vedic mythologies revolve around the cosmos along with the Milky Way, ecliptic, equinox and solstices in particular and other constellations in general. This mythology and divine descriptions are perfectly synchronized descriptions of the four-dimensional macro-cosmos with the micro-cosmic individuals. Moreover, this is perfectly astronomical and scientific as far as the spatial temporal factors are concerned. P. Bala Subrahmanyan charts out the significance of Vedic Jyotiṣa in our life.

Our ancestors did develop three steps, i.e. *madhyama gaṇita*, *mandasphuṭa gaṇita* and *bhūmadhya gaṇita*, to calculate and find out the right position of the planets. E. Sreedharan elucidates another step *ahargaṇa gaṇita*, which was also used to calculate the totality of days of the planets between the starting point and the intended date while revolving round the sun.

According to Narayanan Nampoothiri N.T., the credit of systematizing the knowledge of astronomy and mathematics that existed prior to Āryabhaṭa and providing them a social foundation, goes to Āryabhaṭa. B.H. Tukaram, with special reference to *Siddhānta Sārāṁśa*, opines that the earth is neither rotating around its own axis nor orbiting the sun. In reality, the sun, moon and stars are moving around the stationary earth.

M. Prabhakara Rao engages the readers with the works of great Telugu poets which bear testimony to their firm faith and thorough knowledge of astronomy.

P. Chinnaiah brings to light that Āryabhaṭa's astronomical calculation methods along with the trigonometric tables made foray into the Islamic world. Calendric calculations devised by Āryabhaṭa and his followeres have been in continuous use in India for practical purposes of fixing the Hindu calendar. T. Surendra Reddy says that alms-giving, associated with eclipses, is an Indian practice from time immemorial. We have references of eclipses even in *Ṛgveda*. Pravesh Vyas explores the science of natural disaster prediction in ancient Indian manuscripts and different means are specified there to read the onset of ecological dangers.

In addition to all these papers, this proceeding accommodates twenty-one authentic articles on astronomy and astrology in Sanskrit and Telugu (in Devanāgarī script) from scholars like Gopalakrishna Hegde, Ch. Sivaramakrishna Sharma, E.N. Ishvaran, A. Sripad Bhatt, Keshava Misra, K.C. Nagesh Bhatt, Krishneshvar Jha, P. Pawan Kumar, Chittaranjan Nayak, Govind Prasad Sharma, T. Murali Krishna, N.D. Jayakrishnan Nampootiri, Saagi

Kamalakar Sharma, Madhur Krishnamurti Shastri, Kashibhotal Nag Venkat Parvateeshvar Sharma, T. Venkateshwarlu, R. Anant Padmanabh Rao, V. Giridhar Kumar, P.C. Venkateshwarlu, Elevarty Chandramauli and Satyabhushan Ram.

The National Mission for Manuscripts is pleased to present this publication to readers to make them aware of the knowledge content of ancient Indian manuscripts. Moreover, the information contained in these scholarly papers would, I hope, contribute to the ongoing research in the field of astronomy and astrology.

15 August 2016

Veena Joshi
Director & Joint Secretary
National Mission for Manuscripts

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Keynote
to a National Seminar on Astronomy

Sadguru K. Sivananda Murty

Astronomy is an ancient subject of India besides other countries like Rome, Egypt, Chaldea and some other countries of the ancient world. The interest that the heavens kindled in all humanity, led the people to observe with regularity, a changing picture of the heavens and record their findings. Ancient astronomy in any country is a record of long-time observations of repetitive phenomenon like rising of a star with a periodicity, the heliacal rising and setting of planets, eclipses, etc. A science developed in due course in all these countries adding mathematical expressions of the phenomenon. In India *Vedāṅga Jyotiṣa* is the earliest work assigned to fourteenth century BCE, but that was closely related to Vedic observances. This is the peculiarity of Indian science which is pure Hindu astronomy.

Apart from the development of a purely academic astronomy in India a religious calenderic record of planetary motions with reference to the zodiac came to be recorded for the measurement of the year with eclipses, etc. for purposes of Vedic observances as well as religious observances of the common Hindu society. The mathematical precision achieved in the ancient India a 2,000 years ago led to the preparation of a *pañcāṅga* which is advance information of the motion of sun, moon and the planets for the whole year ahead before it began so that the people would be getting ready in advance for the observance and performance of religious rites. Thus *pañcāṅga* has become an integral part of the Hindu religion awaited for its guidance in religion. The development of

astrology is the prediction of seasonal cycle as well as experiences of individuals based on the birth-stars, etc.

The publication of a *pañcāṅga* in print in the last two centuries has given rise to innumerable and different *pañcāṅga*s containing notable differences in the fixing of a religious event or observance of religious festival or a holy Vedic ritual. The *pañcāṅga*s are not uniform in their record of planetary movements, their entry into a star in a sign which is the basis of religious observance. People are thrown into confusion.

The reason is well known. Hindu religion follows the fixed zodiac, and on that zodiac the position of a planet or even the solar ingress is of great importance. These are dependent upon the fixed zodiac with a difference from the moving zodiac which is known as the *ayanāṁśa*. This *ayanāṁśa* is subject of theoretical calculation based on the year of the zero *ayanāṁśa*, the rate of precession, etc. These elements are taken differently by the astronomers who made the *pañcāṅga*s. This situation in the Hindu religion oriented astronomy has to be and must be sorted out for the benefit of the practising Hindu.

Long ago I had presided over two conferences at Hyderabad and Warangal of *pañcāṅga* makers with a view to reconcile the differences and to arrive at a singular *nirayana pañcāṅga*. The conferences failed in their objective. In this august gathering of astronomers it is my genuine appeal that, if we can find at least four or five astronomers giving us a single *pañcāṅga* for the good of the society to help the situation. This needs setting up of a group, to thoroughly discuss with evidence of the elements that go to determine the *ayanāṁśa*.

My objective approach to such a meeting of eminent astronomers of our country has other demands from me.

1. The religious basis of adopting a *nirayana* (a fixed zodiac) for the Hindu religious purposes. This may be a subject for examination of the Smṛtis to know where, why and how has

it been directed that religious observances should be based on a *nirayana* system (way back in 1949 and 1950, Cyril Fagan who published his magazine *SPICA*, raised this question, but there was no worthwhile discussion by many or a conclusion). The community of astronomers owes this clarification to the society.

2. Hindu astronomy has addressed itself to the study of planets on the zodiac and the "Great bear" resulting in the *saptarṣi* cycle of about 2,700 years. The practical use of this can be found only when different events are recorded on this scale, to find their distance in time for purposes of historical records. This clock has not been used except for one statement in *Mahābhārata: ṛṣayaḥ pitṛdaivatam*, to indicate the event of coronation of Yudhiṣṭhira. No event in subsequent history has been recorded. Can we now prepare a calendar for the future indicating the likely dates of the *ṛṣi*s entering various signs in future?
3. The Hindu religion deals with the *brahmāṇḍa* and the various *loka*s and their interrelationships as they are occupied by various grades of sentient beings. In other words it is assumed that we have a structure of the Universe called the *brahmāṇḍa* containing fourteen different regions called *loka*s occupied by different classes of beings. We find certain relative theories about different time measures with reference to these *loka*s. For example: For a departed soul of the earth which dwells in the *pitṛloka*, one whole terrestrial year on earth is one day in *pitṛloka*. We have the Purāṇas and astronomical works also discovering the time cycle like *kalpa*, *mahāyuga* and *yuga* in terms of the terrestrial year. This time cycle is also related to the time cycle of the *deva*s, Indra and Brahmā, etc. These facts and figures need a re-examination for their rational validity on Earth or whether these figures are related to the distances of these higher *loka*s from the region of our solar system is a question.

It is our tradition in Purāṇas that like men on the Earth even Brahmā has a hundred years long-life. The length of the year of Brahmā is different. In the higher worlds, there is no sunrise and sunset. Hence the earthly year is taken as a unit for any length of time. Does this scale depend upon the higher regions distance from Earth plane? Does it enable us to note the distance of the higher *loka*s from here?

4. The Hindu astronomy believed in the theory of oscillation of the equinoxial point. What we commonly call the precession of the equinox is said to actually librate on either side of the first point of Aries. Not only that, the Hindu theory has actually pinpointed the extent of this libration saying that the equinox precesses up to 27° behind the first point of Aries, returns to the zero point of Aries and also oscillates to 27° in the positive direction. Thus the total oscillation is 108° at a rate that varies from 48 to 51 sec. This theory of libration is peculiar to the Indian astronomers.

In the Western system, the preceding equinox makes a full circle of 360° and returns to the first point of Aries taking about 27,000 years. This major difference between the Indian and the modern or the Western system has not received a thorough analysis. The modern Indian astronomers seem to have just accepted the Western theory without even examining and defending the Indian theory. The verifiability of the Indian theory depends upon observations of the equinox reaching 27° behind the 0° Aries. At the moment the precession is believed to be around 21-23°. The equinox will take another four or five centuries to reach the limit of 27°.

The libration also means that the equinox should at two extreme points come to a halt and reverses its direction. Does it make any major event in the Solar System and on the Earth? Is there a record of such events in the past?

The question before us is whether we are prepared to reject the Indian theory of oscillation without a thorough examination?

Why did the Indian astronomers propound the theory of oscillation? Is it actual or apparent when observed from an outer point in the 3D space, like the southern Polaris point?

Is it not worthwhile that a group of astronomers examine this question from the point of its reality or its being apparent, instead of rejecting it without examination? The very eminent astronomers present in the conference may kindly consider this. Baring these questions before the very eminent astronomers and scholars for the favour of consideration, I beg to remain.

Key to Transliteration

Vowels

अ *a*	आ ā	इ i	इ ī	उ u	ऊ ū	ऋ ṛ	ॠ ṝ
ऌ ḷ	ॡ ḹ	ए e	ऐ ai	ओ o	औ au		

Consonants

Guttural	क ka	ख kha	ग ga	घ gha	ड. ṅa
Palatal	च ca	छ cha	ज ja	झ jha	ञ ña
Cerebral	ट ṭa	ठ ṭha	ड ḍa	ढ ḍha	ण ṇa
Dental	त ta	थ tha	द da	ध dha	न na
Labial	प pa	फ pha	ब ba	भ bha	म ma
Semivowels	य ya	र ra	ल la	व va	
Sibilants	श śa	ष ṣa	स sa	ह ha	
Others	क्ष kṣa	त्र tra	ज्ञ jña		

अं (ं) *ṁ anusvāra* is a nasal off-glide that immediately follows the pronunciation of a vowel as in *saṁskṛti.*

अः *visarga* = *ḥ* consists in abrupt release of breath after a vowel as in *prātaḥ.*

ऽ *avagraha* shows non-pronunciation, that is, deletion of "a" after "e" or "o" as in *ime 'vasthitāḥ.* In Vedic Sanskrit, it can also show word division.

Introduction

V. Venkataramana Reddy

THE astronomy takes into consideration the position of the planets in their revolution around the sun relative to the very distant constellations in the zodiac which are at an enormous distance from the solar system. The zodiacal wheel with all its stars with widely varying distances from the solar system is seen as located on the equatorial plane of the earth. An additional fact of astronomy is, the stars on the zodiac as a rule are having their own proper motions, which may not be relevant to the life and conditions on the solar system significantly.

Whether one is studying our own planet or the planets in the sky, the common man wants to know his own future. There is a dispute and difference of opinion on certain aspects of astronomical calculations among the scholars even today. For this purpose, there is a need to provide a common platform for the scholars and practitioners of astronomy to reflect on the issue.

The last half century has seen materialistic civilization destroying the nature and its eco-balance besides plundering of our planet to exhaust the million-year old accumulations of fusel fuels, minerals, forests, etc. The great question before us is what does the future hold for the human race?

In modern times due to so many reasons, the astronomical knowledge and its *sāmānya jñāna* are slowly disappearing from the scholarly world. But still there are several scholars who can interpret the ancient texts on astronomy with their multi-faceted genius.

India has one of the largest collections of manuscripts of any civilization in the world. An unknown number of rare and unpublished manuscripts on astronomy are still lying in the various manuscript repositories of India.

The National Mission for Manuscripts under the Ministry of Tourism and Culture, Government of India, New Delhi has been organizing seminars in different subject areas. Such seminars provide a platform for scholars working in a given discipline to interact, share information, discuss problems encountered by them and then look towards a solution of those problems. Seminars bring together scholars from different parts of the country working in a particular field and provide them an opportunity to share their experiences.

The Oriental Research Institute of Sri Venkateswara University, Tirupati has been consistently conducting several national and international conferences, seminars and workshops on different subjects. Recently the Institute successfully conducted a three day seminar on “Manuscript Heritage on Astronomy”. More than forty scholars from different parts of India participated and presented their research papers. The seminar attracted not only traditional scholars from Sanskrit field but also scientists like Dr K.L. Ram Kumar, Bhabha Atomic Research Centre, Mumbai; Dr M.D. Srinivas, Centre for Policy Studies, Chennai; Prof. K. Ramasubramanyam, IIT, Bombay; Dr M.S. Sriram, Dept. of Theoretical Physics, University of Madras, Chennai and many more scholars.

The seminar saw many scholarly presentations. Many outstanding scholars from different parts of India gave valuable suggestions to take this noble task ahead. Herein I especially thank and express my sincere gratitude to Prof. Dipti S. Tripathi, former Director, National Mission for Manuscripts for having extended liberal financial assistance for conducting the seminar successfully.

It is a matter of great pleasure that the National Mission for Manuscripts is bringing out the proceedings of this seminar in a very attractive manner. I feel this publication will be worthwhile

and useful to scholars working in the area of Astronomy. And I am also sure that the readers will appreciate the quality and quantity of information housed in the articles.

We look forward to suggestions and active participation of all the readers and scholars to take forward the noble task of preserving and propagating the knowledge contained in the Indian manuscripts heritage.

1

India's Rich Heritage in Astronomy
Astronomers' Names, Years and Their Contributions

Y.V. Subba Rao

Lagadha: First Millennium BCE

THE earliest astronomical text named *Vedāṅga Jyotiṣa* details several astronomical attributes generally applied for timing social and religious events. *Vedāṅga Jyotiṣa* also details astronomical calculations, calendrical studies, and establishes rules for empirical observation. Since the texts written by 1200 BCE were largely religious compositions *Vedāṅga Jyotiṣa* has connections with Indian astrology and enumerates several important aspects of the time and seasons, including lunar months, solar months and their adjustment by a lunar leap month of adhimāsa. *Ṛtu*s and *yuga*s are also described. Some scholars hold that twenty-seven constellations, eclipses, seven planets and twelve signs of the zodiac were also known at that time.

Āryabhaṭa: CE 476–550

Āryabhaṭa was the author of *Āryabhaṭīya* and *Āryabhaṭasiddhānta*, which, according to Hayashi (2008): "circulated mainly in the north-west of India and, through the Sasanian dynasty (224–651) of Iran, had a profound influence on the development of Islamic astronomy". Its contents are preserved to some extent in the works of Varāhamihira (flourished *c.* 550), Bhāskara I (flourished *c.* 629), Brahmagupta (598–*c.* 665) and others. It is one of the earliest astronomical works to assign the start of each day to midnight.

Āryabhaṭa explicitly mentioned that the earth rotates about its axis, thereby causing what appears to be an apparent westward motion of the stars. Āryabhaṭa also mentioned that reflected sunlight is the cause behind the shining of the moon. Āryabhaṭa's followers were particularly strong in south India, where his principles of the diurnal rotation of the earth, among others, were followed and a number of secondary works were based on them.

Varāhamihira: CE 505-587

Varāhamihira was an astronomer and mathematician who studied Indian astronomy as well as the many principles of Greek, Egyptian and Roman astronomical sciences. His *Pañcasiddhāntikā* is a treatise and compendium drawing from several knowledge systems.

Brahmagupta: CE 598–668

Brahmasphuṭa-siddhānta (Correctly Established Doctrine of Brahma, CE 628) dealt with both Indian mathematics and astronomy. Hayashi (2008) writes: "It was translated into Arabic in Baghdad about 771 and had a major impact on Islamic mathematics and astronomy". In *Khaṇḍa-Khādyaka* (A Piece Eatable, CE 665) Brahmagupta reinforced Āryabhaṭa's idea of another day beginning at midnight. Brahmagupta also calculated the instantaneous motion of a planet, gave correct equations for parallax and some information related to the computation of eclipses. His works introduced Indian concept of mathematics-based astronomy into the Arab world.

Bhāskara I: CE 600-680

Authored the astronomical works *Mahābhāskarīya* (Great Book of Bhāskara), *Laghubhāskarīya* (Small Book of Bhāskara) and *Āryabhaṭīya-Bhāṣya* (CE 629) — a commentary on *Āryabhaṭīya* written by Āryabhaṭa. Hayashi (2008) writes:

> Planetary longitudes, heliacal rising and setting of the planets, conjunctions among the planets and stars, solar and lunar eclipses, and the phases of the moon are among the topics Bhāskara discusses in his astronomical treatises.

Bhāskara I's works were followed by Vaṭeśvara (CE 880), who in his eighth chapter of *Vaṭeśvara Siddhānta* devised methods for determining the parallax in longitude directly, the motion of the equinoxes and the solstices and the quadrant of the sun at any given time.

Lalla: Eighth Century CE

Author of *Śiṣyadhīvṛddhi* (Treatise which Expands the Intellect of Students) corrects several assumptions of Āryabhaṭa. *Śiṣyadhīvṛddhi* of Lalla itself is divided into two parts: Grahādhyāya and Golādhyāya. Grahādhyāya (chaps. I-XIII) deals with planetary calculations, determination of the mean and true planets, three problems pertaining to diurnal motion of earth, eclipses, rising and setting of the planets, the various cusps of the moon, planetary and astral conjunctions, and complementary situations of the sun and the moon. The second part titled Golādhyāya (chaps. XIV-XXII) deals with graphical representation of planetary motion, astronomical instruments, spherics, and emphasizes on corrections and rejection of flawed principles. Lalla shows the influence of Āryabhaṭa, Brahmagupta and Bhāskara I. His works were followed by later astronomers, Śrīpati Vaṭeśvara and Bhāskara II. Lalla also authored *Siddhāntatilaka*.

Śrīpati: CE 1045

Śrīpati was an astronomer and mathematician who followed the Brahmagupta school and authored *Siddhānta Śekhara* (The Crest of Established Doctrines) in twenty chapters, thereby introducing several new concepts, including moon's second inequality.

Bhāskara II: CE 1114-1185

Authored *Siddhāntaśiromaṇi* (Head Jewel of Accuracy) and *Karaṇa-kutūhala* (Calculation of Astronomical Wonders) and reported on his observations of planetary positions, conjunctions, eclipses, cosmography, geography, mathematics and astronomical equipment used in his research at the observatory in Ujjain, which

he headed.

Mahendra Sūri: CE 1340–1410

Mahendra Sūri authored *Yantra-rāja* (The King of Instruments, written in CE 1370) — a Sanskrit work on the astrolabe, itself introduced in India during the reign of the fourteenth-century Tughlaq dynasty ruler Firuz Shah Tughluq (CE 1351-88). Mahendra Sūri seems to have been a Jaina astronomer in the service of Firuz Shah Tughluq. The 182 verses of *Yantra-rāja* mentions the astrolabe from the first chapter onwards, and also presents a fundamental formula along with a numerical table for drawing an astrolabe although the proof itself has not been detailed. Longitudes of thirty-two stars as well as their latitudes have also been mentioned. Mahendra Sūri also explained the Gnomon, equatorial coordinates and elliptical coordinates. The works of Mahendra Sūri may have influenced later astronomers like Padmanābha, author of *Yantra-rāja-adhikāra* (CE 1423), in writing the first chapter of his *Yantra-Kiraṇāvalī.*

Nīlakaṇṭha Somayāji: CE 1444–1544

In 1500, Nīlakaṇṭha Somayāji of the Kerala school of astronomy and mathematics, in his *Tantrasaṁgraha*, revised Āryabhaṭa's model for the planets Mercury and Venus. His equation of the centre for these planets remained the most accurate until the time of Johannes Kepler in the seventeenth century. Nīlakaṇṭha Somayāji, in his *Āryabhaṭīya Bhāṣya*, a commentary on Āryabhaṭa's *Āryabhaṭīya*, developed his own computational system for a partially heliocentric planetary model, in which Mercury, Venus, Mars, Jupiter and Saturn orbit the sun, which in turn orbits the earth, similar to the Tychonic system later proposed by Tycho Brahe in the late sixteenth century. Nīlakaṇṭha Somayāji's system, however, was mathematically more efficient than the Tychonic system, due to correctly taking into account the equation of the centre and latitudinal motion of Mercury and Venus. Most

astronomers of the Kerala school of astronomy and mathematics who followed him accepted his planetary model. He also authored a treatise titled *Jyotimīmāṁsā* stressing the necessity and importance of astronomical observations to obtain correct parameters for computations.

Acyuta Pisarati: CE 1550–1621

His *Sphuṭanirṇaya* (Determination of True Planets) details an elliptical correction to existing notions. *Sphuṭanirṇaya* was later expanded to *Rāśigolasphuṭanīti* (True Longitude Computation of the Sphere of the Zodiac). Another work, *Karaṇottama* deals with eclipses, complementary relationship between "the sun and the moon, and 'the derivation of the mean and true planets'". In *Uparāgakriyākrama* (Method of Computing Eclipses), Acyuta Pisarati suggests improvements in methods of calculation of eclipses.

2

Zodiac in Ancient Indian Astronomy

Y.V. Subba Rao

Abstract: THE calculation of the traditional almanacs is based on the *nirayana siddhānta* as conventionally called today to stand in contradistinction to the *sāyana siddhānta*. The beginning of the year, based on the *sāyana siddhānta*, is calculated when the *meṣa saṁkramaṇa* takes place with the sun at the vernal equinoctial point (VEP). Such conjunction of the sun with the VEP was found to be in the first quarter of Aśvinī constellation by Varāhamihira,[1] an astrologer and astronomer par excellence, in CE 520. Kṛttikā of *Vedāṅga Jyotiṣa* continued to be the leading asterism till Varāhamihira exploded the astrological and the astronomical world with his observations. He abandoned Kṛttikā of *Vedāṅga Jyotiṣa* period and adopted Aśvinī as the leading asterism of his period for his calculations. Ignoring, however,

[1] Varāhamihira who lived in the court of King Vikramāditya in CE 520 has a worldwide reputation in the sphere of mathematical astronomy and astrological practices. His *Bṛhat Jātaka* is a very popular text as well as his *Bṛhat Saṁhitā* and *Pañcasiddhāntikā*.

Mythology abounds in his name. Mihira is sun and in India, sun is worshipped as a god. It appears that his prediction about the death of a prince of his patron through a boar resulted in the same manner by a fall of a stuffed head of a boar in the place of a living boar in spite of the maximum precautions taken for that. Hence the appellation Varāha to his name Mihira.

His *Pañcasiddhāntikā* is a collection of texts concerning five systems of astronomy in vogue at that contemporary period and these systems were in use for the preparation of almanac for multipurpose utility like spiritual and mundane necessities.

the principle underlying the pronouncements of Varāhamihira, Indian *paṇḍit*s have stuck on to the *nirayana* system and developed the peculiar problem of *ayanāṁśa* or the Indian precession. It means that the zodiac is fixed which is contrary to theory and observation. Major *muhūrtta*s, according to Āgamaśāstras, are based on the position of the sun in a sign and the position of the moon in a *nakṣatra*. The position of the moon in the *nakṣatra* according to *pañcāṅga* may be correct but the position of the sun in a sign based on the *pañcāṅga* is highly erroneous and differs by the magnitude of *ayanāṁśa*.

The modern Western astronomers have taken a different stand that the zodiac is always moving and moving retrograde and the equinoxes occur earlier and move backwards. As the change is perceptible, however, over a period of about 960 years to shift the VEP from one asterism to the other, this minute detail is not observed by the practical astronomer or astrologer. For this reason, the literature of the medieval and modern periods does not reflect the knowledge of the "precession of the equinoxes".

The present paper is an attempt to show that the astronomers and astrologers including Varāhamihira were fully aware of the "precession of the equinoxes" and even the literature supports this knowledge. By admitting this, the astronomical references can be fully utilized for arriving at the precise dates of several historical events in the cultural history of India for which the epigraphical and archaeological evidences are totally absent.

Introduction

Historically, it is generally agreed that the two zodiacs, fixed and moving, were in alignment with one another about the year CE 285 with both sidereal and tropical ephemeris' listing the passage of the sun into Meṣa (Aries) at the spring equinox. What happened next? What went wrong? Foreign invasions and consequent lack of patronage conspired to make the generations after Varāhamihira commit to the sin of sticking on to the fixed zodiac beginning with the first point of Aśvinī, long companionship with the first point of Aśvinī made it heresy for Indian *paṇḍit*s even though Varāhamihira himself parted with Kṛttikā for obvious reasons. The difference between *sāyana* longitudes and

nirayana longitudes of planets is called *ayanāṁśa* (precession). The raging controversy between the two zodiacs is ever increasing each year with the cumulative increase in the magnitude of *ayanāṁśa* more or less acutely. In every conference astronomers and astrologers of more recent times raise the vexed question of *ayanāṁśa* only to widen the gulf. There is another strange circumstance. The Aries of the moving zodiac and the Aries of the fixed zodiac should both have the same appearance, if the names of the signs have any relationship with their resemblance. The Westerners with the moving zodiac and the Indians with the fixed zodiac should both pretend to see the same appearances in the various signs. While it is clear that similar appearances cannot be seen by both the parties, in signs no longer common to both in the zodiac, the names of the twelve signs are, however, common to the East and the West and continue to be the same. Evidently, the objects or beings after which the signs are named are symbolical of the natures of the signs.

Zodiac

The planets move round the sun in a circular of space in the heavens, about 16° in breadth with 8° on either side of the ecliptic. The ecliptic is the elliptical path among the fixed stars in which the earth revolves round the sun as its centre. We have also seen that to this is the apparent path of the sun viewed from the centre of the earth. A series of constellations lie along this belt. This belt is comprehensive enough to accommodate the movements of all the planets. This Milky Way is called the zodiac. It is along this path that we have to locate the positions of the planets.

Where Does the Zodiac Begin?

The question that arises uppermost is as to the first point from which the longitudes of the planets have to be measured. In other words, we have to fix the starting point of the zodiac. It is needless to state that the longitudes of the planets cannot be measured and their positions determined, unless there is a point to measure from. Common sense suggests that this point cannot and ought not to be arbitrary. It should be associated with some determinable and demonstrable astronomical

phenomenon. The twenty-seven asterisms are clusters of stars that lie along the zodiac, and may be divided into twelve signs[2] of a somewhat irregular extent. But there is absolutely nothing to indicate why a particular asterism should be preferred to any other as the starting point of the zodiac.

The twenty-seven asterisms may be imagined to be merely twenty-seven fixed lamp-posts or milestones along the ecliptic. No particular milestone or lamp-post could be regarded as possessing any special significance or bearing on the determination of the starting point of the zodiac. In India, Varāhamihira, to whom we owe largely for the beginnings of Indian astronomy as well as of Indian astrology, and who is considered to have figured about CE 520, has given us the clue for fixing this starting point of the zodiac. No clues earlier than the time of Varāhamihira seem to be available on the determination of this vital question. Taking clues from *Bṛhat Jātaka*, *Bṛhat Saṁhitā*, *Pañcasiddhāntikā* and Vedic texts like *Ṛgveda* and comparing with the modern Western astronomy, we may arrive at the method of calculation.

A few observations have also to be made before we can follow Varāhamihira with advantage. The twenty-seven asterisms (*nakṣatra*s) are, no doubt, twenty-seven natural divisions of the ecliptic. Each of them roughly measures, therefore, $360/27 = 13\frac{1}{3}^\circ$ of space. This is roughly the space travelled by the moon along the stars in the course of a single day and night. There is nothing, however to choose between

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[2] The twenty-seven asterisms or clusters of stars that lie along the zodiac, and may be divided into twelve signs *rāśi*s. The Sanskrit names of the twelve signs or *rāśi*s in the conventional order are: 1. Meṣa, 2. Vṛṣabha, 3. Mithuna, 4. Karka, 5. Siṁha, 6. Kanyā, 7. Tulā, 8. Vṛścika, 9. Dhanu, 10. Makara, 11. Kumbha, 12. Mīna.

The Sanskrit names of the twenty-seven Asterisms or *nakṣatra*s, beginning with the conventionally leading asterism, are as follows: 1. Aśvinī, 2. Bharaṇī, 3. Kṛttikā, 4. Rohiṇī, 5. Mṛgaśīrṣa, 6. Ārdrā, 7. Punarvasu, 8. Puṣyā, 9. Āśleṣā, 10. Maghā, 11. Pūrvā-Phālgunī, 12. Uttarā-Phālgunī, 13. Hastā, 14. Citra, 15. Svāti, 16. Viśākhā, 17. Anurādhā, 18. Jyeṣṭhā, 19. Mūlā, 20. Pūrvāṣāḍhā, 21. Uttarāṣāḍhā, 22. Śravaṇā, 23. Dhaniṣṭhā, 24. Śatabhiṣā, 25. Pūrvāproṣṭhapadā, 26. Uttarāproṣṭhapadā, 27. Revatī.

one asterism and another, as already observed, for fixing the starting point of the zodiac. The first amongst the twelve signs into which the zodiac is divided is conventionally named Aries or Meṣa. The question, therefore, narrows down to the short point as to where in the ecliptic 0° Aries or Meṣa should begin.

Observations of some sort did exist at Ujjain at the time of Vikramāditya, during whose reign Varāhamihira flourished. It was the longitude of Ujjain that was adopted in Indian Astronomy for imagining an island called Laṅkā in the Indian Ocean (not Ceylon) on the Equator. The standard time in the calendar was called Laṅkā time; and 6 a.m. at Laṅkā was the mean sunrise from which all calculations were made to avoid as many *pañcāṅga* as there are places in India.

In his *Bṛhat Jātaka*, *Pañcasiddhāntikā* and *Bṛhat Saṁhitā* Varāhamihira states that at one time *dakṣiṇāyaṇa* (southward journey of the sun or the summer solstice) took place when the sun was in the middle of Āśleṣā *nakṣatra* and *uttarāyaṇa* (northward journey of the sun or the winter solstice) took place when the sun was at the beginning of Dhaniṣṭhā *nakṣatra* but that in his own time, "as one might see for himself" (so he says) *dakṣiṇāyaṇa* taking place when the sun was in the last quarter of Punarvasu *nakṣatra*.[3] He observed that what had been recorded by the ancients was correct for their time and that what he observed was correct for his time.

There is abundant authority that *Vedāṅga Jyotiṣa* continued to be current till almost Varāhamihira's time until he exploded it with his own observations. It was under such auspices that he could review *pañca-siddhānta*s (five different schools of astronomical calculations) current in his time and produce his *Pañcasiddhāntikā* and *Bṛhat Saṁhitā*. When he stated that at one time *dakṣiṇāyaṇa* took place when the sun was in the middle of Āśleṣā *nakṣatra*, but that in his own time it was taking place when the sun was in the last quarter of Punarvasu *nakṣatra*,

[3] Evidently, Varāhamihira was referring to the astronomical observations in *Vedāṅga Jyotiṣa* about 1500 years before him, cf. Bal Gangadhar Tilak, *Arctic Home in the Vedas*, quoted in M. Krishnamachari, *History of Classical Sanskrit Literature*, p. ix.

he surprised the Indian astronomical world with his observation, with a settled theory behind the change observed. Thus, he ordained the future astronomers to correctly ascertain the places of the planets by daily meridian observations since error in calculation is sinful. He might not have considered the change to be the result of a regular phenomenon with a uniform rate of retrogression due to an aberration or freak of nature.

That the ancient Indian astronomers were fully aware of the retrogression of the equinoctial point along the ecliptic was proved by Bal Gangadhar Tilak beyond doubt from the Vedic reference. He held that the VEP was Mṛgaśīrṣa and that it was the first *nakṣatra* when *Ṛgveda* was composed.

Vedāṅga Jyotiṣa was composed when the vernal equinox was in Kṛttikā and had retrograded during his time to the first quarter of Aśvinī *nakṣatra*. Since the summar solstice took place during the *Vedāṅga Jyotiṣa* period, about the middle of Āśleṣā *nakṣatra*, the vernal equinox must have occurred about the beginning of Kṛttikā. Literature of his time referred to Maghā *nakṣatra* as the eighth *nakṣatra*, which it could be only if Kṛttikā was the first one. The Tamil *Maṇimekhalai* (of about the seventh or eighth century CE) speaks of Viśākhā *nakṣatra*, in which the Buddha was born, as the middle *nakṣatra* or the fourteenth one, which it could be only if the first one was Kṛttikā. Kṛttikā was the first *nakṣatra* evidently in the Vedic time, since the vernal equinoctial point took place in that *nakṣatra*. Therefore, he changed the reckoning system of the calendar of his times. He maintained that the vernal equinox occurred at the beginning of Aśvinī and fixed it as the first asterism.

The above evidences prove that Varāhamihira started his astrological zodiac with vernal equinox point which is not absolutely fixed. This point can be reconfirmed by comparing the calculative system followed by modern Western astronomers under the name of precession of the equinoxes.[4] About 21 March as at present, the

[4] The expression "precession of the equinoxes", means the earlier occurrence of the equinoxes in each successive sidereal year, due to the retrograde motion of the equinoctial points along the ecliptic. A sidereal →

sun starts in all his brilliance in his annual course from the vernal equinox and this phenomenon marks the beginning of the tropical or astronomical year. Western astronomers start 0° Aries with the vernal equinoctial point and the planetary longitudes are measured from this point.

This equinoctial point is not absolutely fixed. It is subject to a slight retrograde motion of about 50.26" a year. It is this retrogradation that is known as the precession of the equinoxes. It was this uniform increase in the longitudes of the fixed stars that attracted the attention of Hipparchus, to whom the discovery of precession is due and the physical cause of this motion was explained by Issac Newton. The equinoxes will continue to occur earlier and move backward by about 50.26'' a year and complete one revolution in about 26,000 years.

This leads us to what he observed. He found that the summer solstice had retrograded from the middle of Āśleṣā *nakṣatra* of the Vedic period to the last quarter of Punarvasu *nakṣatra* in his day, that

← year is the time in which the earth makes one complete revolution round the sun, which is longer than the tropical year by the difference due to the precession of the equinoxes. In other words, it is the year during which the sun in his apparent motion returns to the same fixed star. The term "equinoxes" denotes equal nights and days throughout the world, which occur only twice in a year, the vernal equinox about the 21 March and the autumnal equinox about the 23 September, as at present. Between these two we have the summer solstice about the 22 June and the winter solstice about the 22 December. Whatever may be the starting point of the zodiac, the beginning of the four quarters of the year is beyond controversy. While 21 March and 23 September indicate equal nights and days throughout the world, 22 June and 22 December indicate the longest day and the longest night respectively. The return of the seasons is a permanent factor and we know these seasons are brought about exactly after the same number of days. It is on these phenomena that the European tropical year is based which means that the year which brings the same season after the same number of days. The tropical year is the interval between two consecutive passages of the sun through the same equinoxes, and due to precession the equinoxes will precede their usual time year after year, cf. Stuart J. Inglis, 1962, *Planets, Star and Galaxies*, New York: John Wiley and Sons, pp. 100-05.

is, to about $1\frac{1}{4}$ *nakṣatra*'s extent or about $23\frac{1}{3}°$ during a period of over 1,500 years. We find that Varāhamihira's observations roughly tally, therefore, with modern astronomy as regards the rate of precession.

Vernal Equinox in the Present Day

At the present day, the VEP is in Uttarāproṣṭhapadā having retrograded to it in due course from Aśvinī.

Are we still to regard Aśvinī as the first *nakṣatra*, when the father of Indian astronomy and astrology felt compelled to change over from Kṛttikā of *Vedāṅga Jyotiṣa* to Aśvinī of his day? The true Indian astrological and astronomical starting point of the zodiac is, therefore, the vernal equinoctial point, the same as in the West, and not Aśvinī, one of the twenty-seven lamp-posts or milestones. For astrological as well as astronomical purposes, we are, therefore, concerned only with the moving zodiac, and not with the fixed zodiac of the twenty-seven asterisms beginning with Mṛgaśīrṣa, Kṛttikā or Aśvinī as the case had been during the course of the ages, whenever reformers opened their eyes to facts. As each star parted company in due course with the equinoctial point, it came to be deprived of its leading character and its first place in the order of the stars. Formerly the sun's entry into the constellations, Taurus, Leo, Scorpio and Aquarius, marked respectively the commencement of the spring, summer, autumn and winter seasons. When during the period of the sun was in the Ram at the vernal equinox, the Ram became the leading constellation and the sun's entry into the constellation (Aries) marked the beginning of the spring. The equinoctial points, now having stepped into the next constellations behind Aries and Libra, namely, Pisces and Virgo, we have to step back along with them. They will thus gradually shift their places backward from one constellation to the other along the ecliptic and we should therefore be shifting along with them. Instead of this perennial and periodical shifting from asterism to asterism, let us bid good-bye to the fixed zodiac of the stars and welcome the moving zodiac, mistakenly regarded as the zodiac of the West. Now, it is the longitudes of the planets from the VEP and the division of the zodiac into twelve signs from the same point that we require for purposes of horoscopy

either in the East or in the West. Thus, the Western astronomy proves that the Indian astronomy is absolutely right on the one hand and that the astronomy together with its counterpart astrology cannot be nothing short of absolute science on the other.

Summary

VEP was exactly at Aśvinī in CE 285 vide *Siddhānta Śiromaṇi* of Bhāskara II of the eleventh century. At the present day, the vernal equinoctial point is in the Uttarāproṣṭhapadā last quarter having retrograded into it in due course from Aśvinī, that is, to about 24° during the period of over 1,725 years since CE 285.

Positions of VEP and Leading Asterism

1. Śvetavarāha Kalpa

Period (year)	—
Leading Asterism	Aśvinī
VEP	Aśvinī
Ayanāṁśa	0°

2. *Vedāṅga Jyotiṣa*

Period (year)	1500 BCE
Leading Asterism	Kṛttikā
VEP	In Kṛttikā
Ayanāṁśa	—

3. Bhāskarā II of CE 1100

Period (year)	CE 285
Leading Asterism	Aśvinī
VEP	Coincident with Aśvinī
Ayanāṁśa	0°

4. Varāhamihira

Period (year)	CE 520
Leading Asterism	Aśvinī

VEP	In Aśvinī first quarter
Ayanāṁśa	Between 0°–3° 20'
5. Modern (by Calculation)	
Period (year)	CE 2010
Leading Asterism	Uttarāproṣṭhapadā
VEP	In Uttarāproṣṭhapadā fourth quarter
Ayanāṁśa	24°
6. Future (by Calculation)	
Period (year)	CE 2435
Leading Asterism	Pūrvaproṣṭhapadā
VEP	In Pūrvaproṣṭhapadā first quarter
Ayanāṁśa	30° equal to a sign

The ancient Indian astronomers have evolved a scientific system of calculating the astronomical zodiac while the astronomers of the medieval and modern periods have lost sight of the principle of precessions of the equinoxes. The Western astronomers, on the other hand, could rightly pick up and confirm the exactness of the ancient Indian astronomers. It is a paradox that we appreciate the importance of certain originally Indian concepts only after the foreigners accept them.

These astronomical observations confirm the various dates arrived at by the Sanskritists, historians, etc. regarding the composition of different works as well as the different strata in the layers of Indian civilization and culture. Thus, *Ṛgveda* was composed during 3000–4000 BCE, the Mahābhārata war took place in 2559 BCE, *Vedāṅga Jyotiṣa* was composed in 1550 BCE, Buddha lived in 520 BCE and Varāhamihira lived in CE 520.

For astronomical or astrological purposes, either in the East or in the West, the moving Zodiac Meṣa 0° starting from the VEP and the division of it into twelve signs from the same point is indisputable.

3

History of Indian Mathematics and Its Implications for Mathematical Education

K. Ramasubramanian

Introduction

A FEW years ago, an unusual seminar series was held at Chennai Mathematical Institute (CMI) and the Proceedings that was brought out.

In his scholarly preface, David Mumford observes:[1]

> Too many people still think that mathematics was born in Greece and more or less slumbered until the Renaissance.
>
> The state described by Mumford is primarily due to the fact that the knowledge remained confined among the specialists.
>
> Consequently, the general picture that emerged from the books on history of mathematics with regard to the Indian contributions till recent times were quite incomplete and at times misleading.

Morris Kline[2] observes:

> Sometimes the Hindus were aware that a formula was only approximately correct and sometimes they were not. Their values

[1] C.S. Seshadri (ed.), 2010, *Contributions to the History of Indian Mathematics*, Delhi: Hindustan Book Agency.

[2] Credited with more than a dozen books on various aspects of mathematics such as history, philosophy and pedagogy.

of *p* were generally inaccurate; . . .

In trigonometry the Hindus made a few minor advances.[3] . . .

As our survey indicates, the Hindus were interested in and contributed to the arithmetical and computational activities of mathematics rather than to the deductive patterns.

There is much good procedure and technical facility, but no evidence that they considered proof at all.[4]

The Śulbasūtras

The word *śulba* stems from the root *sulb* (to measure).

Since all the measurements were done using ropes or chords, in the very early times, it seems the word in due course was synonymously employed to refer to the chords themselves.

The etymological derivation of the word *śulba* (referring to a rope) can be given as:

śulbayatyanena iti śulbaḥ ।[5]

The exact derivation of the compound word *śulbasūtra*s, including the grammatical peculiarities is:

śulbayam = śulbaḥ (śulba + ghañ)[6] । *tatsambandhi sūtrāṇi*

Seven Śulbasūtras, namely *Baudhāyana*, *Āpastamba, Kātyāyana, Mānava, Maitrāyaṇa*, *Varāha* and *Vādhūla* are extant today.

Dertermining the East–West Line

Determining the exact east–west line at a given location is a

---

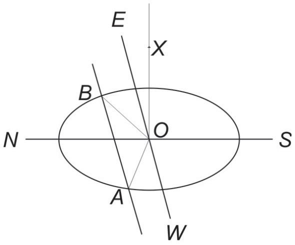
[3] This observation is despite the fact that Hindus have extensively employed *jīvaparasparanyāya*, and obtained complicated results. . . .

[4] Morris Kline, 1972, *Mathematical Thought from Ancient to Modern Times*, New York: Oxford University Press, pp. 188-90.

[5] This derivation is technically referred to as *karaṇavyutpatti.*

[6] This type of derivation is known as भावव्युत्पत्ति and the *sūtra* that comes into play is "भावे घञ्"।

prerequisite for all constructions, be it a residence, a temple, a sacrificial altar or a fireplace.



The procedure for its determination is described thus:

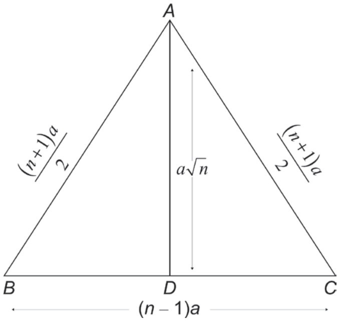
sama śaṅku nikhāya 'śaṅkusammitayā rajjvā' maṇḍalaṁ yatra lekhayoḥ śaṅkvagracchāyā nipatati tatra śaṅkū nihanti sā prācī ı — *Kt.Sū.* 12

Fixing a pin (or gnomon) on level ground and drawing a circle with a cord measured by the gnomon,* he fixes pins at points on the line (of the circumference) where the shadow of the tip of the gnomon falls. That is the *prāci*.

(*For the cord to be measured by gnomon, its length must be at least twice that of the gnomon. This prescription has important astronomical significance.)

To Construct a Square that Is n Times a Given Square

Kātyāyana gives an ingenious method to construct a square whose area is *n* times the area of a given square.



yāvatprmāṇāni samacaturaśrāṇi ekīkartuṁ cikīrṣet ekonāni tāni bhavanti taryak ı *dviguṇānyekata ekādhikāni tryastrirbhavati* ı *tasyeṣuḥ tatkaroti* ı

— *Kt.Si.* VI.7

As much . . . one less than that forms the base . . . the arrow of that [triangle] makes that (gives the required number *n*).

In the Figure

$$BD = \frac{1}{2} BC = \frac{(n-1)}{2} a.$$

Consider ΔABD,

$$AD^2 = AB^2 - BD^2 = \left(\frac{n+1}{2}\right) a^2 - \left(\frac{n-1}{2}\right) a^2$$

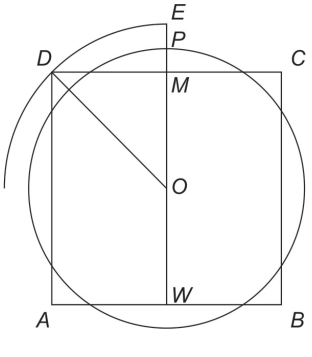
$$= \frac{a^2}{4}(n+1)^2 - (n-1)^2 = \frac{a^2}{4} \times 4n = (na^2).$$

To Transform a Square into a Circle

According to Baudhāyana:

> *caturaśnaṁ maṇḍalaṁ cikirṣan akṣṇayārdhaṁ madhyāt prācīme abhyapātayet yadādatiśiṣyate tasya saha tṛtīyena maṇḍalaṁ parilikhet* ।

akṣṇayārdhaṁ	=	semi-diagonal
madhyāt prācīm	=	from centre to the east
yadādatiśiṣyate	=	whatever (portion) remains
tasya saha tṛtīyena	=	with one-third of that



$AB = 2a$
$OP = r$
$OD = a\sqrt{2}$
$ME = a(\sqrt{2} - 1)$

The radius $OP = r = a + \frac{a}{3}(\sqrt{2} - 1)$

$$= \frac{a}{3}(2 + \sqrt{2}).$$

How to find $\sqrt{2}$?

How Did the Śulbakāras Specify the Value of $\sqrt{2}$?

The following *sūtra* gives an approximation to $\sqrt{2}$

pramāṇaṁ tṛtīyena vardayet, taccaturthena, ātmacatustriṁśonena, saviseṣaḥ ।

$$\sqrt{2} = 1 + \frac{1}{3} + \frac{1}{3 \times 4} - \frac{1}{3 \times 4 \times 34}$$

$$= \frac{577}{408} = 1.4142156\ldots$$

How Did the Śulbakāras Arrive at the above Expression?

Several explanations have been offered over the last centuries, of which one of them is geometrical construction.

Approximation for $\sqrt{2}$

Rationale for the expression $\sqrt{2} = 1 + \frac{1}{3} + \frac{1}{3.4} - \frac{1}{3.4.34}$ by geometrical construction

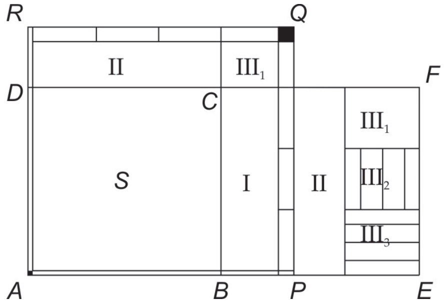
> Consider two squares *ABCD* and *BEFC* (sides of unit length).

> The second square *BEFC* is divided into three strips.

> The third strip is further divided into many parts, and these parts are rearranged (as shown) with a void at *Q*.

> Now, each side of the new square $APQR = 1 + \frac{1}{3} + \frac{1}{3.4}$.

The area of the void at Q is $\frac{1}{3.4}^2$.



Suppose we were to strip off a segment whose breadth is *x* from either side of this square, such that the area of the stripped off portion is exactly equal to that of the void at *Q*, then we have,

$$2x\left(1+\frac{1}{3}+\frac{1}{3.4}\right)-x^2=\left(\frac{1}{3.4}\right)^2.$$

Neglecting x^2 (as it is too small), we get

$$x=\left(\frac{1}{3.4}\right)^2 \times \frac{3.4}{34}=\frac{1}{3.4.34}.$$

Hence the side of the resulting square is

$$\sqrt{2}=1+\frac{1}{3}+\frac{1}{3.4}-\frac{1}{3.4.34}.$$

Saṁkalita and Vārasaṁkalita
(Sum of Series and Sum of Sums)

The results

$$\sum_{r=1}^{n} r = 1+2+\ldots+n=\left[\frac{n(n+1)}{n}\right]$$

$$\sum_{r=1}^{n} r^2 = 1^2+2^2+\ldots+n^2=\frac{n(n+1)(2+1)}{6}$$

and $\sum_{r=1}^{n} r^3 = 1^3+2^3+\ldots+n^3=\left[\frac{n(n+1)}{2}\right]^2$

were known to the authors of *AB*, *GSS*, *PG*, *L*.

Now we consider sum of sums, for which we use the notation,

$$V_n^{(1)} = 1+2+\ldots+n = \frac{n(n+1)}{2}$$

$$V_n^{(2)} = V_1^{(1)} + V_2^{(1)} + \ldots + V_n^{(1)}$$

$$= \sum_{r=1}^{n} \frac{r(r+1)}{2} = \frac{n(n+1)(n+2)}{1.2.3}.$$

Vārasaṁkalita

k^{th} order repeated sum of natural numbers (in *Gaṇitakaumudī*).

Nārāyaṇa presents the formula in the following *āryā*:

ekādhikavāramitāḥ padadirūpottarāḥ pṛthak te 'ṁśāḥ ।

ekādokacayahagaḥ taddhāto vārasaṁkalitam ||

padādirūpottarāḥ — $n, n + 1, n + 2 \ldots\ldots$

ekādhikavāramitāḥ — limited to $k + 1$ terms

ekādokacayahagaḥ — 1, 2, 3 . . . are the divisors

tadvāto vārasaṁkalitam — the product is *vārāsaṁkalita*

The sum of sums

$$V_n^{(k)} = V_1^{(k-1)} + V_2^{(k-1)} + \cdots V_n^{(k-1)}$$

is stated to be

$$V_n^{(k)} = \frac{n(n+1)\cdots(n+k)}{1.2.3\cdots k+1} = {}^{n+k}C_{k+1}.$$

The Cow Problem

prativarṣaṁ gauḥ sūte varṣatritayena tarṇakī tasyāḥ |
vidvan viṁśativarṣaiḥ gaurekasyāśca santatiṁ kathaya ||

A cow gives birth to a [she] calf every year [and] their calves themselves [begin giving birth], in three years time. O learned, tell the number of progeny produced by a cow in twenty years.

Recalling

$$V_n^{(0)} = 1 + 1 + \ldots + 1 = n.$$

$$V_n^{(1)} = V_1^{(0)} + \ldots + V_n^{(0)} = 1 + 2 + \ldots + = \frac{n(n+1)}{2}.$$

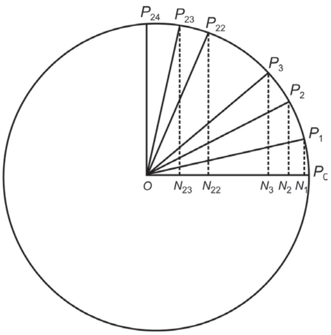
$$V_n^{(2)} = V_1^{(1)} + V_2^{(1)} + \ldots + V_n^{(1)} = \frac{n(n+1)(n+2)}{1.2.3}.$$

Year	1st gen.	2nd gen.	3rd gen.	4th gen.	5th gen.	6th gen.	7th gen.
1	1						
2	1						
3	1						
4	1	$V_1^{(0)}$					
5	1	$V_2^{(0)}$					
6	1	$V_3^{(0)}$					
7	1	$V_4^{(0)}$	$V_1^{(1)}$				
8	1	$V_5^{(0)}$	$V_2^{(1)}$				
9	1	$V_6^{(0)}$	$V_3^{(1)}$				
10	1	$V_7^{(0)}$	$V_4^{(1)}$	$V_1^{(2)}$			
11	1	$V_8^{(0)}$	$V_5^{(1)}$	$V_2^{(2)}$			
12	1	$V_9^{(0)}$	$V_6^{(1)}$	$V_3^{(2)}$			
13	1	$V_{10}^{(0)}$	$V_7^{(1)}$	$V_4^{(2)}$	$V_1^{(3)}$		
14	1	$V_{11}^{(0)}$	$V_8^{(1)}$	$V_5^{(2)}$	$V_2^{(3)}$		
15	1	$V_{12}^{(0)}$	$V_9^{(1)}$	$V_6^{(2)}$	$V_3^{(3)}$		
16	1	$V_{13}^{(0)}$	$V_{10}^{(1)}$	$V_7^{(2)}$	$V_4^{(3)}$	$V_1^{(4)}$	
17	1	$V_{14}^{(0)}$	$V_{11}^{(1)}$	$V_8^{(2)}$	$V_5^{(3)}$	$V_2^{(4)}$	
18	1	$V_{15}^{(0)}$	$V_{12}^{(1)}$	$V_9^{(2)}$	$V_6^{(3)}$	$V_3^{(4)}$	
19	1	$V_{16}^{(0)}$	$V_{13}^{(1)}$	$V_{10}^{(2)}$	$V_7^{(3)}$	$V_4^{(4)}$	$V_1^{(5)}$
20	1	$V_{17}^{(0)}$	$V_{14}^{(1)}$	$V_{11}^{(2)}$	$V_8^{(3)}$	$V_5^{(4)}$	$V_2^{(5)}$
Sum	20	153	560	1001	762	210	8

Construction of the Sine-table (Āryabhaṭa's Method)

- A quadrant is divided into twenty-four equal parts, so that each **arc bit**
- Procedure $\alpha = \frac{90}{24} = 3^\circ 45' = 225'.P_iN_i)\,\mathrm{i} = 1, 2, \ldots, 24$ is given.
- The *R* sines of the intermediate angles are determined by interpolation (I order or II order).

Author, please check



Recursion Relation for the Construction of Sine-table

Āryabhaṭa's algorithm for constructing sine-table

The content of the verse in *Āryabhaṭīya* translates to:

$$R\sin(i+1)\alpha - R\sin i\alpha = R\sin i\alpha - R\sin(i-1)\alpha - \frac{R\sin i\alpha}{R\sin i\alpha}.$$

In fact, the values of the twenty-four *R* sines themselves are explicitly noted in another verse.

The exact recursion relation for the *R* sine differences is:

$$R\sin(i+1)a - R\sin ia$$
$$= R\sin ia - R\sin(i-1)a - R\sin ia\, 2(1-\cos a).$$

Approximation used by Āryabhaṭa is $2(1 - \cos a) = \frac{1}{225}$.

While,

$$2(1-\cos\alpha) = 0.0042822, \frac{1}{225} = 0.00444444.$$

In the recursion relation provided by Nīlakaṇṭha we find

$$\frac{1}{225} \rightarrow \frac{1}{233.5} (= 0.0042827).$$

Comment on Āryabhaṭa's Method (Delambre)

Commenting upon the method of Āryabhaṭa in his monumental work Jean Baptiste Joseph Delambre[7] observes:

> The method is curious: it indicates a method of calculating the table of sines by means of their second differences.
>
> . . . The differential process has not up to now been employed except by Briggs, who himself did not know that the constant factor was the square of the chord. . . . Here then is a method which the Indians possessed and which is found neither amongst the Greeks nor amongst the Arabs.[8]

---

[7] "... an astronomer of wisdom and fortitude, able to review 130 years of astronomical observations, assess their inadequacies, and extract their value." — Prix prize citation 1789.

[8] J.B.J. Delambre, 1817, *Histoire de l'Astronomie Ancienne*, t1, Paris, p. 457; →

Magic Squares

Depending on the number of variant ways in which one can get the desired sum, magic squares have been classified into:

- semi-magic (only rows and columns sum up to the number)
- magic and (rows, columns and principal diagonals)
- pan-diagonal magic (the above, plus the broken diagonals).

The first systematic description and classification of $n \times n$ magic squares is to be found in *Gaṇitasārakaumudī* of Ṭhakkara Pheru (*c.* 1300), wherein he presents the following types:

- *samagarbha* (n doubly-even or of the form $4m$)
- *viṣamagarbha* (n singly-even or of the form $4m + 2$)
- *viṣama* (n is odd).

A more detailed mathematical treatment, by exclusively devoting a chapter (consisting of 75+ verses), is provided by Nārayaṇa, [a] in his *Gaṇitakaumudī* (*c.* 1356).

General Treatment of Samagarbha Magic Squares

The folding method (*samapuṭavidhi*) given by Nārāyaṇa:

> *samagarbhe dve kārye chādakasaṁjñaṁ tayorbhavedekam* ।
> *chādābhidhānamanyat karasampuṭavacca sampuṭo jñeyaḥ* ।।
> *iṣḍādīṣṭacayāṅkā bhadramitā mūlapaṅktisaṁjñādyā* ।

- Consider two $n \times n$ squares where $n = 4m$.
- Of the two, one is called the coverer (*chādaka*).
- The other is called the covered (*chādya*).
- The folding here is just like folding the palms.
- The first sequence known as *mūlapaṅkti* [has],
- any desired number as the first term (*ṇiṭāddhi*) and so too the common difference (*caya*) [and]

← cited in B. Datta and A.N. Singh, 1983, "Hindu Trigonometry", *The Indian Journal of History of Science,* 18(1): 77.

> is limited by the order of the magic square.

tadvadabhīpsitamukhacayapaṅktiśca[9] *anyā parākhyā syāt* ।।

Similarly, (another) sequence having desired number as the first item and also as the common difference is known as *parāpaṅkti*.

Given below a few examples of *mūlapaṅkti* and *parāpaṅkti.*

Mūlapaṅkti				*Caya*	*Parāpaṅkti*				*Caya*
1	2	3	4	1	0	1	2	3	1
2	4	6	8	2	1	2	3	4	1
3	6	9	12	3	2	3	4	5	1
3	6	9	12	3	4	6	8	10	2
4	8	12	16	4	0	3	6	9	3

mūlākhyapaṅktiyogonitaṁ phalaṁ parasamāsaṁbhaktam ।
labdhahatāparapaṅkti guṇajākhyā sā bhavet paṅkti ।।

The result obtained by decreasing the sum of the *mūlapaṅkti* [from the desired magic sum], when divided by the sum of the *parāpaṅkti* [is the *guṇa*].

The elements of the *parāpaṅkti* multiplied by that *guṇa* obtained is known as *guṇapaṅkti*.
Example: Suppose the desired sum $S = 40$

mūlapaṅkti — [1 2 3 4]. Its sum $S_m = 10$

parāpaṅkti — [0 1 2 3]. Its sum $S_p = 6$. Now,

$$\frac{S - S_m}{S_p} = \frac{40 - 10}{6} = 5.$$

Using this we obtain *guṇapaṅkti* – [0 5 10 15].

mūlaguṇākhye paṅkti ye te bhadrārdhatastu parivṛtte ।

The two sequences that are known as *mūlapaṅkti* and *guṇapaṅkti*, are to be arranged [in the cells] in a cyclic manner from the centre of the magic square.

[9] The *vigraha* is *mukhañca cayaśca mukhacayau* । *abhīpsitau mukacayau abhīṣṭamūkhacayau tau yasyāḥ paṅkte sā abhīpsitamukhacayapaṅkti* ।

mūlapaṅkti — 1 2 3 4. *guṇapaṅkti* — 0 5 10 15.

2	3	2	3
1	4	1	4
3	2	3	2
4	1	4	1

10	15	5	0
5	0	10	15
10	15	5	0
5	0	10	15

ūrdhvasthitaiḥ tadaṅkai chādakasañchādyayoḥ pṛthagyāni ||

tiryakkoṣṭhānyādo anyatarasminnūrdhvagāni koṣṭhāni |
bhadasyārdhaṁ kramagaiḥ utkramagaiḥ pūrayedardham |
bhadrāṇāmiha sampuṭavidhi ukto nṛharitanayena ||

The horizontal blocks in the first and the vertical ones in the other half of the magic square *bhadra* is to be filled in order and the other half in the reverse order.

2	3	2	3		10	15	5	0		2	8	17	13
1	4	1	4	+	5	0	10	15	=	16	14	1	9
3	2	3	2	(folded)	10	15	5	0		3	7	18	12
4	1	4	1		5	0	10	15		19	11	4	6

The Śulba Theorem (Bhujā-koṭi-karṇa-nyāya)

A clear enunciation of the so-called "Pythagorean" theorem is found in the Śulbasūtras:[10]

dīrghacaturaśrasya ikṣṇayārajjuḥ[11] *pūrvamānītiryaṅmānī ca yat* |
pṛthagbhūte kurutaḥ tadubhayaṁ karoti ||

The square of the diagonal of a rectangle is the sum of the squares of the lateral and the vertical sides.

10 *Baudhāyana Śulbasūtras* 1.48.

11 The word *akṣṇayā* is an indeclinable. It occurs in the Vedic literature at several places: *akṣṇayā vyāghārayati* | . . . *tasmādakṣṇayā pasavśoṅgāni pratitiṣṭhanti* |

By now, this *sūtra* is fairly well known. The purpose of bringing up this topic is to present the interesting discussion and the dissectional proof presented by Nīlakaṇṭha in his *Siddhāntadarśana*.

Two Possible Ways of Demonstration

1. *Saṁkhyānveṣaṇam*: Demonstration by enumerating

   dvayorāśyorvargayogamūlaṁ niravayavam ekādisaṁkhyāviśeṣeṣu kayoḥ syāditi saṁkhyā niścīyarte । tadanveṣaṇa eko mārgaḥ ।

2. *Kṣetracchedanam*: Demonstration by area dissection method

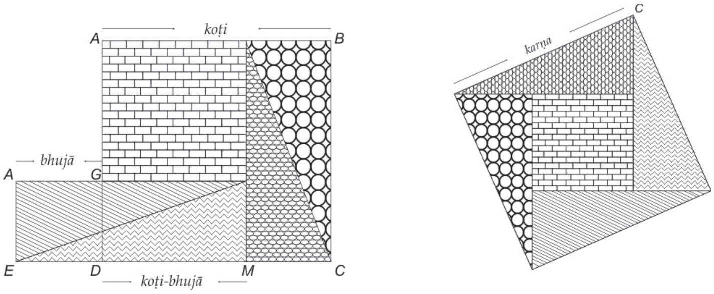
   aśeṣaviṣayavyāpī kṣetracchedakadvāraḥ anyo mārgaḥ ।

Choosing the second over the first Nīlakaṇṭha states the reason for his choice:

alpaviṣayatvāt	—	limited
ānantyāt	—	the set will be enormous in size
avikṣānte	—	and will be never ending
kṣetracchedana	—	area dissectional proof

etatsarve yuktimūlameva na tvāgamamūlam ।

All this is based on reasoning alone and does not need the authority of any authentic text [for its validity].



The Number of Terms in an Arithmetical Series

Consider an arithmetical series of the form:

$$a + (a + d) + (a + 2d) + (a + 3d) + \dots + (a + (n - 1)d). \tag{2}$$

The formula for finding the number terms n in the series, in terms of it sum S, the first term a and the common difference d is encoded in the following verse:[12]

gaccho 'ṣṭottaraguṇitād dviguṇādyattaraviśeṣavargayutāt ।
mūlaṁ dviguṇādyabanaṁ svottarbhājitaṁ sarūpārdham ॥

The content of the above verse can be expressed as:

$$n = \frac{1}{2}\left(\frac{\sqrt{8Sd + (2a - d)} - 2a}{d} + 1\right). \tag{3}$$

Approximations to π

The commentary *Kriyākramakarī* while presenting the ratio of the circumference to the diameter given by different *ācāryas* observes:

mādhavācāryaḥ punaḥ atopyāsannatamāṁ paridhi-saṁkhyām uktavānvibudhanetragajāhihutāśanatriguṇavedabhavāgaṇab āhavaḥ ।
navanikharvamite vṛtivistare paridhimānmidaṁ jagad-urbudhāḥ ॥[13]

The value of π given in the above verses is:

$$\pi = \frac{2827433388233}{9 \times 10^{11}}$$
$$= 3.141592653592 \text{ (correct to 11 places).}$$

Conclusion

Introducing a bit of history would make the mathematics education

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[12] Āryabhaṭa, *Āryabhaṭīyam*, Gaṇitapāda, verse 20.

[13] *Vibudha* = 33, *netra* = 2, *gaja* = 8, *ahi* = 8, *hutāsana* = 3, *triguṇa* = 3, *veda* = 4, *bha* = 27, *vāraṇa* = 8, *bāhu* = 2, *nava-nikharva* = 9 × 1,011. (The word *nikharva* represents 1,011.)

more complete. It would enable us to have a multicultural perspective which is presently lacking in the educational curricula.

The Indian approach to a problem being algorithmic, it would enable the students to have a sense of a different flavour of mathematics. For example, the prescription in Śulbasūtra texts for finding surds, the recurrence relation given by Āryabhaṭa for evaluating sine function, the techniques for solving indeterminate equations given by Brahmagupta and Bhāskara, the method of arriving at infinite series finding fast convergent approximations to the Gregory–Leibniz series for *p.*

Some of the unique techniques along with the illustrative examples and demonstrations provided in the texts could perhaps prove to be simpler for the students in assimilating the concepts with much ease.

There could be fun in memorizing the formula (for instance, for the number of terms in an arithmetical series) in the form of verses.

Knowing history would help us in getting away with the false pictures that have already been created by some of the accounts — be it generated by Eurocentric bias or Indicentric bias.

Lastly, making the students aware of the major achievements of their own ancestors — particularly in their impressionable age — is quite likely to boost their self-confidence and also provide the necessary motivation in building a self-reliant nation.

4

Kerala Works on Mathematics and Astronomy
Some Open Vistas

M.D. Srinivas

In his pioneering survey of works of the Kerala School of Astronomy in 1972, K.V. Sarma listed around 402 works in mathematics and astronomy.[1] Of these, over 150 works happen to be in Malayalam. In his more recent survey of the Sanskrit science texts available in the manuscripts repositories of Kerala and Tamil Nadu, Sarma has listed over 450 works in Sanskrit on mathematics and astronomy from Kerala.[2] Most of these works pertain to the period 1350–1850.

Here, we present a chronological listing of the important members of the Kerala School and their works. This is compiled from the above two works of KV Sarma. We also indicate whether the work has been edited and translated. In the end, we append a list of works by unknown authors which have been published.

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[1] K.V. Sarma, 1972, *A History of the Kerala School of Hindu Astronomy*, Hoshiarpur: Vishveshvaranand Institute, p. viii. Sarma also notes that of the 402 works on astronomy and mathematics, 211 are Karala texts, thirty-four are Tantra and six are Siddhānta texts.

[2] K.V. Sarma, 2002, *Science Texts in Sanskrit in the Manuscripts Repositories of Kerala and Tamil Nadu*, New Delhi: Rashtriya Sanskrit Sansthan. The total number of works on astronomy and mathematics is 934 of which 100 are said to have been edited.

It may be noted that only two works were edited prior to 1900, and about ten were edited during 1900-50. Since 1950, about fifty works of the Kerala School have been edited. About forty-five tracts by unknown authors have also been published. Amongst the works which are available, but have not yet been edited, are three works of Mādhava, six of Parameśvara, one of Nīlakaṇṭha, one of Jyeṣṭhadeva, six of Śaṅkara of Mahiṣamaṅgalam, three of Śaṅkara Wariyar, one of Nārāyaṇa, one of Acyuta Pisarati, twelve of Putuman Somayāji and almost all the works of later authors.

Amongst the works which have been edited, only about ten have been translated into English. Detailed Malayalam expositions of the Gaṇitādhyāya of *Yuktibhāṣā* of Jyeṣṭhadeva and *Karaṇapaddhati* of Putuman Somayāji were published more than fifty years ago.[3]

It is generally believed that the remarkable work of the Kerala School of Astronomy was first brought to the notice of modern scholarship by C.M. Whish[4] in the 1830s, but it seems that, at least from the early decades of the nineteenth century, many British observers had noted and reported on the knowledge of infinite series and other advanced mathematical techniques amongst the south Indian astronomers.[5] However, the work of the Kerala School was completely ignored by modern scholarship for over a century till it was resurrected by the pioneering work of C.T. Rajagopal

3 *Yuktibhāṣā Gaṇitādhyāya Edited with Malayalam Explanation and Notes by* Rāmavarma maru Thampuran and A.R. Akhileswara Aiyer, Thrissur 1948; *Karaṇapaddhati, Edited with Malayalam Explanation and Notes* by P.K. Koru, Cherp, 1953.

4 C.M. Whish, "On the Hindu Quadrature of the Circle, and the Infinite Series of the Proportion of the Circumference to the Diameter Exhibited in the Four Śāstras, the Tantrasaṁgraha, Yuktibhāṣā, Karaṇapaddhati and, Sadratnamālā" tr. Roy, *As. Soc.* (*G.B.*), 3: 509-23.

5 See for instance the notes of G. Hyne in John Warren, 1825, *Kāla Saṁkalita,* Madras, pp. 92-93, 330-1.

and his collaborators.[6] Following the work of Rajagopal and his collaborators, there have been several studies on the mathematical achievements of the Kerala School, most of which deal with the demonstrations contained in the first part, Gaṇitādhyāya, of the famous Malayalam work *Yuktibhāṣā* (*c.* 1530) of Jyeṣṭhadeva[7]

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[6] C.T. Rajagopal, 1940,"K. Mukunda Marar, Proof of Gregory's Series", *Teacher's Magazine,* 15: 28-34; K. Mukunda Marar and C.T. Rajagopal, 1944, "On the Hindu Quadrature of the Circle" *Journal of Bombay Branch of Royal Asiatic Society* (*JBBRAS*), 20: 65-82; K. Mukunda Marar and C.T. Rajagopal, 1945, "Gregory's Series in the Mathematical Literature of Kerala", *Math. Student,* 13: 92-98; A. Venkataraman, 1948, "Some Interesting Proofs from Yuktibhāṣā", *Math. Student,* 16: 1-7; C.T. Rajagopal, 1949, "A Neglected Chapter of Hindu Mathematics", *Scr. Math.*, 15: 201-09; C.T. Rajagopal and A. Venkataraman, 1949, "The Sine and Cosine Power Series in Hindu Mathematics", Journal of the Royal Asiatic Society of Bengal (*JRASB*) 15: 1-13; C.T. Rajagopal and T.V.V. Aiyar, 1951, "On the Hindu Proof of Gregory's Series", *Scr. Math.*, 17: 65-74; C.T. Rajagopal and T.V.V. Aiyar, 1952, "A Hindu Approximation to Pi", *Scr. Math.*, 18: 25-30; C.T. Rajagopal and M.S. Rangachari, 1978, "On an Untapped Source of Medieval Keralese Mathematics", *Arch. for Hist. of Ex. Sc.*, 18: 89-101; C.T. Rajagopal and M.S. Rangachari, 1986, "On Medieval Kerala Mathematics", *Arch. for Hist. of Ex. Sc.*, 35(2): 91-99.

[7] We may, for instance, cite the following: A.P. Jushkewitsch, 1964, *Geschichte der Mathematik Mittelalter*, German tr. V. Ziegler, Leipzig; R.C. Gupta, 1973, "The Mādhava–Gregory Series", *Math. Ed.*, 7: B63-70; R.C. Gupta, "Nīlakaṇṭha's Rectification Formula", *Math. Ed.*, 6: B1-2; 1974, "An Indian Form of Third Order Taylor Series Approximation of the Sine", *Hist. Math.,* 1: 287-89; 1975, "Mādhava's and Other Medieval Values of *p*"; *Math. Ed.*, 9: B45-48; "Mādhava's Power Series Computation of the Sine", *Gaṇita*, 27: 19-24; 1979, "Parameśvara's Rule for the Circum-radius of a Cyclic Quadirilateral", *Historia Mathematica*, 4: 67-74; A.K. Bag, 1976, Mādhava's Sine and Cosine Series, *IJHS,* 11:54-57; 1979, *Mathematics in Ancient and Medieval India*, Varanasi; T.A. Saraswati Amma, 1979, *Geometry in Ancient and Medieval India*, Varanasi; B. Datta and A.N. Singh (revised by K.S. Shukla), 1983, "Hindu Trigonometry", *IJHS*, 18: 39-108; B. Datta and A.N. Singh (revised by →

There have also been some studies highlighting the important

← K.S. Shukla), 1993, "Use of Calculus in Hindu Mathematics", *IJHS*, 19: 95-104; T. Hayashi, T. Kusuba and M. Yano, 1989, "Indian Values for *p* Derived from Āryabhaṭa's Values", *Historia Scientiarum*, 37: 1-16; 1990, "The Correction of the Mādhava Series for the Circumference of a Circle", *Centauras*, 33: 149-74; Ranjan Roy, 1990, "The Discovery of the Series Formula for *p* by Leibniz, Gregory and Nīlakaṇṭha", *Math. Mag.*, 63: 291-306; D. Gold and D. Pingree, 1991, "A Hitherto Unknown Sanskrit Work Concerning Mādhava's Derivation of the Power Series for Sine and Cosine", *Historia Scientiarum*, 42: 49-65; G.C. Joseph, 1991, *The Crest of the Peacock: The Non-European Roots of Mathematics*, London (2nd edn, Princeton 2000); B. Datta and A.N. Singh (revised by K.S. Shukla), 1993, "Use of Series in India", *IJHS*, 28: 103-29; A. Mukhopadhyaya and M.R. Adhikari, 1995, "Polygonal Approximation to Circle and Mādhavācārya, *IJHS*, 30: 35-46; V.J. Katz, 1995, "Ideas of Calculus in Islam and India", *Math. Mag.*, 68: 163-74; Kim Plofker, 1996, "An Example of the Secant Method of Iterative Approximation in a Fifteenth-century Sanskrit Text", *Hist. Math.*, 23: 246-56; T. Hayashi, T. Kusuba and M. Yano, 1997, *Studies in Indian Mathematics: Series, p and Trigonometry* (in Japanese), Tokyo; T. Hayashi and T. Kusuba, 1998, "Twenty-one Algebraic Normal Forms of Citrabhānu", *Hist. Math.*, 25: 1-21; V.J. Katz, 1998, *A History of Mathematics: An Introduction*, New York, 2nd edn; S. Paramesvaran, 1998, *The Golden Age of Indian Mathematics*, Kochi; T. Hayashi, 1999, "A Set of Rules for the Root-Extraction Prescribed by the Sixteenth-Century Indian Mathematicians, Nīlakaṇṭha Somasutvan and Śaṅkara Wariyar", *Historia Scientiarum,* 9(2): 135-53; T. Hayashi, 2001, "Govindasvamin's Arithmetic Rules Cited in the Kriyākramakari of Śaṅkara and Nārāyaṇa" *IJHS*, 35: 189-231; Kim Plofker, 2001, "The 'Error' in the Indian 'Taylor Series Approximation' to the Sine", *Hist. Math.*, 28: 283-95; C.K. Raju, 2001, "Computers, Mathematics Education, and the Alternative Epistemology of the Calculus in the Yuktibhāṣā", *Phil. East and West,* 51: 325-62; D.F. Almeida, J.K. John and A. Zadorozhnyy, 2001, "Keralese Mathematics: Its Possible Transmission to Europe and the Consequential Educational Implications", *J. Nat. Geo.*, 20: 77-104; D. Bressoud, 2002, "Was Calculus Invented in India?", *College Math.* →

contributions made by the Kerala School in Astronomy, focusing mainly on the revised planetary model introduced by Nīlakaṇṭha in his *Tantrasaṁgraha* (*c.* 1500) and other works.[8] Detailed English

← *J.*, 33: 2-13; J.K. John, 2002, "Derivation of the Saṁsakāras Applied to the Mādhava Series in Yuktibhāṣā" in *500 Years of Tantrasaṁgraha: A Landmark in the History of Astronomy*, ed. K. Ramasubramanian, M.S. Sriram and M.D. Srinivas, Shimla, pp. 169-82; T. Hayashi, 2003, "South-Indian Rationales of the Formulas for the Volumes of Pyramid and Regular Tetrahedron", *The Science and Engg Rev. of Dohshiba Univ.*, 44(1): 72-82 (also in Śemuṣī: *Baladeva Upadhyaya Birth Centenary Volume*, Varanasi, 2004, pp. 734-45); G.G. Emch, R. Sridharan and M.D. Srinivas (eds.), 2005, *Contributions to the History of Indian Mathematics*, New Delhi.

[8] R.C. Gupta, 1974, "Solution of the Astronomical Triangle as Found in the Tantrasaṁgraha", *IJHS*, 9: 86-99; D. Pingree, 1978, "History of Mathematical Astronomy in India", in *Dictionary of Scientific Biography*, vol. XV, New York; 1981, *Jyotiḥśastra*: *Astral and Mathematical Literature*, Wiesbaden; S.N. Sen and K.S. Shukla (eds.), 1985, *A History of Indian Astronomy*, New Delhi (rev. edn, 2000); K.V. Sarma and B.V. Subbarayappa, 1985, *Indian Astronomy: A Source Book*, Bombay; R.C. Gupta, 1987, "Mādhava's Rule for Finding Angle between the Ecliptic and the Horizon and Āryabhaṭa's Knowledge of It", in *History of Oriental Astronomy*, Cambridge, pp. 197-202; S. Hariharan, 1988, "Declination in Indian Astronomy and the Approach of Kerala Astronomers", *Jour. As. Soc.*, 30: 39-49; K.V. Sarma and S. Hariharan, 1991, Yuktibhāṣā of Jyeṣṭhadeva: A Book of Rationale in Indian Mathematics and Astronomy in Analytical Appraisal", *IJHS,* 26: 185-207; K. Ramasubramanian, M.D. Srinivas and M.S. Sriram, 1994, "Modification of the Ancient Planetary Model by the Astronomers of the Kerala School and the Implied Heliocentric Picture of the Planetary Motion", *Current Science,* 66: 784-90; S. Balachandra Rao, 1998, *Indian Mathematics and Astronomy: Some Landmarks*, Bangalore (3rd edn, 2004); D. Pingree, 2001, "Nīlakaṇṭha's Planetary Models", *Jour. Ind. Phil.*, 29: 187-95; K. Ramasubramanian, M.D. Srinivas and M.S. Sriram (eds.), 2002, *500 Years of Tantrasaṁgraha*: *A Landmark in the History of Astronomy*, Shimla; K. Chandra Hari, 2003, "Eclipse Observations of →

expositions of *Yuktibhāṣā* and *Tantrasaṁgraha* have been published recently.[9]

The various investigations, so far, show that the corpus of works of the Kerala School are indeed a rich and valuable source for studying the development of Indian mathematical and astronomical tradition in all its facets: epistemology of science, proofs and demonstrations, mathematics, planetary models, spherical astronomy, efficient algorithms for computations concerning the moon, shadows, eclipses, etc., and a host of special topics dealt with in various short tracts written till late in nineteenth century. However, many more in-depth studies are needed for us to be able to clearly understand and assess this important phase in the development of Indian scientific tradition.

APPENDIX

Authors and Works

Haridatta (*c.* 650–700)

1. *Grahacāranibandhana* (ed. K.V. Sarma, Madras, 1954)
2. *Mahāmārganibandhana* (NA)

Devācārya (Fl 689)

1. *Karaṇaratna* (ed. and tr. K.S. Shukla, Lucknow, 1979)

← Paramesvara", *IJHS*, 38: 43-59; K. Ramasubramanian and M.S. Sriram, 2003, "Corrections to the Terrestrial Latitude in Tantrasaṁgraha", *IJHS*, 38: 129-44; K. Chandra Hari, 2003, "Computations of the True Moon by Madhava of Saṅgamgrām", *IJHS*, 38: 231-55.

[9] *Gaṇita-Yuktibhāṣā*, ed. and tr. with Explanatory Notes by K.V. Sarma, M.S. Sriram, K. Ramasubramanian and M.D. Srinivas, Delhi: Hindustan Book Agency, 2008 (repr. Springer, 2009); *Tantrasaṁgraha of Nīlakaṇṭha Somayāji* tr. with Explanatory Notes by K. Ramasubramanian and M.S. Sriram, New York: Springer, 2011.

Govindaswami (*c.* 800-50)

1. *Bhāṣya on Mahābhāskarīya of Bhāskarācārya-I* (ed. T.S. Kuppanna Sastri, Madras, 1957)
2. *Gaṇitamukha* (NA)
3. *Govindakṛti* (NA)

Śaṅkaranārāyaṇa (*c.* 825–900)

1. *Vivaraṇa on Laghubhāskarācārya of Bhāskarācārya*-I (ed. S. Venkatasubramonia Iyer and S. Kochukunju Asari, Trivandrum, 1949)

Udayadivākara (*c.* eleventh century)

1. *Sundarī on Laghubhāskarācārya of Bhāskarācārya-I*

Mādhava of Saṅgamagrāma (*c.* 1340–1425)

1. *Veṇvāroha* (ed. with Vyākhya in Malayalam of Acyuta Pisarati) by K.V. Sarma, Tripunnithura, 1956)
2. *Cāndravākyāni or Silaṁ Ratnaḥ Śriyetyadi Vākyāni or Viliptādi Vākyāni* (ed. K.V. Sarma, Tripunnithura, 1956)
3. *Sphuṭacandrārti* (ed. and tr. K.V. Sarma, Hoshiarpur, 1973)
4. *Agaṇitagrahacāra*
5. *Lagnaprakaraṇa*
6. *Madhyamānayanaprakāra*
7. *Golavāda* (NA)

Parameśvara of Vaṭaśśeri (*c.* 1360–1455)

1. *Bhaṭadīpikā on Āryabhaṭīya* (ed. H. Kern, Leiden, 1874; repr. 1906, 1973)
2. *Galadīpikā* I (ed. T. Ganapati Sastri, Trivandrum, 1916)
3. *Parameśvara on Laghumānasa of Muñjāla* (ed. B.D. Apte, Pune, 1944; 2nd edn, 1952)
4. *Karmadīpikā on Mahābhāskarīya of Bhāskarācārya I* (ed. B.D. Apte, Pune, 1945)
5. *Parameśvara on Laghubhāskarīya of Bhāskarācārya I* (ed. B.D. Apte, Pune, 1946)

6. *Siddhāntadīpikā on Mahābhāskarīya of Govindaswami* (ed. T.S. Kuppanna Sastri, Madras, 1957)
7. *Galadīpikā* II (ed. (with auto-commentary Vivṛti) and tr. K.V. Sarma, Madras, 1957)
8. *Vivṛti on Galadīpikā* II (ed. K.V. Sarma, Madras, 1957)
9. *Grahaṇāṣṭaka* (ed. and tr. K.V. Sarma, Madras, 1959)
10. *Vivaraṇa on Sūryasiddhānta* (ed. K.S. Shukla, Lucknow, 1957)
11. *Dṛgganita* (ed. K.V. Sarma, Hoshiarpur, 1963)
12. *Grahaṇāmaṇḍana* (ed. and tr. K.V. Sarma, Hoshiarpur, 1965)
13. *Grahaṇānyāyadīpikā* (ed. and tr. K.V. Sarma, Hoshiarpur, 1966)
14. *Vivaraṇa on Līlāvatī of Bhāskarācārya* II
15. *Vākyaraṇa*
16. *Candrachāyāgaṇita*
17. *Vyaktīpākāṣṭaka*
18. *Vṛtti on Vyatīpātāṣṭaka*
19. *Goladīpikā* III

Parameśvara (fl fifteenth century)

1. *Haricarita* (ed. (with a ṭīkā) V. Krishnamacharya, Madras, 1948)

Nīlakaṇṭha Somayāji or Somasutvan of Tṛkkaṇṭiyūra (1444–1545)

1. *Āryabhaṭīyabhāṣya on Āryabhaṭīya* (Gaṇitapāda, ed. K. Sambasivasastri, Trivandrum, 1930; Kālakriyāpāda, ed. K. Sambasivasastri, Trivandrum, 1931; Galapāda, ed. Suranad Kunjan Pillai, Trivandrum, 1957)
2. *Tantrasaṁgraha* (ed. (with C. *Laghuvivṛti* of Śaṅkara Wariyar) by Suranad Kunjan Pillai. Pillai, Trivandrum, 1958; ed. (with C. *Yuktidīpikā* (for chaps. I-IV) and *Laghuvivṛti* (for chaps. V-VIII) of Śaṅkara Wariyar) by K.V. Sarma, Hoshiarpur, 1977; tr. V.S. Narasimhan, *IJHS,* 1998-99; Translated with Explanatory Notes by K. Ramasubramanian and M.S. Sriram (in Press)
3. *Golasāra* (ed. and tr. K.V. Sarma, Hoshiarpur, 1970)
4. *Candracchāyāgaṇita* (ed. (with auto-commentary) and tr. K.V. Sarma, Hoshiarpur, 1976)

5. *Vyākhyā on Candracchāyāgaṇita* (ed. K.V. Sarma, Hoshiarpur, 1976)
6. *Siddhāntadarpaṇa* (ed. K.V. Sarma, Madras, 1955; ed. (with auto-commentary) and tr. K.V. Sarma, Hoshiarpur, 1976)
7. *Vyākhyā on Siddhāntadarpaṇa* (ed. K.V. Sarma, Hoshiarpur, 1976)
8. *Jyotirmīmāṁsā* (ed. K.V. Sarma, Hoshiarpur, 1977)
9. *Grahasphuṭānayane Vikṣepavāsanā* (ed. K.V. Sarma 1979)
10. *Grahaṇaparīkṣākrama* (Part of *Āryabhaṭīyabhāṣya* on Golapāda 48) (ed. (with commentary in Malayalam) K.V. Sarma (in press))
11. *Grahaṇanirnya*
12. *Sundararājapraśnottara* (NA)

Citrabhānu (1475–1550)

1. *Karaṇāmṛta* (ed. (with commentary of Śaṅkara Wariyar) by V. Narayanan Nambudiri, Trivandrum, 1975)
2. *Ekaviṁśatipraśnottara* (NA)

Śaṅkara of Mahiṣamaṅgalam (1494–1570)

1. *Gaṇitasāra* (Malayalam)
2. *Candragaṇitakrama* (Malayalam)
3. *Ayanacalanādigaṇita* (Malayalam)
4. *Bālaśaṅkara* (Malayalam) Śaṅkara on *Laghubhāskarīya* of Bhāskarācārya I
5. *Bālaśaṅkara* (Malayalam) Śaṅkara on *Pañcabodha*
6. *Pañcabodhadarpaṇa* (Malayalam)

Jyesṭḥadeva (1500–1610)

1. *Yuktibhāṣā* (Malayalam) (Gaṇitādhyāya, ed. with Notes in Malayalam by Ramavarma Maru Thampuran and A.R. Akhileswara Aiyer, Trichur, 1948; ed. K. Chandrasekharan, Madras, 1953; ed. (with a Sanskrit version Gaṇitāyuktibhāṣā) and tr. K.V. Sarma, with Explanatory Notes by K. Ramasubramanian, M.D. Srinivas and M.S. Sriram (in press))
2. *Dṛkkaraṇa* (Malayalam)

Śaṅkara Wariyar of Tṛkkuṭaveli (1500–60)

1. *Laghuvivṛti on Tantrasaṁgraha* of *Nīlakaṇṭha* (ed. S.K. Pillai, Trivandrum, 1958; chaps. V-VIII, ed. K.V. Sarma, Hoshiarpur, 1977)
2. *Kriyākramakari on Līlāvatī of Bhāskarācārya II* (only up to middle of Kṣetravyavahāra) (ed. K.V. Sarma, Hoshiarpur, 1975)
3. *Yuktadūrikā on Tantrasaṁgraha* of *Nīlakaṇṭha* (ed. (chaps. V-VIII NA) K.V. Sarma, Hoshiarpur, 1977)
4. *Commentary on Karaṇāmṛta of Citrabhānu* (ed. V. Narayanan Nambudiri, Trivandrum, 1975)
5. *Kriyākalāpa* (Malayalam) *on Tantrasaṁgraha of Nīlakaṇṭha* (ed. K.V. Sarma (in press))
6. *Karaṇasāra*
7. Auto-commentary (Malayalam) on *Karaṇasāra*
8. *Laghuvivṛti on Pañcabodha*

Nārāyana of Mahiṣamaṅgalam (1540–1610)

1. *Kriyākramakari on Līlāvatī of Bhāskarācārya* II (starts from the middle of Kṣetravyavahāra) (ed. K.V. Sarma, Hoshiarpur, 1975)
2. *Uparāgakriyākrama* (ed. K.V. Sarma (in press)
3. *Kramadīpikā on Līlāvatī of Bhāskarācārya* II

Acyuta Pisarati of Tṛkkaṇṭiyūr (1550–1621)

1. *Rāśigolasphuṭanīti* (ed. tr. K.V. Sarma, Madras, 1953; Hoshiarpur, 1977)
2. *Uparāgaviṁśati* (ed. (with a Malayalam commentary) by Ramavarma Maru Thampuran, Tripunnithura, 1954)
3. *Vyākhyā* (Malayalam) on *Venvaroha* of Madhava (ed. K.V. Sarma, Tripunnithura, 1956)
4. *Karaṇottama* (ed. (with auto-commentary *Vivaraṇa*) by K. Raghavan Pillai, Trivandrum, 1964)
5. *Vivaraṇa on Karaṇottama* (ed. K. Raghavan Pillai, Trivandrum 1964)
6. *Sphuṭanirṇayatantra* (ed. with auto-commentary K.V. Sarma, Hoshiarpur, 1974)

7. Auto-commentary on *Sphuṭanirṇayatantra* (ed. K.V. Sarma, Hoshiarpur, 1974)
8. *Chāyaṣṭaka* (ed. K.V. Sarma, Hoshiarpur, 1974)
9. *Uparāgakriyākrama*

Dāmodara of Maṅgalaśreṇi (1575–1675)

1. *Vyākhyā on Līlāvatī of Bhāskarācārya* II (NA)

Eṭakramañceri Nampaūtiri (1625–1700)

1. *Bhadradīpagaṇita*
2. *Bhugolañāyam* (Malayalam)

Putumana Somayāji of Śivapur (1660–1740)

1. *Karaṇapaddhati* (ed. K. Sambasiva Sastri, Trivandrum, 1937; ed. (with Explanatory Notes in Malayalam) P.K. Koru, Cherp, 1953; ed. (with two Malayalam Commentaries) S.K. Nayar, 1956)
2. *Uparāgagaṇana* (ed. K.V. Sarma (in Press)
3. *Nyāyaratna* I
4. *Nyāyaratna* II
5. *Nyāyaratna* III
6. *Pañcabodha*
7. *Pañcabodhāṣṭaka*
8. *Grahagaṇita*
9. *Grahaṇāṣṭaka*
10. *Candracchāyāgaṇita*
11. *Candracchāyāgaṇibtadaśaka*
12. *Veṇvārohāṣṭaka*
13. *Apamādinirṇaya*

Puruṣottama (*c.* 1689)

1. *Pañcabodhāṣṭaka*

Aḷvāñceri Tamprākkal (1725–1800)

1. *Gaṇitasārasaṁgraha* (Malayalam)
2. *Jyotiḥśāstrasaṁgraha*
3. Commentary on *Jyotiḥśāstrasaṁgraha* (Sanskrit and Malayalam)
4. *Saṁgrahasādhanakriyā*
5. Commentary (Malayalam) on *Saṁgrahasādhanakriyā*

Kṛṣṇadāsa or Koccu Kṛṣṇan Āśān (1756–1812)

1. Commentary (Malayalam) on *Āryabhaṭīya*
2. *Pañcabodhagaṇita* (Malayalam)
3. *Kaṇakkuśāstram* (Malayalam) (NA)
4. *Bhāṣāgolayukti* (Malayalam) (NA)

Puradahanapura Dvija (1775–1860)

1. *Grahamadhyamabhuktayaḥ*
2. *Parahita-sphuṭanirṇaya-guṇākāra-hārakāḥ*
3. *Janmāṣṭamī-jayantī-sphuṭanirṇaya*
4. *Aṣṭamī-jayantī-nirṇaya* (Malayalam)

Bhārdvāja Dvija (1775–1860)

1. *Gaṇitayuktayaḥ* (*Candracchāyāgaṇanavāsanā*) (ed. K.V. Sarma, Hoshiarpur, 1979)
2. *Karaṇadarpaṇa*

Gaṭigopa (*c.* 1800)

1. Commentary on *Āryabhaṭīya*
2. Commentary (Malayalam) on *Āryabhaṭīya*

Rājaśaṅkaravarman of Kaṭittanāṭa (1774–1839)

1. *Sadratnamālā* (published (with auto-commentary in Malayalam) by Kavanodayam Press, Nadapuram, 1898; ed. K.V. Sarma, New Delhi, 2001; ed. (with auto-commentary in Malayalam) K.V. Sarma (in press))

2. Auto-commentary (Malayalam) on *Sadratnamālā* (published by Kavanodayam Press, Nadapuram, 1898; ed. K.V. Sarma (in press))

Godāvarma (1800-51)

1. *Vyākhyā on Siddhāntaśiromani of Bhāskarācārya* II

Manallur Subrahmaṇya Śāstrī (1829-88)

1. *Agaṇita* (1851)

Rāma Varman Koyittampurān (1853–1910)

1. *Jyotiṣapradīpa* (Malayalam)

A.R. Rājarājavarman Koyittampurān (1853–1918)

1. *Pañcāṅgasiddhipaddhati* (published from Trivandram)
2. *Karaṇapariṣkāra*
3. *Jyotiṣaprakaraṇam*
4. *Jyotiṣaprakaraṇa on Golādhyāya of Siddhāntaśiromaṇi of Bhāskarācārya II*

Vāsuṇṇi Mūssatu (1855–1914)

1. Commentary (Malayalam) on *Pañcabodha*

Punnaśśeri Nampi Nīlakaṇṭha Śarmā (1858-1935)

1. *Jyotiḥśāstrabodhinī* (published in 2 vols., Thrissur, 1922, 1929)
2. *Pañcabodhakriyābhāṣya* (Malayalam)

P.S. Purushottaman Namputiri

1. *Gaṇitanirṇaya* (Sanskrit with Malayalam exposition) (Thrissur, 1940)

K.V.A. Rama Poduval

1. *Śuddhadṛggaṇita* (Sanskrit with Malayalam exposition) (Kannur, 1952)

V.P. Kunhikkanna Poduval

1. *Śuddhadṛggaṇita* (Sanskrit with Malayalam exposition) (Kozhikode, 1956)

Authors Whose Period is Not Known

Dāmodara

1. *Siddhāntahṛdaya*

Nārāyaṇa of Perumannu

1. *Tantrasāra*

Nīlakaṇṭha

1. *Sūryasiddhāntaprakriyāmālā*

Punnāgaparatroḍabhikṣu

1. *Garahagaṇita*

Vāsudeva

1. *Galaghukaraṇaratna*

Published Works Whose Authors Are Not Known

Major Works

Gaṇitayuktabhāṣā (Sanskrit) (ed. K.V. Sarma, Shimla, 2005)

Shorter Tracts

1. *Kaṇakkusāram* (Malayalam) (ed. C. Acyuta Menon, Madras, 1950)
2. *Kaṇakkusāram Bālaprabodham* (Malayalam) (ed. C. Acyuta Menon, Madras, 1950)
3. *Garahacāranibandhana-saṁgraha* (ed. K.V. Sarma, Madras, 1954)
4. *Siddhāntadarpaṇa-siddha-paryāyadaya* (ed. K.V. Sarma, Madras, 1955)
5. *Siddhāntadarpaṇastha-paryāyabhūdināni* (ed. K.V. Sarma, Madras, 1955)
6. *Dṛg-veṇvāroha-kriyā* (ed. K.V. Sarma, 1956)
7. *Sphuṭanirṇayasaṁgraha* (ed. K.V. Sarma, Hoshiarpur, 1974)
8. *Sphuṭanirṇayanirnātaparyāyadayaḥ* (ed. K.V. Sarma, Hoshiarpur, 1974)
9. *Tantrasaṁgrahaparyāyaiḥ Sphuṭanirṇayoktabhagaṇānayanam* (ed. K.V. Sarma, Hoshiarpur, 1974)

10. *Parahitāt Sphuṭanirṇayatulya-madhyamānayanam Guṇakārahārakāḥ* (ed. K.V. Sarma, Hoshiarpur, 1974)
11. *Sphuṭanirṇayatulya -grahamadhyamānayanam* (ed. K.V. Sarma, Hoshiarpur, 1974)
12. *Sphuṭanirṇayadhāritaḥ Khaṇḍadhruvāḥ* (ed. K.V. Sarma, Hoshiarpur, 1974)
13. *Sphuṭanirṇayanītaḥ Khaṇḍadhruvāḥ* (ed. K.V. Sarma, Hoshiarpur, 1974)
14. *Sphuṭanirṇayasiddhau Kalyādidhruvau* (ed. K.V. Sarma, Hoshiarpur, 1974)
15. *Grahasphuṭaparilekhaḥ* (ed. K.V. Sarma, Hoshiarpur, 1974)
16. *Madhyacchāyānayanayuktiḥ* (ed. K.V. Sarma, Hoshiarpur, 1979)
17. *Candraśṛṅgonnati Kṣetrasya Bhujākoṭikarṇānayane Yuktiḥ* (ed. K.V. Sarma, Hoshiarpur, 1979)
18. *Lambānayanesphuṭānyāyātideśaḥ* (ed. K.V. Sarma, Hoshiarpur, 1979)
19. *Natilambānavikṣepavāsanā* (ed. K.V. Sarma, Hoshiarpur, 1979)
20. *Krativāsanā* (ed. K.V. Sarma, Hoshiarpur, 1979)
21. *Rāśigolasphuṭanītiḥ* (ed. K.V. Sarma, Hoshiarpur, 1979)
22. *Valanaśṛṅgonnatyorvāsanā* (ed. K.V. Sarma, Hoshiarpur, 979)
23. *Vikṣepacalanavāsanā* (ed. K.V. Sarma, Hoshiarpur, 1979)
24. *Vyatīpātendvānayanam* (ed. K.V. Sarma, Hoshiarpur, 1979)
25. *Vikṣepagolavāsanā* (ed. K.V. Sarma, Hoshiarpur, 1979)
26. *Khaṇḍadinanirṇayayukitḥ* (ed. K.V. Sarma, Hoshiarpur, 1979)
27. *Candravākyavāsanā* (ed. K.V. Sarma, Hoshiarpur, 1979)
28. *Vākyadhruvasaṁskārahārakayukitḥ* (ed. K.V. Sarma, Hoshiarpur, 1979)
29. *Koṇaśaṅkuvāsanā* (ed. K.V. Sarma, Hoshiarpur, 1979)
30. *Chāyāviṣayakasūtrāni* (ed. K.V. Sarma, Hoshiarpur, 1979)
31. *Gataiṣyacalanayuktiḥ* (ed. K.V. Sarma, Hoshiarpur, 1979)
32. *Valanānayanavāsanā* (ed. K.V. Sarma, Hoshiarpur, 1979)
33. *Valanaviṣayavāsanā* (ed. K.V. Sarma, Hoshiarpur, 1979)
34. *Natilambanayorvāsanā* (ed. K.V. Sarma, Hoshiarpur, 1979)

35. *Uḍḍīyamānavāsanā* (ed. K.V. Sarma, Hoshiarpur, 1979)
36. *Bhujāphalavāsanā* (ed. K.V. Sarma, Hoshiarpur, 1979)
37. *Mansphuṭasaṁskārayukitḥ* (ed. K.V. Sarma, Hoshiarpur, 1979)
38. *Grahasphuṭakarmavāsanā* (ed. K.V. Sarma, Hoshiarpur, 1979)
39. *Grahasphuṭakriyā* (ed. K.V. Sarma, Hoshiarpur, 1979)
40. *Vikṣepānayanevāsanā* (ed. K.V. Sarma, Hoshiarpur, 1979)
41. *Nalikāmaṇīyuṭeyukitḥ* (Malayalam) (ed. K.V. Sarma, Trivandrum, 1991)
42. *Mahājyānayanaprakāra* (ed. and tr. D. Gold and D. Pingree, *Historia Scientiarum*, 1991)
43. *Grahaṇanayanavāsanā* (ed. K.V. Sarma (in press))
44. *Grahaṇapadeśa* (ed. K.V. Sarma (in press))
45. *Sūkgrahaṇagaṇitam Nīlakaṇṭha Somsutānusāri* (ed. K.V. Sarma (in press))

5

Continued Fractions in Karaṇapaddhati

M.S. Sriram and *R. Venketeswara Pai*

Karaṇapaddhati was composed around CE 1732 by Putumana Somayāji (1660-1740), a seventeenth century astronomer – mathematician from Kerala. He was also the author of *Pañcabodha*, *Nyāyaratna*, *Vaṇvarohāṣṭaka*, *Grahaṇāṣṭaka*, *Jātakadeśamārga* and *Bahvṛcaprāyaścitta.*

Our work is based on:

1. Sanskrit edition of the text: vol. 126 of Trivandrum Sanskrit Series, K. Sambasiva Sastri, 1937.
2. Malayalam edition of text, with mathematical notes, P.K. Koru, Cherp, 1953.
3. Malayalam edition with two Malayalam commentaries, S.K. Nayar, Madras, 1956.

Normally, a *karaṇa* text discusses the recent epoches and only computational algorithms. But *Karaṇapaddhati* is a unique work aimed at assisting astronomers in preparing *karaṇa* and *vākya* texts by giving *paddhati.*

It accounts for the revolution numbers in a *mahāyuga*, *mahāguṇakāra*s, and *mahāhārakāra*s.

nānājñānapragalmastilabalamasusūkṣmaṁ dhayedrājadambho
bhadrodantodharendro niranusṛgadhisaukhyaṁ variṣṭho
'bhiṣaṅgaḥ ।
dordaṇḍāgre 'drinātho viṣamitavipinaṁ candrarekhāmbukhinne-

Table 5.1: Revolutions in a Mahāyuga*

Planet	*In Kaṭapayādi*	*In Numerals*
Sun	*nānājñānapragalbhaḥ*	4,320,000
Moon	*tilabalamasūkṣmaṁ*	57,753,336
Moon's apogee	*dhayedrājadambhaḥ*	488,219
Mars	*bhadrodantodharendraḥ*	2,296,824
Mercury	*niranusūgadhisokhyam*	17,937,020
Jupiter	*variṣṭhobhiṣaṅgaḥ*	364,224
Venus	*dordaṇḍāgre'drināthaḥ*	7,022,388
Saturn	*viṣamitavipinam*	146,564
Moon's node	*candrarekhāmbukhinnā*	232,226
Number of civil days	*anṛśaṁsaḥ kaḷāthīsamartyaḥ*	1,577,917,500

* The number of revolutions made by the planets and the number of civil days in a *Mahāyuga.* These revolution numbers as well as the number of civil days in a *Mahāyuga* are the same as in *Āryabhaṭīya* as also in *Tantrasaṁgraha.*

tyarkādeḥ paryayāḥ syuḥ kṣitidinamanṛśaṁsaḥ
kaḷārthīsamartyaḥ ।। 3 ।।

In the above verse Putumana Somayāji gives the number of revolutions made by all the planets in a large period *mahāyuga* (4,320,000 years) and also specifies the total number of civil days in that period. For specifying these numbers he has adopted the *kaṭapayādi* system of numeration employed by almost all the Kerala astronomers starting from Haridatta (seventh century). Table 5.1 presents these numbers along with their Sanskrit equivalents.

After stating the *Āryabhaṭīya* values as above, Putumana Somayāji introduces corrections to the rates of motion of the planets. The corrected numbers for a planet are expressed in terms of *mahāguṇakāra, G* and *mahāhāra, H* (Table 5.2). G/H is the number of revolutions of a planet per day. Alternately, H/G is the number of days per one revolution.

For the Sun there is no correction , and G is the number of

Table 5.2: The Mahāguṇakāras and Mahāhāras of the Planets

Planet	*In Kaṭapayādi*	*In Numerals*
Mahāguṇakāra (G)		
Moon	*nītisakalanidhirnaḷabhūt*	4,909,031,760
Moon's apogee	*tadvargajo nābhimatam*	65,408,346
Mars	*aviti prītisādhugaṇaḥ*	539,762,640
Mercury	*anartthāṅgahārīsaṁkarobhūt*	4,215,283,700
Jupiter	*urvīndrogajamarmajit*	85,583,240
Venus	*ahīśo nagaranāsatuṣṭaḥ*	165,0230,580
Saturn	*urvīmokṣa vibhāvagā*	34,446,540
Moon's node	*raṅge jāvālivāsa*	7,433,832
Mahāguṇakāra (H)		
Moon	*ino māsādidhuro rājyavalaye*	134,122,987,500
Moon's apogee	*annaśivo dhanī vibhuḥ pāpāriḥ*	211,440,945,000
Mars	*agnirutpatinṛpajanasthale*	370,810,612,500
Mercury	*agnirutpatinṛpajanasthale*	370,810,612,500
Jupiter	*agnirutpatinṛpajanasthale*	370,810,612,500
Venus	*agnirutpatinṛpajanasthale*	370,810,612,500
Saturn	*agnirutpatinṛpajanasthale*	370,810,612,500
Moon's node	*nūnanītirbaladhanvīnāśe*	50,493,360,000

years in a *mahāyuga*, and H is *bhūdina*, or the number of civil days in the *mahāyuga*.

G = 4,320,000 and H = 1,577,917,500

Mahāguṇakāras and *mahāhāras* are transformed into *dṛḍhaguṇakāras* and *dṛḍhahāras* by dividing each by the *apavartaṇa*, or the Greatest Common Divisor (GCD) (Table 5.3).

Vallayupasaṁhara and Alpaguṇakāras and Alpahāras

The problem of large G and H is more acute when have to use difference between two rates of motion, like those of the moon and its apogee, for instance (when we have to calculate

$\frac{G_1}{H_1} - \frac{G_2}{H_2} = \frac{G_1H_2 - G_2H_1}{H_1H_2}$). So, we need small, *guṇakāras* (G_1) and *hāras*, (H_1) whose ratios will approximate the "exact" ratio $\frac{G}{H}$. This is where the continued fraction method comes.

Table 5.3: The Dṛḍhaguṇakāras and the Dṛdhahāras of Different Planets in *Vākyas* as Given in the Commentary

Planet	*Apavartaṇa* (*GCD*)	*Dṛḍhaguṇakāras* D_g	*Dṛdhahāras* D_h
Sun	*ūnamāsam* 7,500	*tatsama* 576	*dhījagannūpuram* 210,389
Moon	*nīti* 60	*coḷikathā kuñcapade* 81,817,196	*śatrukulaṁ halīmallārīndre* 2,235,383,125
Moon's apogee	*tajñaḥ* 6	*yuddhagaḥ pīndhānuṣkaḥ* 10,901,391	*jñānaśaṅkī medhyajño vidrumāṅgaḥ* 352,401,557,500
Mars	*nīti* 60	*bhūvane stabdho dhījit* 8,996,044	*māsajātasampanno jayantaḥ* 6,180,176,875
Mercury	*anīka* 100	*saṅgaharo śaṅkaro 'bhūt* 42,152,837	*mādrīpatirnaya-dānasaṅgaḥ* 3,708,106,125
Jupiter	*avadhī* 940	*tatvajñayoddhā* 91,046	*māṁsagaṅdhisabhā-viddholam* 394,479,375
Venus	*nṛttam* 60	*garbhajālagno matsarī* 27,503,843	*māsajātasampanno jayantaḥ* 6,180,176,875
Saturn	*netā* 60	*dhaniṣko vasumān* 574,109	*māsajātasampanno jayantaḥ* 6,180,176,875
Moon's node	*vajraṁ* 24	*gūḍhasiddhirnṛgaḥ* 309,743	*anūnanidhirjalānāṁ pūram* 2,103,890,000

Large *G* and *H*: Not convenient.

Somayāji has two *vallayupasaṁhāra* methods for obtaining the approximate *guṇakāra*s, G_1 and *hāras,* H_1. We describe the second method below:

anyonyāhṛtabhājyahārakaphalaṁ sarvaṁ tvadho'tdo nyaset
ekatrādāphalena hīnamaparatryaikaṁ dvayoścopari ।
kuryād valyupasaṁhṛtiṁ dyuparitaḥ pūrvapraṇāśaṁ vinā
tyājyaṁ tatprathamordhvagaṁ haraguṇāśśaṣṭāśca vā svecchayā ॥ 6 ॥

The results obtained by dividing *guṇa* and *hāra* mutually by each other have to be kept one below the other at one place. Place the same results [one below the other] at another place by dropping the first result. Placing 1 above in both the places, may *vallayupasaṁhāra* be done [as before] from the top without deleting the previous results. [However], 1 from the first column has to be dropped. The remaining numbers are taken as *hāra* and *guṇa* respectively.

Let $q_1, q_2, q_3 \ldots$ be the successive quotients. In the first place all of them need to be placed one below the other. In another place, the same results have to be placed by omitting the first quotient q_1 as shown in Table 5.4.

Now, placing 1 above the column in both the places the process of *vallayupasaṁhāra* has to be done as demonstrated in Table 5.5. The successive entries in columns II and IV are generated from the columns I and III using the procedure described in the first method.

In Table 5.5 the second column represents the sets of *hārakas* and the fourth column *guṇakāra*s. It is said *tyājyam tatprathamordhvagaṁ*.

That is, 1 at the top of the *hāraka*s column (II in Table 5.5) has to be dropped. Once we do this, whatever remains in column II and column IV can be as such paired up to get the sets of *alpahāraka*s and *alpaguṇakāra*s. For a ratio $\frac{G}{H}$, the different pairs that get generated are listed in Table 5.6.

Table 5.4: The Way the Successive Quotients (*Vallīphalas*) Need to be Arranged in the Second Method of *Vallayupasaṁhāra*

q_1	-
q_2	q_2
q_3	q_3
q_4	q_4
q_5	q_5
..	..
..	..
..	..

Table 5.5: Generating the *Alpaguṇakāras* and *Alpahāras* Using the Second Method of *Vallayupasaṁhāra*

I	II	III	IV
1	1		
q_1	q_1	1	1
q_2	$q_1 \times q_2 + 1$	q_2	q_2
q_3	$(q_1 \times q_2 + 1) \times q_3 + q_1$	q_3	$q_2 \times q_3 + 1$
q_4	$((q_1 \times q_2 + 1) \times q_3 + q_1) \times q_4 + (q_1 \times q_2 + 1)$	q_4	$(q_2 \times q_3 + 1) \times q_4 + q_2$
...	...	...	...
...	...	...	...
...	...	...	...

Table 5.6: Pairs of *Alpaguṇakāras* and *Alpahārakas* Obtained by the Second Method of *Vallayupasaṁhāra*

$(H_1, G_1) = (q_1, 1)$
$(H_2, G_2) = (q_1 \times q_2 + 1, q_2)$
$(H_3, G_3) = ((q_1 \times q_2 + 1) \times q_3 + q_1, q_2 \times q_3 + 1)$
$(H_4, G_4) = (((q_1 \times q_2 + 1) \times q_3 + q_1) \times q_4 + (q_1 \times q_2 + 1), (q_2 \times q_3 + 1) \times q_4 + q_2)$
...
...

Explanation

When we perform the mutual division starting from G, H:

$$
\begin{array}{l}
G)\ H\ (q_1 \\
\quad \underline{Gq_1\qquad\quad} \\
\qquad r_1)\ \ G\ \ (q_2 \\
\qquad\qquad r_1q_2 \\
\qquad\qquad\ \ r_2)\ \ r_1\ \ (q_3 \\
\qquad\qquad \overline{\qquad r_2q_3\qquad} \\
\qquad\qquad\ \ \overline{\qquad\qquad\quad} \\
\qquad\qquad\qquad\quad \cdot \\
\qquad\qquad\qquad\quad \cdot \\
\qquad\qquad\qquad\quad \cdot \\
\qquad\qquad\qquad\quad r_n)\ \ r_n - 1\ \ (q_n + 1 \\
\qquad\qquad\qquad\qquad\ \ \underline{r_nq_n + 1\quad} \\
\qquad\qquad\qquad\qquad\quad r_n + 1
\end{array}
$$

We can write this in terms of equations as follows:

Assuming $H > G$, we divide H by G. Let

$$\frac{H}{G} = q_1 + \frac{r_1}{G}.$$

Here q_1 is the first quotient and r_1 the first remainder. We now divide G by r_1 to obtain the second quotient and the second remainder.

$$\frac{G}{r_1} = q_2 + \frac{r_2}{r_1}.$$

Repeating this process, we have

$$\frac{r_1}{r_2} = q_3 + \frac{r_3}{r_2} \vdots\vdots$$

and

$$\frac{r_{n-1}}{r_n} = q_{n+1} + \frac{r_{n+1}}{r_n},$$

Hence

$$\frac{H}{G} = q_1 + \cfrac{1}{q_2 + \cfrac{1}{q_3 + \cdots + \cfrac{1}{q_n}}}.$$

As $\frac{H}{G}$ is a ratio of two integers, the process will terminate for some n, when $r_n = 0$. Then

$$\frac{H}{G} = q_1 + \cfrac{1}{q_2 + \cfrac{1}{q_3 + \cdots + \cfrac{1}{q_n}}}$$

Consider

$$\frac{H_1}{G_1} = \frac{q_1}{1} \, (H_1 = q_1, G_1 = 1)$$

$$\frac{H_2}{G_2} = q_1 + \frac{1}{q_1} = \frac{q_1 q_2 + 1}{q_2} (H_2 + q_1 q_2 + 1, G_2 = q_2)$$

$$\frac{H_3}{G_3} = q_1 + \cfrac{1}{q_2 + \cfrac{1}{q_3}}$$

$$(H_3 = (q_1 q_2 + 1) q_3 + q_1, G_3 = q_2 q_3 + 1)$$

. . .

Table 5.7: *Alpaguṇakārās* and *Alpahārakās* of Moon

Alpaguṇakāras A_g	*Alpahārakas* H_h
1	27
3	82
28	765
115	3142
143	3907
38868	1061939
116747	3189724
155615	4251663
1050437	28699702
2256489	61651067
10076393	275303970
12332882	336955037
34742157	949214044
81817196	2235383125

These are the same as the ones listed in the *vallayupasaṁhāra* method.

As an example, we list *alpaguṇakāra*s and *alpahāraka*s of the moon in Table 5.7. Table 5.8 gives *alpaguṇakāra*s and *alpahāraka*s of moon's anomaly (Mean Moon – Moon's apogee).

Obtaining the Khaṇḍas and Dhruvas for the Moon

For using the *vākya* method for finding the longitude of the moon on any given day, it is necessary to find a nearby earlier day, at the mean sunrise of which the moon's *kendra* (anomaly) is close to zero. This is *khaṇḍa* or *khaṇḍadina.* The following verse gives the algorithm for finding *khaṇḍa* corresonding to any *ahargaṇa*:

> *devendraśarmaikyadinendutuṅgabhedārthayukteṣṭadinendu-kendrāt* ।
> *liptīkṛtāt kendrahareṣa avabhīṣṭenāhatya nānārtiparaira vāptāḥ* ।। 2 ।।
>
> *abhīṣṭahārordhvahareṇa hatvā pūrvoditābhiṣṭahareṇā hṛtvā* ।
> *tatrādhikonaṁ dyugaṇāt viśodhyaṁ hāraujayugmatvavaśāt krameṇa* ।। 3 ।।
> *śiṣṭaṁ śaśāṅkoditavākyakhaṇḍaḥ. . . .*

Half of the difference between *bhuktī*s of the moon and its apogee in sum of the 248 (*devendra*) and 55 (*sarma*) days has to be added to the longitude of moon's anomaly in minutes for the desired day, multiplied by the desired *kendrahāra*s and divided by the 21,600 (*nanārtipara*). Now multiplying the result obtained by the previous divisor and dividing it by the desired divisor, the remainder has to be subtracted from *ahargaṇa*. For odd dividers, *adhikaśiṣṭa* has to be subtracted and for even ones has to be subtracted. The remainder obtained by subtraction would be the *vākyakhaṇḍa* for the moon.

In order to determine *khaṇḍa* we need to know *guṇakāra*s and *hāraka*s related to *kendragati.* Assuming that we have determined all of them, let's denote the odd *hārakas* by $h_1, h_3, h_5 \ldots$ and the odd *guṇa*s by $g_1, g_3, g_5 \ldots$. Similarly, let $h_2, h_4, h_6 \ldots$ and $g_2, g_4, g_6 \ldots$ be

Table 5.8: *Guṇakāras* and *Hārakas* Corresponding to the Moon's Anamoly (*Mandakendra*)

Alpa-Hārakas (h_i)	*Alpa-Guṇakāras* (g_i)
27	1
28	1
55	2
248	9
3031	110
12372	449
188611	6845
1332649	48367
1521260	55209
21109029	766081
43739318	1587371
414762891	15052420
458502209	16639791
1331767309	48332002
1790269518	64971793
3122036827	113303795
4912306345	178275588
8034343172	291579383
12946649517	469854971
20980992689	761434354
54908634895	1992723679
75889627584	2754158033
130798262479	4746881712
599082677500	21741684881
126040405436547500	4574211340428709

the even *hārakas* and *guṇas* respectively. Suppose we would like to find *khaṇḍa* corresponding to *ahargaṇa* A. Then the algorithm given in the verse towards this may be written as follows:

Add half *mandakendra* of the moon in minutes corresponding to 303 days to the value of *mandakendra* corresponding to *ahargaṇa* A. That is, first we need to find

$$(\theta_0 - \theta_m)'_A + \frac{(\theta_0 - \theta_m)'_{303}}{2},$$

where q_0 and q_m are the longitudes of mean planet (i.e. moon) and its apogee respectively.

This quantity has to be divided by 21,600 (*nanārtipara*) and multiplied by any desired *kendrahāra* (h_1) (listed in Table 5.8).

$$\frac{\left((\theta_0 - \theta_m)'_A + \frac{(\theta_0 - \theta_m)'_{303}}{2}\right)}{21600} \times h_i$$

The result obtained from thus has to be multiplied by the penultimate divisor of the desired divisor *ūrdhvahāraka* and divided by *iṣṭahāraka*. The remainder R is given by

$$R = \text{Rem}\left[\frac{\left[\left(\frac{\left((\theta_0 - \theta_m)'_A + \frac{(\theta_0 - \theta_m)'_{303}}{2}\right)}{21600} \times h_i\right) \times h_{(i-1)}\right]}{h_i}\right].$$

The "( )" denotes the integral part of the quantity contained with in. This remainder R is to be found and stored for further operations.

In order to obtain *khaṇḍa*, *adhikaśiṣṭa* (R) or *unaśiṣṭa* ($h_i - R$) has to be subtracted from A depending on whether h is odd or even respectively. That is,

Khaṇḍa, $A' = A -$ *adhikaśiṣṭa* (for odd h_i), (1) or

$= A -$ *unaśiṣṭa* (for even h_i). (2)

We ignore the correction term $\frac{(\theta_0 - \theta_m)'_{303}}{2}$ for the time being. Consider the anomaly $(q_0 - q_m)a$ in minutes, including the zero-

correction at *kali* beginning (*kalyadidhruva*). The text does not specify how this is computed. Probably it is computed using the *kendragati* as $\frac{g_1}{h_i}$ revolutions/day, for a reasonably large value of the *hāraka.*

$$\frac{(\theta_0 - \theta_m)A}{21600}$$

which is the *kendra* in revolutions can be expressed as $\frac{n'}{h_i}$ (after subtracting integral number of revolutions). Hence *kendra* at *A* can be expressed as

$$A = \frac{(\theta_0 - \theta_m)_A}{21600} = \frac{n_1}{h_i}$$

or

$$\left[A = \frac{(\theta_0 - \theta_m)_A}{21600} = h_i\right] = [n'] = n,$$

where "[ ]" denotes the integer nearest to *n*'. So, we are essentially approximating the anomaly at *A* by $\frac{n}{h_i}$, where *n* is an integer. For large h_i (say 12,372), this is a good approximation. *Khaṇḍa A*' corresponds to the day when the anomaly is close to zero. Let *A*' = *A* – *x*. So *x* is the number of days in which the *kendra* increases by $\frac{n}{h_i}$, revolutions. As the daily motion of the *kendra* is $\frac{g_1}{h_i}$ revolution, *x* satisfies

$$\frac{g_1}{h_i} \times x - y = \frac{n}{h_i}$$

where *y* is the number of completed revolutions of *kendra*. Then the above expression can be rewritten as

$$g_i x - h_i y = n$$

or

$$g_i x - n = h_i y$$

Let

$$r = \text{Remainder}\left[\frac{nh_i - 1}{h_i}\right]$$

Then it can be shown that

$x = r$, □ for "odd" h_i

and

$x = h_i - r$, □ for "even" h_i

are solutions of

$$g_i x - n = h_i y.$$

Hence, we have shown that *khaṇḍa* A' is given by

$A' = A - r$ □ for even i

$\quad = A - (h_i - r)$ □ for odd i

where

$$r = \text{Remainder}\left[\frac{\left(\frac{(\theta_0 - \theta_m)' A}{21600} \times h_i\right) \times h_i - 1}{h_i}\right]$$

as stated in the text, apart from the correction term. The correction term makes *kendra* smaller at A', for small h_i like 248.

True Longitude of the Moon Using the Vākya Method

At *khaṇḍa*, the moon's anomaly is (nearly) zero. So, the "Equation of Centre" (correction due to the eccentricity of the orbit) is zero, and the "True Longitude" equals the "Mean Longitude".

Now we explain how *vākya*s are obtained. The increase in the true longitude after one day of the 248-day cycle is

$$\frac{360°}{24.32167852} - \sin^{-1}\left[\frac{7}{80} \times \sin\left(\frac{9}{248} \times 360\right)\right]$$

The first term represents the increase in the mean longitude as

the sidereal period is 27.32167852 days. The second term represents the equation of centre, as the anomaly is (9/248) × 360 at the end of first day. We find the value of the above is $0^r\ 12°\ 3'$ correct to a minute, which is precisely the value implied by the first *vākya: girnaḥ śriyaḥ.*

Similarly, the increase in the true longitude at the end of two days of the cycle is

$$\frac{2\times 360°}{27.32167852}-\sin^{-1}\left[\frac{7}{80}\times\sin\left(\frac{18}{248}\times 360\right)\right]=0^r 24°\ 9'$$

Correct to a minute, which is exactly the value implied by the second *vākya: dhenavaḥ śriḥ.*

The increase in the true longitude at the end of 154 days of the cycle, for instance, is

$$\frac{154\times 360°}{27.32167852}-\sin^{-1}\left[\frac{7}{80}\times\sin\left(\frac{9}{248}\times 154\times 360\right)\right]$$

$$=7^r 21°\ 49'$$

differing from $7^r\ 21°\ 48'$ implied by the 154th *vākya jitvasya rathaḥ,* only by a minute.

6

Moon as Chronometer for Rectification of Birth Time

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Introduction

THE term *nakṣatra* refers to a segment of the zodiac covering an arc of 13°-20'. The zodiac of 360° is thus made up of twenty-seven *nakṣatra*s, viz., 27 x 13°-20' = 360°, making a full circle. Each *nakṣatra* is given a separate name in Indian astronomy and its zone or place in heavens can easily be identified during night time by the presence of prominent star(s) in its zone. Each *nakṣatra* is thus made up of a group of cluster of stars, arranged in a well definable shape and many a time the name given to a *nakṣatra* is derived from the nature of the shape it presents to the viewer on the earth. The presence of Candra (the moon), the fastest moving body of the planetary entities in each of these *nakṣatra*s, is one of the important parameters in Oriental astrology. Its entry and exit timings and the duration of the transit in each *nakṣatra* is calculated and listed in the almanacs published from different parts of the Oriental countries. For example, when a particular day's *nakṣatra* is listed in the almanac as Rohiṇī, it means that for a major part of the day or at the time of sunrise, Candra is in the zone in the heavens represented by Rohiṇī. Candra is thus the long needle of the zodiac clock given by nature.

Daśā Periods

All these twenty-seven *nakṣatra*s have been assigned to the nine planets (*graha*s) in Hindu astrology and each planet is supposed

to own three *nakṣatra*s. The nine planets considered are — (1) Ravi (Sun), (2) Candra (Moon), (3) Kuja (Mars), (4) Budha (Mercury), (5) Guru (Jupiter), (6) Śukra (Venus), (7) Śani (Saturn), (8) Rāhu (Dragon Head) and (9) Ketu (Dragon Tail). In Hindu astrology, each individual's lifespan is supposed to come under the spell of these planets at different points of time in life, each spell of the planet lasting for a certain period of time known as *daśā* period. The position of Candra in a *nakṣatra* during the birth time decides the birth *daśā* period of the individual. Thus if Candra is found in Mṛgaśirā or Citrā or Dhaniṣṭhā *nakṣatra*s owned by Kuja, then the birth *daśā* is that of Kuja. After Kuja *daśā*, the *daśā* period of another planet starts and the sequence continues until all the planets are covered. The *daśā* periods of the planets are not of same duration. The sequence of *daśā* periods and their duration is (1) Ravi: 6 years, (2) Candra: 10 years, (3) Kuja: 7 years, (4) Rāhu: 18 years, (5) Guru: 16 years, (6) Śani: 19 years, (7) Budha: 17 years, (8) Ketu: 7 years, and (9) Śukra: 20 years making the total lifespan as 120 years (*viṁśottari daśā*). Again each *daśā* period of a planet is divided into nine *antardaśā* (sub-*daśā*) periods, which are assigned to each of the planets starting with the *daśā* period planet and following the sequence. *Antardaśā* period of a planet is proportional to its *daśā* period within the *daśā* period of the main planet in such a way that the total duration of the *antardaśā* periods of all the planets corresponds to the *daśā* period of the main planet. This can be continued to arrive at still small periods of time intervals within *antardaśā* and so on. Thus we have *vidaśā* (sub-*antardaśā*), *sūkṣma* (sub-*vidaśā*) and *prāṇa* (sub-*sūkṣma*) periods as enunciated by the ancient *ṛṣi* Parāśara in his *Horāśāstra*.

In the example given above, after Kuja *daśā,* the sequence of *daśā*s is Rāhu, Guru, Śani, Budha, Ketu, Śukra, Ravi and Candra. Each *daśā* period can be divided into *antardaśā* periods and so on. It should be mentioned that the duration of the birth *daśā* period generally does not pertain to the total duration of the *daśā* period of that planet. It depends on the exact position of Candra while

transiting in the *nakṣatra* at the time of birth. As mentioned earlier, the span of each *nakṣatra* is 13°-20' or 800' arc. This total of 800' corresponds to the total *daśā* period of the planet owning the *nakṣatra.* If Candra has already transited through a part of *nakṣatra* at the time of birth, the balance *daśā* period of the planet during birth is calculated proportionally from the remaining part of the arc of 800'. Thus the calculation of *daśā* periods requires the presence of Candra in the zodiac at a given point of time. Further, it may be noted that for calculation of *daśā* periods of planets a "*nakṣatra* day" is defined. This *nakṣatra* day is the duration of the time taken by Candra to transit through a *nakṣatra.* This *nakṣatra* day defined in this fashion is different from the day that we normally use, viz. 24-hour day or sunrise to sunrise or sunset to sunset. The duration of a *nakṣatra* day is not constant. It is different in different *nakṣatra*s as well as different in the same *nakṣatra* depending on the *tithi* (Ravi–Candra distance) present on that day. Candra spends about 28 hours in a *nakṣatra* around full-moon time and about 21 hours around new-moon time.

The month of 30 days based on *nakṣatra paddhati* is the duration of time Candra takes to cover an arc in the zodiac described by thirty *nakṣatra*s. This corresponds to 400° (360° for covering twenty-seven *nakṣatra*s and another 40° for the remaining three *nakṣatra*s). Thus if one starts counting the beginning of the month, say at Aśvinī 0°, the month ends when Candra completes one cycle of 27 + 3 *nakṣatra*s, viz. the end of Kṛttikā. The second month begins when Candra enters Rohiṇī 0°. Continuing this argument, a year of 360 days based on *nakṣatra paddhati* corresponds to the time taken by Candra to cover 360 *nakṣatra*s or thirteen cycles of twenty-seven *nakṣatra*s plus nine more *nakṣatra*s. That is at the beginning of the year, if it is Aśvinī 0°, then the year ends at Āśleṣā 0° and the second year begins at Maghā 0°. We can extend this logic to the lifespan and the *daśā* periods of an individual also. If one's birth *nakṣatra* is Rohiṇī, this *nakṣatra* returns exactly after three years (or multiples of three years). Sixty years of that person will be complete when

Candra has completed 60 x 360/27 = 800 cycles and enters Rohiṇī again. One would see the 1,000 full moons if one survives for 75 years (75 x 360/27 = 1,000).

Candra thus serves as a precise indicator for timing and when a new *daśā* period has to begin, it would not just begin on any day other than one shown by Candra. Ravi *daśā* period for any one would begin only when the *nakṣatra* on that day is owned by Ravi (Kṛttikā or Uttarāṣāḍhā). Similarly, Candra *daśā* period begins when the *nakṣatra* on that day is Rohiṇī, Hastā, Śravaṇā.

The sequence of *daśā* and *antardaśā*s as envisaged in the *viṁśottari daśā* system and the *nakṣatra*s on the first and last day of the *antardaśā* period with in a *daśā* period is given in Table 6.1. The first column gives the total number of *nakṣatra*s (A) to be covered in the indicated *antardaśā* period (column 2). For example, in RA-CA period, the entire duration of the period has a total of 180 *nakṣatra*s. That means to cover the entire RA-CA period, 180-*nakṣatra* days are to be elapsed.

Table 6.1: Starting and Ending *Nakṣatra*s for Each *Daśā* (D) and *Antardaśā* (AD) Periods of Planets

A	*D-AD*	*Start–End*	*Start–End*	*Start–End*
108	*RA-RA*	*Kṛttikā–Kṛttikā*	*Uttarā-Phālgunī–Uttarā-Phālgunī*	*Uttarāṣāḍhā–Uttarāṣāḍhā*
180	*RA-CH*	*Kṛttikā–Uttarāṣāḍhā*	*Uttarā-Phālgunī–Kṛttikā*	*Uttarāṣāḍhā–Uttarā-Phālgunī*
126	*RA-KU*	*Uttarāṣāḍhā–Uttarā-Phālgunī*	*Kṛttikā–Uttarāṣāḍhā*	*Uttarā-Phālgunī–Kṛttikā*
324	*RA-RH*	*Uttarā–Phālgunī–Uttarā-Phālgunī*	*Uttarāṣāḍhā–Uttarāṣāḍhā*	*Kṛttikā–Kṛttikā*
288	*RA-GU*	*Uttarā-Phālgunī–Kṛttikā*	*Uttarāṣāḍhā–Uttarā-Phālgunī*	*Kṛttikā–Uttarāṣāḍhā*
342	*RA-SA*	*Kṛttikā–Uttarāṣāḍhā*	*Uttarā-Phālgunī–Kṛttikā*	*Uttarāṣāḍhā–Uttarā-Phālgunī*
306	*RA-BU*	*Uttarāṣāḍhā–Kṛttikā*	*Kṛttikā–Uttarā-Phālgunī*	*Uttarā–Phālgunī Uttarāṣāḍhā*

cont.

Table 6.1 *cont.*

A	*D-AD*	*Start–End*	*Start–End*	*Start–End*
126	*RA-KE*	*Kṛttikā–Uttarāṣāḍhā*	*Uttarā-Phālgunī–Kṛttikā*	*Uttarāṣāḍhā–Uttarā-Phālgunī*
360	*RA-SU*	*Uttarāṣāḍhā–Kṛttikā*	*Kṛttikā–Uttarā-Phālgunī*	*Uttarā-Phālgunī–Uttarāṣāḍhā*
300	*CH-CH*	*Rohiṇī–Punarvasu*	*Hastā–Viśākhā*	*Śravaṇā–Pūrvābhādrā*
210	*CH-KU*	*Punarvasu–Aśvinī*	*Viśākhā–Maghā*	*Pūrvābhādrā–Mūlā*
540	*CH-RH*	*Aśvinī–Aśvinī*	*Maghā–Maghā*	*Mūlā–Mūlā*
480	*CH-GU*	*Aśvinī–Śravaṇā*	*Maghā–Rohiṇī*	*Mūlā–Hastā*
570	*CH-SA*	*Śravaṇā–Pūrvābhādrā*	*Rohiṇī–Punarvasu*	*Hastā–Viśākhā*
510	*CH-BU*	*Pūrvābhādrā–Śravaṇā*	*Punarvasu–Rohiṇī*	*Viśākhā–Hastā*
210	*CH-KE*	*Śravaṇā–Viśākhā*	*Rohiṇī–Pūrvābhādrā*	*Hastā–Punarvasu*
600	*CH-SU*	*Viśākhā–Śravaṇā*	*Pūrvābhādrā–Rohiṇī*	*Punarvasu–Hastā*
180	*CH-RA*	*Śravaṇā–Hastā*	*Rohiṇī–Śravaṇā*	*Hastā–Rohiṇī*
147	*KU-KU*	*Citrā–Uttarābhādrā*	*Dhaniṣṭhā–Puṣyā*	*Mṛgaśīrṣa–Anūrādhā*
378	*KU-RH*	*Uttarābhādrā–Uttarābhādrā*	*Puṣyā–Puṣyā*	*Anūrādhā–Anūrādhā*
336	*KU-GU*	*Uttarābhādrā–Pūrvā-Phālgunī*	*Puṣyā–Pūrvāṣāḍhā*	*Anūrādhā–Bharaṇī*
399	*KU-SA*	*Pūrvā-Phālgunī–Mṛgaśīrṣa*	*Pūrvāṣāḍhā–Citrā*	*Bharaṇī–Dhaniṣṭhā*
357	*KU-BU*	*Mṛgaśīrṣa–Pūrvā-Phālgunī*	*Citrā–Pūrvāṣāḍhā*	*Dhaniṣṭhā–Bharaṇī*
147	*KU-KE*	*Pūrvā-Phālgunī–Dhaniṣṭhā*	*Pūrvāṣāḍhā–Mṛgaśīrṣa*	*Bharaṇī–Citrā*
420	*KU-SU*	*Dhaniṣṭhā–Pūrvā-Phālgunī*	*Mṛgaśīrṣa–Pūrvāṣāḍhā*	*Citrā–Bharaṇī*
126	*KU-RA*	*Pūrvā-Phālgunī–Bharaṇī*	*Pūrvāṣāḍhā–Pūrvā-Phālgunī*	*Bharaṇī–Pūrvāṣāḍhā*

cont.

Table 6.1 *cont.*

A	*D-AD*	*Start–End*	*Start–End*	*Start–End*
210	*KU-CH*	*Bharaṇī–Dhaniṣṭhā*	*Pūrvā-Phālgunī–Mṛgaśīrṣa*	*Pūrvāṣāḍhā– Citrā*
972	*RH-RH*	*Śatabhiṣā–Śatabhiṣā*	*Ārdrā–Ārdrā*	*Svāti–Svāti*
864	*RH-GU*	*Śatabhiṣā–Śatabhiṣā*	*Ārdrā–Ārdrā*	*Svāti–Svāti*
1026	*RH-SA*	*Śatabhiṣā–Śatabhiṣā*	*Ārdrā–Ārdrā*	*Svāti–Svāti*
918	*RH-BU*	*Śatabhiṣā–Śatabhiṣā*	*Ārdrā–Ārdrā*	*Svāti–Svāti*
378	*RH-KE*	*Śatabhiṣā–Śatabhiṣā*	*Ārdrā–Ārdrā*	*Svāti–Svāti*
1080	*RH-SU*	*Śatabhiṣā–Śatabhiṣā*	*Ārdrā–Ārdrā*	*Svāti–Svāti*
324	*RH-RA*	*Śatabhiṣā–Śatabhiṣā*	*Ārdrā–Ārdrā*	*Svāti–Svāti*
540	*RH-CH*	*Śatabhiṣā–Śatabhiṣā*	*Ārdrā–Ārdrā*	*Svāti–Svāti*
378	*RH-KU*	*Śatabhiṣā–Śatabhiṣā*	*Ārdrā–Ārdrā*	*Svāti–Svāti*
768	*GU-GU*	*Pūrvābhādrā–Maghā*	*Punarvasu–Mūlā*	*Viśākhā–Aśvinī*
912	*GU-SA*	*Maghā–Rohiṇī*	*Mūlā–Hastā*	*Aśvinī–Śravaṇā*
816	*GU-BU*	*Rohiṇī–Maghā*	*Hastā–Mūlā*	*Śravaṇā–Aśvinī*
336	*GU-KE*	*Maghā–Śravaṇā*	*Mūlā–Rohiṇī*	*Aśvinī–Hastā*
960	*GU-SU*	*Śravaṇā–Maghā*	*Rohiṇī–Mūlā*	*Hastā–Aśvinī*
288	*GU-RA*	*Maghā–Aśvinī*	*Mūlā–Maghā*	*Aśvinī–Mūlā*
480	*GU-CH*	*Aśvinī–Śravaṇā*	*Maghā–Rohiṇī*	*Mūlā–Hastā*
336	*GU-KU*	*Śravaṇā–Punarvasu*	*Rohiṇī–Viśākhā*	*Hastā–Pūrvābhādrā*
864	*GU-RH*	*Punarvasu–Punarvasu*	*Viśākhā–Viśākhā*	*Pūrvābhādrā–Pūrvābhādrā*
1083	*SA-SA*	*Puṣyā–Pūrvā-Phālgunī*	*Anūrādhā–Pūrvāṣāḍhā*	*Uttarābhādrā–Bharaṇī*

cont.

Table 6.1 *cont.*

A	*D-AD*	*Start–End*	*Start–End*	*Start–End*
969	*SA-BU*	*Pūrvā-Phālgunī–Puṣyā*	*Pūrvāṣāḍhā–Anūrādhā*	*Bharaṇī–Uttarābhādrā*
399	*SA-KE*	*Puṣyā–Bharaṇī*	*Anūrādhā–Pūrvā-Phālgunī*	*Uttarābhādrā–Pūrvāṣāḍhā*
1140	*SA-SU*	*Bharaṇī-Puṣyā*	*Pūrvā-Phālgunī–Anūrādhā*	*Pūrvāṣāḍhā–Uttarābhādrā*
342	*SA-RA*	*Puṣyā–Uttarābhādrā*	*Anūrādhā–Puṣyā*	*Uttarābhādrā–Anūrādhā*
570	*SA-CH*	*Uttarābhādrā–Bharaṇī*	*Puṣyā–Pūrvā-Phālgunī*	*Anūrādhā–Pūrvāṣāḍhā*
399	*SA-KU*	*Bharaṇī–Dhaniṣṭhā*	*Pūrvā-Phālgunī–Mṛgaśīrṣa*	*Pūrvāṣāḍhā–Citrā*
1026	*SA-RH*	*Dhaniṣṭhā–Dhaniṣṭhā*	*Mṛgaśīrṣa–Mṛgaśīrṣa*	*Citrā–Citrā*
912	*SA-GU*	*Dhaniṣṭhā–Anūrādhā*	*Mṛgaśīrṣa–Uttarābhādrā*	*Citrā–Puṣyā*
867	*BU-BU*	*Jyeṣṭhā–Uttarāṣāḍhā*	*Revatī–Kṛttikā*	*Āśleṣā–Uttarā-Phālgunī*
357	*BU-KE*	*Uttarāṣāḍhā–Revatī*	*Kṛttikā–Āśleṣā*	*Uttarā-Phālgunī–Jyeṣṭhā*
1020	*BU-SU*	*Revatī–Uttarāṣāḍhā*	*Āśleṣā–Kṛttikā*	*Jyeṣṭhā–Uttarā-Phālgunī*
306	*BU-RA*	*Uttarāṣāḍhā–Kṛttikā*	*Kṛttikā–Uttarā-Phālgunī*	*Uttarā-Phālgunī–Uttarāṣāḍhā*
510	*BU-CH*	*Kṛttikā–Revatī*	*Uttarā-Phālgunī–Āśleṣā*	*Uttarāṣāḍhā–Jyeṣṭhā*
357	*BU-KU*	*Revatī–Ārdrā*	*Āśleṣā–Svāti*	*Jyeṣṭhā–Śatabhiṣā*
918	*BU-RH*	*Ārdrā–Ārdrā*	*Svāti–Svāti*	*Śatabhiṣā–Śatabhiṣā*
816	*BU-GU*	*Ārdrā–Uttarā-Phālgunī*	*Svāti–Uttarāṣāḍhā*	*Śatabhiṣā–Kṛttikā*
969	*BU-SA*	*Uttarā-Phālgunī–Āśleṣā*	*Uttarāṣāḍhā–Jyeṣṭhā*	*Kṛttikā–Revatī*
147	*KE-KE*	*Aśvinī–Hastā*	*Maghā–Śravaṇā*	*Mūlā–Rohiṇī*

cont.

Table 6.1 *cont.*

A	*D-AD*	*Start–End*	*Start–End*	*Start–End*
420	*KE-SU*	*Hastā–Aśvinī*	*Śravaṇā–Maghā*	*Rohiṇī–Mūlā*
126	*KE-RA*	*Aśvinī–Mūlā*	*Maghā–Aśvinī*	*Mūlā–Maghā*
210	*KE-CH*	*Mūlā–Hastā*	*Aśvinī–Śravaṇā*	*Maghā–Rohiṇī*
147	*KE-KU*	*Hastā–Pūrvābhādrā*	*Śravaṇā–Punarvasu*	*Rohiṇī–Viśākhā*
378	*KE-RH*	*Pūrvābhādrā–Pūrvābhādrā*	*Punarvasu–Punarvasu*	*Viśākhā–Viśākhā*
336	*KE-GU*	*Pūrvābhādrā–Maghā*	*Punarvasu–Mūlā*	*Viśākhā–Aśvinī*
399	*KE-SA*	*Maghā–Rohiṇī*	*Mūlā–Hastā*	*Aśvinī–Śravaṇā*
357	*KE-BU*	*Rohiṇī–Maghā*	*Hastā–Mūlā*	*Śravaṇā–Aśvinī*
1200	*SU-SU*	*Pūrvā-Phālgunī–Dhaniṣṭhā*	*Pūrvāṣāḍhā–Mṛgaśīrṣa*	*Bharaṇī–Citrā*
360	*SU-RA*	*Dhaniṣṭhā–Mṛgaśīrṣa*	*Mṛgaśīrṣa–Citrā*	*Citrā–Dhaniṣṭhā*
600	*SU-CH*	*Mṛgaśīrṣa–Pūrvā-Phālgunī*	*Citrā–Pūrvāṣāḍhā*	*Dhaniṣṭhā–Bharaṇī*
420	*SU-KU*	*Pūrvā-Phālgunī–Uttarābhādrā*	*Pūrvāṣāḍhā–Puṣyā*	*Bharaṇī–Anūrādhā*
1080	*SU-RH*	*Uttarābhādrā–Uttarābhādrā*	*Puṣyā–Puṣyā*	*Anūrādhā–Anūrādhā*
960	*SU-GU*	*Uttarābhādrā–Citrā*	*Puṣyā–Dhaniṣṭhā*	*Anūrādhā–Mṛgaśīrṣa*
1140	*SU-SA*	*Citrā–Pūrvāṣāḍhā*	*Dhaniṣṭhā–Bharaṇī*	*Mṛgaśīrṣa–Pūrvā-Phālgunī*
1020	*SU-BU*	*Pūrvāṣāḍhā–Citrā*	*Bharaṇī–Dhaniṣṭhā*	*Pūrvā-Phālgunī–Mṛgaśīrṣa*
420	*SU-KE*	*Citrā–Bharaṇī*	*Dhaniṣṭhā–Pūrvā-Phālgunī*	*Mṛgaśīrṣa–Pūrvāṣāḍhā*

[RA = Ravi; CA = Candra; KU = Kuja; RH = Rāhu; GU = Guru; SA = Śani; BU = Budha; KE = Ketu; SU = Śukra

A = Total number of *nakṣatra*s in the corresponding *daśā* and *antardaśā*].

Quantization of Birth Time

Candra serving as the precise indicator of timing can be extended to arrive at the expected time of birth also. Let us assume that a particular birth has occurred during the transit of Candra in Kṛttikā *nakṣatra* owned by Ravi. That is to say birth has occurred during Ravi *daśā* period lasting for six years representing whole of 13°-20'= 800' arc in the zodiac belonging to Kṛttikā *nakṣatra.* This 800' of arc is equal to 6 x 360 = 2,160 *nakṣatra*s or 2,160/27 = 80 lunar cycles. That is if all the 80 lunar cycles were to be over, then 800' of arc distance has to be covered. Thus we can visualize a clock with two needles; one long needle representing the daily movement of Candra (time needle) to complete the lunar cycles (in the above case 80) and another, short one covering the 800' arc (arc needle) distance in the zodiac. Thus the short needle advances by 10' of the arc for every lunar cycle and covers 800' in 80 lunar cycles. It should be clearly understood that in every lunar cycle, Candra transits through all twenty-seven *nakṣatra*s. During that period the arc needle would have moved by only 10'.

For each *nakṣatra* transited by the time needle, only 10'/27 = 22.222" of arc is travelled by the arc needle. When both the needles are exactly at Kṛttikā 0, whole of Ravi *daśā* period of six years is accounted. Any birth in Kṛttikā *nakṣatra* is therefore possible only when the arc needle is in between 0° and 22.222" and after 22.222", the time needle would have entered into another *nakṣatra*'s domain. Birth in Kṛttikā is not possible for another twenty-seven days (or after twenty-seven *nakṣatra*s are travelled through) till the arc needle is in between 10' and 10'-22.222", during which time both the needles conjunct again in Kṛttikā *nakṣatra*. It is therefore clearly seen that for the birth to occur repeatedly in Kṛttikā *nakṣatra* only, there will always be an interval of twenty-seven days. That is the period of Ravi *daśā* getting consumed would be either 0 day for birth at 0° Kṛttikā or twenty-seven days for birth at 10' of arc needle or 2 x 27 days for birth at 20' of arc needle and so on. Any other number would not just fit into the scheme since the long needle would be

elsewhere. Thus quantization of birth time occurs. Whether it is the dictum of nature or the *ṛṣi*s who devised this *viṁśottari daśā paddhati* expect us to accept this mode of calculation is beyond our comprehension. In actual practice, a reverse calculation is carried out. That is we have the birth time, the *nakṣatra* of the birthday is found out from the almanac and the longitude of Candra at birth time is then arrived at. From this if one calculates the balance of the *daśā* period and the period elapsed before the birth, one gets a number, which may or may not follow the pattern just now suggested. There are several factors contributing to this discrepancy. One is that the almanac we are using may not give the correct longitude of Candra. Another could be erroneous noting of the birth time. There is already enough confusion in agreeing to what decides the correct birth time. Ideal thing could be to accept the given birth time, try to arrive at the correct longitude of Candra at birth time using well established and reliable almanacs or ephemeris, calculate the consumed birth *daśā* period and then adjust the birth time in such a way that the consumed *daśā* period in days would be exactly a multiple of twenty-seven. It is easier said than done, as the calculations, though not difficult, are tedious. Computer programes are now available internationally, where the planetary longitudes are calculated very accurately.

When we adopt these programs to the Indian *nirayana* system, the concept of *ayanāṁśa* has to be considered. Without going into the unsolved riddle of which *ayanāṁśa* is proper, we started using the horoscopes made out of a computer program which, uses an *ayanāṁśa* value very close to that suggested by late K.S. Kṛṣṇamūrti. This became the baseline for our further research on analytical horoscopy. Subsequently we have been using our own computer programs, which were written keeping our specific needs in focus. As the *ayanāṁśa* does not remain constant through out the year, necessary correction is carried out to get the progressive *ayanāṁśa* for each week. When the balance *daśā* period is calculated for a given birth time using this program, the consumed *daśā* period in

days comes close to a multiple of twenty-seven without applying any correction. Whenever it is slightly deviating, the birth time is corrected by suitable addition or subtraction depending on which number of days is closer to the multiple of twenty-seven. The horoscope thus obtained is then subjected to critical analysis by correlating it to the events in the life of that individual.

Thus any birth time given is suitably corrected so that the consumed *daśā* period in days is a multiple of twenty-seven. Subsequent *daśā* and *antardaśā* periods are calculated based on *nakṣatra*s. Our computer program gives the *daśā, antardaśā* and *vidaśā* periods based on this *nakṣatra paddhati.* As has already been mentioned, for correct analysis it is advisable to go up to the *prāṇa daśā* periods. Any event that takes place in one's life in fact occurs during the *daśā* period when other seniors approve of that event. For causing any event, *prāṇa daśā* may have supreme importance followed by *sūkṣma daśā, vidaśā*, *antardaśā* and lastly *mahādaśā.* So, for astrological comprehension, one should not ignore these all-important smaller *daśā*s. However, it is absolutely essential to know how to calculate these *daśā*s accurately before trying to use them for analytical purpose. The method of calculation based on *nakṣatra*s as suggested by our ancient *ṛṣi*s is a valuable tool in this direction. The study of astrology does not begin until one masters the role of these five types of *daśā*s. When one gets married, say in GU-RH-KU-CA-RA period, the astrologer should not be just satisfied attributing the marriage to GU and RH period. As Guru *daśā* period lasts for sixteen years, and the marriage occurred towards the end of his *daśā* period, an astrologer should be able to analyse and say as to why Guru did not give him marriage until towards end of his *mahādaśā* period or why RH did not give marriage till the end of his *antardaśā* period and so on.

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8

Astro Identities in the Sūktas of Veda

C.L. Prabhakar

VEDAS are eternal. They are sources of knowledge relating to all branches of learning. Astronomy is the first preference and from the movements of the deities in the sky only, the earth is governed. They identify with the cosmos and universe and, therefore, astronomy is a pet subject of relevance and involvement in the *mantra*s of *sūkta*s of Veda. Astronomy is concerned with the celestial bodies, cosmos, planets, creation, clouds, rain, process of rain, planets, comets, stars and many more. It is a world by itself. It talks about the solar system, the solar region, the moon and the changes that occur in the cosmos and so on.

Vedas are the first source of knowledge to provide the concept and understanding of the happenings and the effects of the systems available in the cosmos upon the earth and atmosphere. The seasons, caused according to the right timings, have their say on the sun, moon and atmosphere. *Yajurveda* says that the seasons have different characteristics and accordingly the sun too varies in view of his effect upon the earth *nānāliṅgatvāt ṛtūṇāṁ nānāsūryatvaṁ Taittirīya Āraṇyaka* points out the characteristics of each season in a poetic way. Though sun is the same, changeless, still he shows shades owing to the senses to help life on the earth. He also goes through the power and dimness in his diurnal motion, *ayana*s. It is in two phases: *uttarāyana* and *dakṣiṇāyana*, the waxing and waning. It is also for the moon per month but for sun it is six months once each time. This variation is only to cater to the life needs on the earth. The moon which depends upon the sun is exposed in the

like manner. Among several rays of the sun a particular ray of the sun by name *ama* charges moon each month and projects him on the horizon to shed light and darkness with his waxing and waning phases. When he is totally full, he is described as the *rakacandraḥ*, if not the *amāvāsyacandraḥ* who does not appear on the horizon, however.

The Puruṣasūkta of *Ṛgveda* describes the moon and the minds are related. It is said *candramāmanasojātaḥ*. As per the moon, the mind also reacts, namely moody and bright.

Vālmīki says:

cañcalam hi manaḥmanuṣyānāṁ ।

Here he refers the nature of human mind

gamanāgamana silammanaḥ ।

It is said in *Bhāgavata Purāṇa* that moon is born out of the water and so he possesses the *ārdratā* and fickleness of the waves of the ocean. Sun and moon are the energies available in the sky providing the necessary changes on the planet earth. There are many hymns which describe the astro identity of the sun and moon in the Veda.

Aruṇapraśna, the first section of *Taittirīya Āraṇyaka,* is the source where at we have the knowledge more on the sun, the solar system and the accomplices of sun to run life and weather upon the earth. Besides this, we have the sky and earth which are regarded as our primordial parents in the nature: *pṛthivīmātaḥ dyauḥpitā*. In the Pṛthivīsūkta which is a description of the earth it is mentioned

bhūmirbhūmnādyauriva varimnā ।

Here *bhūma* and *varimā* are the characteristics of the earth and the heaven. Herein also we get some thoughts of our Vedic seers on the concepts and characteristics of the contents of the cosmos.

To start with we have *Gaṇapati Atharvaśīrṣa Upaniṣad* belonging to *Atharvaveda*. Here Lord Gaṇapati is described to be the identity with the *ākāśa*. Consider the expressions *bhūmirāponilonalonabhaḥ, tvaṁ catvāri vākpadāni* etc. that describe the diety.

There are many more like that which bear reference to the cosmos. Here it is pointed out that this deity is all in all to provide necessary sap and substance to the creatures of the earth. He provides *vṛddhi* and *ṛddhi* besides other things for the happiness of life. Knowledge about him came to be known as *gaṇeṣa-vidyā.* In *Sūryopaniṣad* too, the knowledge and identities regarding sun come under the purview of *savitṛ-vidyā. Vidyā*s are cosmological since they generate energies from the influences of the deities who are basically astral in their make or concept. The tool is their *upāsanā.*

The characteristic of Vedic *sūkta*s is to link the deities with the cosmos since they are identities to that and if at all their idols/*vigraha*s installed for worship at the temple *gopura*s (conical structures) are built with a significance that the cosmic energy is drawn into the *garbhagṛha* and that the installed deities became more powerful to emit influence and benefits to their *upāsaka*s respectively. This deity may be Gaṇapati's identical with the other cosmic identities like Āditya and Indra. This is to indicate that the deities are deriving the energies from the space. They are all congruent forces guarding the activity of the earth. It is said: *ātmanaḥ akṣaraḥ sambhūtaḥ, ākāśādvāyuḥ vāyoragniḥ candramāḥ . . .* and so on.

A meditation upon this Gaṇapatisūkta shall reveal the astro contents in the personality of the deity. There is polarization of powers in Gaṇapati related to the universe and working of the universe too. *Vidyā*s are the tools to realize the secret of the universe. It is indicated: *sarvaṁbrahmaupaniṣadaṁ.*

In Hiraṇyagarbhasūkta of *Ṛgveda*, we find the *mantra*s relating to the creation and answer to the quest who should be worshipped and worshipped with oblation as a part of appeasement *kasmaidevāya haviṣa vidhema.* The question itself has the answer thus: *prajāpatayedevāya haviṣavidhema.*

Here Prajāpati is an entity from whom things emanate including the cosmos and the beings to pervade the same. A golden

egg (*hiraṇyagarbha*) was at the beginning floating on the water which became cause for the creation. What was there at first? There are several answers advanced by the Vedic *mantra*s. The work of Prajāpati is put in this expression: *sadādhārāpṛthvīṁ dyamutemām,* referring to the holding together of the earth and the heaven for the convenience of beings upon the earth and the cosmos and for providing sustenance. Basically the earth is the mother and the heaven is the father. Thus these two make a *dampatī* (couple). For the creation of anything in existence, the *dampatī*s play an important role.

There is reference to the origin and development of the creation and the universe in the Puruṣasūkta. There are two sets of creation from the Lord Puruṣa Nārāyaṇa: one is the social order and the other is the cosmic order. There is the description of the figure (*rūpa*) of Puruṣa Nārāyaṇa as: *sahasraśīrṣāpuruṣaḥ . . . sabhūmim viśvatovṛtvātyatiṣṭhaddaśāṅguḷam*.

Here he is expansive both in his foot, intelligence and further he has enveloped the earth and remained high still ten inches above the earth to be as the supervisor for the whole creation and the contents of the universe. His *mahimā* is so much and defined as is said in the expression — *etāvānasya mahimā.*

But Puruṣa Nārāyaṇa is yet more enhanced in terms of form and powers (*atojyāguṇāśca puruṣāḥ*). His limbs have become source for the social objects and the astro objects like moon, sun and so on. In the entire Puruṣasūkta we have two sets of creation from the great Puruṣa Nārāyaṇa and this indicates that astronomical data is at first and the earthly existence next. But both are interdependent.

Here is a *śānti mantra*:

dyauḥ śāntiḥ antarīkṣaṁ śāntiḥ pṛthivī śāntiḥ
āpaḥ sāntiḥ oṣadhayaḥ śāntiḥ

It is an astronomical quest further in the *mantra*s of Veda to seek peace to the contents of the cosmos and the earth. They provide knowledge that there would not be any surprise at the role and

movement of astral bodies in the sky and what could be the reasons for the happenings and sounds in the sky. For example, in the Aruṇapraśna of *Taittirīya Āraṇyaka* it is mentioned that two Vedic students Vasiṣṭha and Rohiṇī investigated about the causes of sound in the sky. It is thus:

ko 'ntarikṣe śabdaṁ karotīti vasiṣṭhorauhinomi māgaṁśacakre।

The answer they got was *vasrevavidyuditi.*

Owing to the combustion of wind and the lightening (heat) in the sky there is the emanation of sound.

Here again we see the Vedic seers had the *tapobalam* and the *sādhanā-siddhi* that they were able to get the grasp of the cosmos. In Aruṇapraśna, we get the expression saying the *sūryamaṇḍala* is revolving. The same is seen in the expression:

apsyamahametat sūryamaṇḍalaṁ parivartamānaṁ gārgyaḥ prāṇatrātaḥ।

The seer by name Prāṇatrāta, son of Garga Mahāmuni, has this achievement of viewing the Lord Sun. There is another expression for the cognizance of all knowledge on astronomy. Kaśyapa Prajāpati is the seer. It is said: *kaśyapaḥ paśyako bhavati*.

It is viewed that Kaśyapa and Paśyaka, the seer, are shown interrelated. Rather if we reverse to read Kaśyapa it denotes Paśyaka meaning seer, the perceiver.

In Nārāyaṇasūkta, we have references describing the deity as an astral body, resident of the sky and a strong cause for the governance of the world and all the *loka*s. Stay in the vast space (*ākāśa*) is a characteristic, providing convenience and better scope for the supervisory activity. *Ākāśa* is Brahmā as *Īśāvāsyopaniṣad* of *Yajurveda* proclaims: *khaṁ brahmā*. The sky is the great expanse described with the name Brahmā. In fact, one of the classifications suggested for astral identities is the celestial, terrestrial and many other forms of deities. They are described to be transparent, translucent and opaque gods.

Sun is a celestial God. Agni is the terrestrial deity. Indra is the *dyusthāna devatā*. When the deities are subjected to analysis and descriptions, the *sūkta*s like Puruṣasūkta, Śrīsūkta, Hiraṇyagarbhasūkta, Agnisūkta, Pavamānasūkta, Āyuṣyasūkta, Bhāgyasūkta, Anobhadrasūkta, etc. highlight the knowledge and astro connections of the deities with the astronomical procedures, influences and content in the personalities and functional excellences of the deities.

The respective Vedic seers are related to various identities. These *mantra*s are revealed to them and they have immortalized them as pieces of the knowledge on a scale of gradations and excellences. Actually the knowledge of astronomy which talks about the movement of deities and planets and the astral contents of the atmosphere, etc., looks quite educative. In the Śrīsūkta, the Goddess Lakṣmī is requested to visit the devotee's house emanating from the waters.

Vedāṅga Jyotiṣa is dependent on *bhacakra* and *khacakra* which relate to the zodiac houses and the influence of the planets. When Viṣṇu is referred as the lord of the earth, Bhūdevī, it indicates that the connections of the astro bodies arise from the earth only.

The *mantra – viṣṇorṇukaṁ vīryārṇi pravocaṁ yaḥ pārtivānimimāmerajāṁsi* – indicates that Viṣṇu rose up from the earth and measured the cosmos with his three strides and pervaded the whole cosmos and yet remained a supervisor to all, at all times. In the *śānti mantra – pṛthivīśāntasāgnināśāntasame śāntapraśaṁśamayatu* – the earth is peaceful with Agni, the atmosphere with wind, the heavens with Āditya thus pleased three *loka*s should maintain the peace and balance of all the people and objects.

Besides the deities we have the stars, asterisms, the seers of different levels in the comprehension of the gods who have contributed to the core of knowledge on astro systems and deliberations. In *Yajurveda* there are mentioning of the stars and the Rohiṇī star to be best among the stars. Based on the Vedic

knowledge there have come several conjectures and elucidations regarding the contents and movements of the cosmic bodies. Hereby it is implied that through man's effort and worship the dynamism in the objects of nature and contents of creation is possible. The Camakādhyāya of *Yajurveda* reveals how man is able to cause peace and prosperity for personal and impersonal things, belongings connected to his narrow purview and expansive for other objects and therefore it is agreed that Namakam and Camakam chapters of *Yajurveda* constituted to be the totality of the *sūkta* called Rudrapraśna. It is said:

namakaṁcamakaṁcaiva puruṣasūktaṁ ca yadviduḥ ।
mahādevena tattulyam tanme manaśśivasaṁkalpamastu ।।

The Veda *sūkta*s like Namakam, Camakam, Puruṣasūkta and more are equivalent to Mahādeva and hence all the understanding of the astro identities and their connections with earth and its activity would be revealed giving rise to peaceful mind and mind that of Lord Rudra, the Mahādeva. In the Śāntisūkta the *mantra* – *namo vāce namo vācaspataye* – it is mentioned that Goddess Sarasvatī is *sumṛdika*, highly compassionate and is like a mother as expansive in *karuṇa* as the sky unto her devotees:

sumṛdikāsarasvatīmātevavyomasadṛśi

In a prayer to *sūrya,* a wish is submitted thus *jyokcasabaryaṁ dṛśe* meaning the goal of the devotee is to see the *sūryajyok* and it is every time a wish of a *vaṭu* when he does *sandhyopāsanā.* When worship is offered there is this formula:

dyāvāpṛthivabhyāṅgosvāhā
dyāvāpṛthivībhyāgamidamna mama

Here, the heaven and the earth are both taken as related identities and appeasement is done to both of them.

When we dive deep into the bevy of Veda *mantra*s of all the four Vedas we notice the energy is derived from the cosmos and activity is performed upon the earth or/and vanished into the *loka*s

of their like. Each deity has a region for himself, going by name such as *ādityaloka*, *rudraloka, nārāyaṇaloka* and so on. A study on the *loka*s is done by many scholars and a good deal of information on the *loka*s or the different regions is elucidated based on the Vedic *mantra*s and from the successive literature that followed the Vedas. In conclusion it may be cited thus:

yo vedamadhīte sanityaśāntaḥ sarvāṅ kāmāṅ
vidyānāpyate anubhāvate ca ।

Thus we notice in the various *mantra*s of the Vedas where the deities, their activities and the scope of application in the sacrifices, etc. figure and they add up to the knowledge of Vedic astronomy.

9

Equinox and Astronomy of Viśvarūpa

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Abstract: Vedic mythology and the divine descriptions are perfectly synchronized descriptions of the four-dimensional macro-cosmos with the micro-cosmic individuals. In Vaiṣṇavism Lord Mahāviṣṇu is the ultimate godhead of the cosmos while it is Lord Śaṅkara in Śaivism. So the Vedic mythologies revolve around the cosmos along with the Milky Way, ecliptic, equinox and solstices in particular and other constellations in general. The equinox is mentioned as situated at the end of Aries and Scorpio in the constellations Kṛttikā and Viśākhā in *Vāyu*, *Viṣṇu* and *Brahmāṇḍa Purāṇa* and its shifting from Gemini to Aries as is perfectly traced by M. Nalini Mohan and K.D. Abhyankar on the basis of Vedic and Purāṇic allegories. So these astronomers consider this evidence along with recent geological, genetic and other evidences, and derive at the conclusion that the Vedic civilization was 8,000–10,000 years old, while the religious people consider it excisted from time immemorial.

Keywords: Equinox, ecliptic, constellations, mythology, Mahāviṣṇu.

In Vedic mythology the constellations and planets are supposed to be the residences of deities and due to personification, the worship goes on the names of deities and constellations. The entire cosmos is worshipped as the physical body or *viśvarūpam* of Lord Mahāviṣṇu vertically, starting at the northern apical equinox along with polaris

as his face and southern lowest Meṣa as his feet or as *śiṁsumāra kuṇḍalī* inversely. Most of the southern constellations are described as personified initial incarnations of Lord Mahāviṣṇu such as Matsya, Kūrma, Varāha and god's of southern temples such as Lord Jagannātha and Lord Veṅkaṭeśvara. The northern constellations around Scorpio and Sagittarius are described as Lord Viṣṇu, the upper northern constellation as Lord Brahmā with his associated sages and the eastern constellations around Gemini and Taurus as Lord Śaṅkara. Our Milky Way passes through all these important constellations.

The two halves of the cosmos are visualized as the day and night, Kṣara and Akṣara Puruṣa of the physical body of the Uttama Puruṣa or Lord Mahāviṣṇu, appearing and disappearing along with the fourth dimensional time, during evolution and involution of the cosmos. This has been the astronomically correlated, composite, monistic unitary scientific concept of Vedic times that was recorded and described by Veda Vyāsa in the four Vedas and eighteen eighteen Mahapurāṇas and eighteen Uupapurāṇas.

The Vedic scriptures explain the cosmos under two categories: four- dimensional mechanical parts and non-dimensional consciousness, both under the law of cause and action. They describe the planets and constellations of the entire cosmos as the abodes of gods and so the rituals and worship go on in the name of the deities along with the constellations which are inseparable. This unified concept is the background for the personification of 3,339 dark lunar days of the eighteen-years cycle with the 3,339 number of gods and their drinking of *soma* as discussed by R.N. Iyyangar:

manvantareṣu sarveṣu devatāyatnāni vai ।
abhimānino 'vatiṣṭhanti yāvadābhūtasamplavam ॥
— *Vāyu Purāṇa* 1.53.77

manvantareṣu sarveṣu sthitāḥ kālābhimāninaḥ ।
sthānābhimānino hyete tiṣṭhantīha prasamyamāt ॥
— *Vāyu Purāṇa* 1.30.26

yathā devagṛhāṇīha sūryacandragrahāḥ smṛtāḥ ।
— *Brahmāṇḍa Purāṇa* 9.24.5

tāni devagṛhāṇi syuḥ sthānākhyāni bhavanti hi ।
— *Matsya Purāṇa* 126.40

Milky Way

A very detailed description of the cosmos is seen in *Matsya, Vāyu, Śrīdevī, Brahma, Brahmāṇḍa Purāṇa,* etc. In the chapter Bhuvanakosaṁ the ecliptic, constellations, solar system, planets, etc. are described along with equinoxes, solstices, seasons, months, lunar elongations, weeks, eclipses and so on. The cosmos is divided into two halves, northern and southern hemispheres, by our Milky Way (Ākāśa Gaṅgā) (*Nārada Purāṇa* 11.179) at the Sagittarius. The northern part of the Milky Way is described as Mandākinī (Ganges of the heaven) with the constellations Perseus, Cepheus, Camelopardolis, Vulpecula, Sagitta, Aquila, Ophiuchus and Cygnus. The southern part is described as Bhogavatī (Ganges of *pātāla*) with the constellations Crux, Centaurs, Pyxis, Puppis, Carina, Circinus, Ara, Norma and Serpens and the middle one as Bhagīrathī (Ganges of the earth), which is at the Orion arm along with Orion, Gemini and Taurus. The description of the ecliptic and the twelve houses along with the twenty-seven constellations, divided into three groups or "streets", is invariably found in all the Purāṇas. Further along with some northern constellations such as Polaris, Ursa Major, Ursa Minor, Cygnus, Hercules and Corona Borealis and southern constellations such as Canopus, Serpens, Scutum, Crux and Mensa. and with the ecliptic at the middle, cosmos is described as the body of the Lord at various places with various names such as Śiṁsumāra, Nakṣatra Puruṣa, Lord Kūrma, Lord Varāha and so on.

nāgavīthyuttarāvīthī hyajavīthi ca dakṣiṇā ।
mūlañcaiva tathāṣāḍhetyajavīthyudayāśrayaḥ ।।
— *Brahmāṇḍa Purāṇa* 1.21.76,
Vāyu Purāṇa 1.50.130

ābrahmakaṭāhānta padānyetāni sa prabhuḥ ।
pādāṅguṣṭhanirbhinnaṁ brahmāṇḍaṁ bibhide dvidhā ।।
— *Nārada Purāṇa* 1.11.179

All the mythological stories linked to River Ganges are exclusively linked to Ākāśa Gaṅgā (Milky Way). The Milky Way was supposed to be originated from the toe of Lord Kṛṣṇa during a divine musical concert by Lord Śaṅkara, at the constellations Aquila which is adjacent to Sagittarius. So the Sagittarius (Lord Viṣṇu) is supposed to be the base of feminine part of the *jyotirliṅga* and the Gemini (Lord Śiva) as the apical masculine part which correspond to their natural south-west and north-eastern positions in the sky. When the Milky Way is described along with its associated constellations as a single unit, it is either Lord Śaṅkara or Lord Viṣṇu or as Lord Ananta Bhūteśa — is supposed as occupying most of the lower seven and upper seven worlds — the Lord being in the middle of the Milky Way wearing it as a garland. In philosophical discussions the initial deity is called as Hiraṇyagarbha (cosmic egg) or Prajāpati who represents the cosmos and year as his two halves.

vāmapādāṅguṣṭha nakhaśroto vinirgatām ।
— *Viṣṇu Purāṇa* 152

so 'yaṁ gaṅgāpravāheṇa śvetaśailopaśobhitaḥ ।
saṁkarṣaṇātmakarudro viśānalaśikhojjvalaḥ ।।
— *Śivapurāṇe Śatarudrasaṁhitāyām* 15.12

The sun travels inside the ecliptic in his northern journey from vernal equinox and outside the ecliptic in his southern journey from autumnal equinox. The four cardinal points of the ecliptic are most important for all sacrificial purposes and worships and were observed and calculated accurately. The vernal equinox represents the highset altitude and so it is supposed to be the face of God. At that time (around 3000 years BCE) it was around Kṛttikā or Eta Tauri at 27 to 30° of Aries. The three stars of Aries; Beta Aries, 41 Aries and Eta Tauri, which are in highest latitude 20-48, 27-15 and 24-06° respectively are supposed to be the gateway to the path of gods,

devayāna through Ursa Major. The autumnal equinox represents the lowest southern altitude and principal area for the worship of manes.

The southern-most stars lambda Scorpi, delta Sagittarius (Mūlā, Pūrvāṣāḍhā and Uttarāṣāḍhā, 37-06 and 29-49°) of Sagittarius which is at the centre of our galaxy, are supposed to be the way to *pitṛyāna*. The two equinoxes are supposed to be the faces of deities and manes respectively. The northern equinox is auspicious for the sacrificial functions aimed at salvations and the southern equinox along with *mahālaya* new moon is most auspicious for ceremonial functions of manes *pitṛyāna* aimed at progeny and worldly achievements. The winter solstice represents the shortest longitude with shortest day (9.36 hours) and the opening sacrificial day for all worships of heavenly deities. The summer solstice represents the longest day (14.24 hours) with maximum longitude and the opening ceremonial day for all oblations to manes. The two halves of the cosmos are considered as the two halves of the Lord. The seven sages of Ursa Major are believed to be the first persons to visualize the creation and divinity and so they are most important and prominent in all sacrifices.

> *dvādaśabhiśśīghraṁ muhūrttairdakṣiṇāyane trayodaśārthaṁ ṛkṣāṇāṁ madhyecāntaramaṇḍalam* । — *Matsya Purāṇa* 123.72

> *abhyantaraṁ sa paryeti maṇḍalānyuttrāyaṇe bāhyato caiva satataṁ sūryamaṇḍlam* । —Ibid.123.66

> *tadā dānāni deyāni pitṛbhyo viṣuveṣu ca* ।
> *brahmāṇebhyo viśeṣeṇa mukhametattu daivatam* ॥
> — *Brahmāṇḍa Purāṇa* 1.21.143.49

> *yadvai puruṣamevaṁ viṣuvāntasya yathā dakṣiṇordhva evaṁ pūrvārdho viṣuvato* । — *Aitareya Purāṇa* 4.22.18

> *tasmāt smṛtaṁ prajānāṁ vai viṣuvatsarvagaṁ sadā* ।
> — *Brahmāṇḍa Purāṇa*, 1.21.155

saptarṣīṇāṁ manoścaiva ādau tretāyuge tataḥ ।
— *Matsya Purāṇa* 141.52

In spite of the change of the equinoxes and solstices, the latitudes and deities of the constellations, such as Aśvinā to Aśvini, Viṣṇu to Śravaṇā, Brahmā to Rohiṇī, Rudra to Ārdrā and *pitṛ*s to Makhā will not change. So this non-mutable latitude of constellation and the *nirayana* concept are coordinated, with the ever-changing longitudes of solstices and equinoxes of *sāyana* concept harmoniously for different sacrificial functions.

Equinox in Vāyu, Viṣṇu and Brahmāṇḍa Purāṇa

The vernal equinox forms when the sun is at the end of Aries (Meṣa) in the first quarter of the constellation Kṛttikā and the moon is at the end of Scorpio in the fourth foot of the constellation Viśākhā. Similarly the autumnal equinox forms when the sun is in the third foot of Viśākhā in Libra (Tulā) and moon at the head of Kṛttikā in Taurus. This equinoctial point, where the day and night are equal with 12 hours, is considered as the face of the gods and most auspicious for all the sacrificial purposes of northern gods and southern manes.

meṣānte ca tulānte ca bhāskarodayatasmṛtā ।
muhūrtā daśapañcaiva ahorātriśca tāvatī ॥

kṛttikānāṁ yathā sūryaḥ prathamāśagato bhavet ।
viśākhānāṁ tathā jñeyaḥ caturthāṁśe niśākaraḥ ॥

viśākhānāṁ yathā sūryaścarante 'śaṁ tṛtīyakam ।
tathā candaraṁ vijānīyāt kṛttikā śirasi sthitam ॥

vijānīyādevamāhurmaharṣayaḥ sūryeṇa ।
viṣuvaṁ vidyāt kālaṁ somena lakṣayet ॥
— *Vāyu Purāṇa* 1.50.195-97,
Brahmāṇḍa Purāṇa 1.21.143-49

śaradvasantayormadhye viṣuvantu vibhāvyate ।
tulā meṣa gate bhānau samaratridinantu ॥

tat karkaṭe 'va sthite bhānau dakṣināyanamucyate ।
uttarāyaṇamapuktaṁ makarasthe divākare ॥
— *Viṣṇu Purāṇa* 2.8.67-68

prathame kṛttikābhāge yathā bhāsvāṁstadā ।
śaśi viśākhānāṁ cathurtheṁśe mune tiṣṭhatyasaṁśayam ॥

viśākhānāṁ yadā sūryaḥ caratyaṁśaṁ tṛtīyakam ।
tadā candraṁ vijānīyāt kṛttikā śirasi sthitam ॥

tadaiva viṣuvākhyo vai kālaḥ puṇyo 'bhidhīyate ।
— Ibid. 2.8.76-78

From Māgha to Āṣāḍha starting with constellation Dhaniṣṭhā, the six months are *uttarāyaṇa* and from Śravaṇā to Puṣyā the six months are *dakṣiṇāyaṇa*. The sun after completing his southern journey enters into *uttarāyaṇa* or northern journey in Māgha. The first day of the five-year *yuga* (*pañcābda yuga*) starts with *saṁvatsara, uttarāyaṇa māgha māsam, śukla pratipadā*, sun in the constellation Dhaniṣṭhā and *ṛtu* (season) is Śiśira.

etena gatiyogena yadā kāṣṭhāntu dakṣiṇam ।
paryāgacchet tadādityo māghe kāṣṭhāntameva hi ॥
— *Vāyu Purāṇa* 1.50.122

śaradvasantayormadhye viṣuvaṁ tadvibhāvyate ।
— Ibid. 1.50.176, *Matsya Purāṇa* 123.95

tapatapasyau madhumādhavau ca śukraḥ
śuciścāyanamuttraṁsyāt ।
— *Vāyu Purāṇa* 1.50.200, *Viṣṇu Purāṇa* 2.8.81,
Brahmāṇḍa Purāṇa 1.21.150

varṣāṇāñcāpi pañcānāmādyaḥ saṁvatsaraḥ smṛtaḥ ।
ṛtūnāṁ śiśirañcāpi māsānāṁ māgha eva ca ॥

nakṣatrāṇāṁ śraviṣṭāsyādayanānāṁ tathottaram ।
pakṣāṇāṁ śuklapakṣasutithīnāṁ pratipattathā ॥

ahorātri vibhāgānāmahaścāpi prakīrtitam ।

śravanāntaṁ dhaniṣṭhādi yugaṁ syāt pañcavārṣikam ॥
— *Brahmāṇḍa Purāṇa* 1.25.141-44,
Vāyu Purāṇa 1.53.113-16

arcayanti sadā liṅgaṁ śivaḥ khalu dṛśyate ।
— *Kūrma Purāṇa, Uttara,* 2139

vāmanasya padaṁ kṛṣṇaṁ jñeyaṁ vai uttrāyaṇam ।
devādyaiḥ sakalairvandyaṁ dakṣiṇaṁ dakṣiṇāyanam ॥
— *Bhaviṣya Purāṇa* 1.107.3

Śiṁsūumāra Kuṇḍali

The principles of Vedas have become mythological expansions when the lives of Lord Rāma and Kṛṣṇa and other incarnations came into existence and the astronomy is the only scientific link between the two. The entire cosmos in general and ecliptic with Ursa Major and Minor in particular are described as the physical body of Lord Mahāviṣṇu vertically or as *śiṁśumāra kuṇḍali* inversely (or śisu or śiṁsumāra — His own child) specifically for the purpose of yogic meditation, *yogi hutdhyāna gamyam.* This description is universal in Vedas and Purāṇas with variation in the number of narrated constellations.

Bṛhadāraṇyakopaniṣad: The "life" is described as *śiśu* (child) of *Para-Brahman* which is at the top of cosmos under the equinox with the seven stars of Ursa Major *saptarṣi maṇḍala* as the seven openings: two eyes, two ears, two nostrils and mouth.

Yajurveda Āraṇyakam: Here the Śiśumāra or Śiśukumāra involves Ursa Major and Minor and the constellations of ecliptic.

Brahma Purāṇa states that the principle of Śiṁśumāra is Lord Viṣṇu who is in the form of a *śiśu* as Vaṭapatraśāli in the ocean of Ākāśa Gaṅgā. *Brahmāṇḍa Purāṇa* states that the four apical stars of Śimśumāra (Ursa Minor) will not set and are seen always, i.e. the other constellations of cosmos rotate around them forever.

The description of Śiṁśumāra is seen in almost all Purāṇas:

Matsya, *Vāyu*,*Viṣṇu*, *Viṣṇudharmottara*, *Śrīdevī*, *Brahma*, *Brahmāṇḍa* and so on. A more detailed description of cosmos as Śiṁśumāra is seen in *Viṣṇu Purāṇa* and *Śrīdevī Bhāgavata*.

Dhruva (Polaris), the son of Uttānapāda, is at the top of the cosmos, with all constellations rotating around him, followed by the sages of Ursa Minor called as Dhātā, Vidhātā, Indra, Agni, Kaśyapa, Dharma, and then by the seven sages of Ursa Major called as Marīci, Vasiṣṭha, Aṅgīrasa, Atri, Pulaha, Pulastya and Kratu. At the middle below the Ursa Major is the ecliptic divided into three streets with its twenty-seven or twenty-eight constellations. This ecliptic is sometimes described as *jagaccakram, viṣṇucakram, sudarśanam* and so on.

> *saṁsārabhramaṇacakraṁ cakraṁ viṣṇurekasthitam* ।
> *dharmacakraṁ kālacakraṁ bhacakrañca mahābhujaḥ* ।।
> — *Viṣṇudharmottara Purāṇa* 60.5

The constellations of the ecliptic are described as the ventral and dorsal parts of the body of Lord Viṣṇu. The first nine constellations from Aries to Cancer are described as the *iravata vīthī*, the second nine constellations from Leo to Scorpio are described as the *jaradgavi vīthī* and the last nine constellations from Sagittarius to Pisces as *viśavānara vīthī*. Each of the three streets is again sub-divided into three streets totalling to nine.

Sometimes the twenty-seven constellations are worshipped as Lord Vasudeva in Nakṣatra Puruṣa Pūjā (*Matsya Purāṇa* 54.1.32) starting with Mūlā constellation as his feet and Mṛgaśirā as his eyes, Citrā and Śatabhiṣā as his face, forehead and so on. The planets of our solar system are described as the different parts of Śiṁśumāra. The southern constellation Canopus is described as his upper jaw and Mensa as his lower jaw. The entire cosmos from northern Polaris to southern Mensa are inversely indicating the vertically downward evolution of *Para-Brahman* as indicated in *Gītagovinda*.

> *ūrdhvamūlamadhaśśākha*

— *Gītagovinda* 15.1

mūle namo viśvadharāya pādau gulphāvanantāya ca rohiṇīṣu ।
— *Matsya Purāṇa* 54.10

ādhāraśśiśumārasya sarvādhyakṣo janārdanaḥ ।
— *Brahma Purāṇa* 24.1.7

tārakā śiṁśumārasya nāstameti catuṣṭayam ।
— *Viṣṇu Purāṇa* 2.12.34

medībhūtaḥ samastasya jyotiścakrasya vai dhruvaḥ ।
— *Brahma Purāṇa*

yo 'sau caturdaśakṣeṣu śiṁśumāro vyavasthitaḥ ।
— *Matsya Purāṇa* 124.5

Divinity and Gods

The cosmos which is meditated upon as a single unit is subdivided into a number of subunits in local units of time and space. The lunar elongations, weeks, years, directions, planets, constellations and everything related to space, time and actions are descendants of Śiṁśumāra and so they are divine.

Serpens Cauda, Serpens tail. Bootes are visualized as Ananta or Bhūteṣa, extending from lower south to upper north, and Ophiuchus, Herculis, Corona Borealis, Aquila, Sagitta and Corona Benenices along with our earth and Ananta are visualized as Lord Viṣṇu and his associates. Cygnus and Lyra are described as Lord Brahmā and Sarasvatī and Draco, Ursa Minor, Ursa Major, Triangulum, Cepheus and Cassiopea as the associated sages of Lord Brahmā. Kaurus, Gemini, Cancer, Leo, Virgo, Auriga, Orion, Caniis Major and Canis Minor are described as Lord Śaṅkara with his family. Lord Viṣṇu is supposed to be the left or lower part and Lord Śiva as the upper or right part, as per their position in the Milky Way. The entire Milky Way with its associated constellations is the *viśvarūpam* of either Lord Viṣṇu or Lord Śiva.

The Argo Navis hydra and Piscis Austrinus are described as

Matsyāvatāra, Sagittarius, Aquarius and Capricorn as Kūrmāvatāra, Aquarius with Piscis Austrinus as Śvetavarāha. The mythology of Lord Jagannātha goes with Serpens, Ophiuchus, Grus, Phoenix, Piscis Austrinus and Sculptor. The mythology of Lord Veṅkaṭaśvara involves Viṣṇu constellations, Milky Way, Canopus and Centaurs. So due to all these incarnations and *śiṁsumāra kuṇḍali,* the *viśvarūpam* of Lord Mahāviṣṇu, involves maximum number of constellations of cosmos (Raghava Rao 1954; Nalini Mohan 1995; Brady 1998; Abhyankar 2007).Aries, Cetus and Centaurs Taurus are described as Aśvins (*ṚV* I.8.118-20) with their chariot. In the final step the cosmos and constellations are described as directional gods, constellational gods, spatial gods and ultimately the single unitary *viśvarūpam* has gone to a maximum of 3,306 *devayāna* deities of Vaiśvadevam and 33 gods of *pitṛyāna* totalling to 3,339, equated to dark lunar days of one ecliptic cycle of the nodes of the entire cosmos (Iyengar 2005 Abhyankar 2006).

> *dṛṣṭvā tadaiśvaraṁ rūpaṁ rudraṁ nārāyaṇātmakam* ।
> *kṛtārthaṁ menire santaḥsvātmānaṁ brahmavādinaḥ* ॥
> — *Kūrma Purāṇa*, Uttara, 5.17

> *ātmānaṁ brahmarandhrasya āhusyāṁ deva vādinaḥ* ।
> — *Skanda Purāṇa* (Maheśvara Khaṇḍa) 2.22.10)

Ambrosia Gods

In Vedic mythology the rituals involving the "Agni" and *yāga* occupies the most important part and it is the end part of one and all rituals. So the fire-related rituals are of three types like the three Vedas and three syllables of Alaṁkāra.

They are *dakṣiṇāgni* at the southern equinox related to *anvāhara* ceremonial function of *pitṛyāna* associated with Svadhā and Viśākhā constellation, *gārhapatyāgni*, related to rituals of a family, initiated at the time of marriage, linked to Uttarābhādrapadā constellation and finally *āhavanīyāgni* related to the sacrificial rituals of *devayāna* deities, linked to Svāhākāra and Kṛttikā constellation. Their further division into so many is discussed in detail in *Matsya*

Purāṇa (Agnivaṁśam 51). For initiation into a kārmic path, rituals, *darśa, anumati* and *cinivāli* are supposed to be the best movements, which when clubbed with eclipse and equinox are most auspicious movements, where the combination with equinox is not found sometimes for two or three centuries even.

> *īlaḥ purūravāḥ vidvān māsa śrāddha cikīrṣayā* ।
> *rūpastha pitṛmanthaṁ taṁ somaṁ divi samāsthitaḥ* ॥
> — *Mahānārāyaṇopaniṣad*

They are supposed to be the three parts of the Milky Way in ascending order and so all the rituals are invariably linked to full/new moon, eclipses and equinoxes. The ceremonial functions of manes are linked to the new moon and southern equinox while the sacrificial functions of higher deities are related to northern equinox and full moon. This is where the number of gods and their drinking of ambrosia after full moon and up to new moon came into existence and the one single god has become 3,339 in number in rituals (Abhyankar 2007; *Bṛ Up* 5.9).

Conclusion

The astronomical descriptions of Lord Viṣṇu, Śaṅkara or Brahmā are individualistic involving the local constellations, while that of *viśvarūpam* of either Mahāviṣṇu or Maheśvara whichever the name may be is holistic involving the entire cosmos. So the micro-cosmos representing an individual merges with the macro-cosmos representing the Lord.

This is the inner concept of all the Veda *sūkta*s such as Puruṣa, Viṣṇu, Nārāyaṇa, Rudra, Śrī, Suparṇa, Durgā, Nāsadīya and Devī and so on. In Vedic culture this merging is suggested and directed at various steps depending on the individual level to follow the ritualistic *tretāgni* way to 3,339 gods of kārmic path or monistic divine path of dedication to Viṣṇu or Śiva or yogic *kuṇḍalinī* path through the beam of equinox from the deity Indrāgni of constellation Viśākhā to Agni of Kṛttikā constellation or finally

the path of analytical, intellectual, non-dualistic renunciation. All this is perfectly astronomical and scientific as far as the spatial temporal factors are concerned and the divinity is beyond senses and science either at individualistic micro or holistic macro level.

Acknowledgements

We thank Kakatiya Publications, Hyderabad for their dedicated patronage in translating all the Purāṇas from Sanskrit to Telugu which are referred above, for the past twenty years. We also thank I-SERVE, Hyderabad for their continuous encouragement and support.

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10

Vedic Jyotiṣa
Lifelong Guide to Lead Humans to Realize and Actualize Their Divine Nature

P. Bala Subrahmanyam

Jyotiṣa (The Knowledge of Movement of Heavenly Objects like stars, planets, etc.), a Vedāṅga, is known as the eye of the Vedas. The *svādhyāya* of *nakṣatreṣṭi mantra*s compiled in the third chapter (*adhyāya*) of *Kṛṣṇa Yajurveda* gives each of us, *jīvas*, the specific original form (*bimba*) of Lord Viṣṇu of which we are reflections (*prati-bimbas*[1]). This knowledge is helpful to us to consciously set our long-term goal of realizing our true nature (that specific form among the twenty-seven fundamental forms of Viṣṇu) and move forward in that direction, as it is easy to realize our unity with Him by cultivating those of His divine qualities that are potentially inherent to our nature (spiritual *svadharma*).

A representative sample of eight of these twenty-seven *nakṣatra mantra*s, viz. Mṛgaśirā (Soma), Punarvasu (Aditi), Āśleṣā (Vaiṣṇava *sarpa* Ādiśeṣa), Anurādhā (Mitra), Uttarāṣāḍhā (Viśvedevas), Śravaṇā (Viṣṇu–Trivikrama), Uttarāproṣṭhapadā (Ahirbudhnya) and Bharaṇī (Yama) are studied in detail in this paper. This unique knowledge, original to Vedas (*apūrva*) is meant to be used as a long-

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1 *sopādhiranupādhiśca pratibiṁbo dvidheṣyate* ।
jīvā iśasyānu pādhirindrachāpo yathā raveḥ ।।

paiṅgi śruti pratibimbāṁśakā jivāḥ prādurbhāvāḥ pare smṛtāḥ ।
— *Varāha Purāṇa* quoted by Śrī Madhvācārya
in 2.3.50 of his *Brahmasūtra-bhāṣya*

term and lifelong guide for us, humans, as, this Vedic Jyotiṣa, based on our birth-star, gives us the appropriate times to perform each of our actions as worship of this Viṣṇu as per its invocatory verses in its introduction by Lagadha (*Yajña Kālārtha-Siddhi*).[2]

> *śiksā-naso-jyotiṣākṣo nirukta-śravaṇaśca yaḥ* ।
> *chandaḥ-pādaḥ kalpa-hastaḥ tathā vyākaranānanaḥ* ॥
>
> The Veda Puruṣa has the six Vedāṅgas as parts of his body as follows: Śikṣā (Phonetics) as his nose, Jyotiṣa (Astronomy and Astrology) as his eyes, Nirukta (Etymology) as his ears, Chanda (Prosody) as his feet, Kalpa (The Science of Ritual Procedures) as his hands and Vyākaraṇa (Grammar) as his face.

The list of the presiding deities (*adhi-devatā*s) of the twenty-seven *nakṣatra*s (constellations of stars) under which each of us is born as per the *nakṣatreṣṭi mantra*s of third chapter (*adhyāya*) of *Kṛṣṇa Yajurveda* is given in Table 10.1.

All the human *jīva*s borne under a *nakṣatra* have the *devtā* form of Viṣṇu presiding over that, as their original form (*bimba*) of which all of them are reflections (*pratibimba*s).[3] So it is easy for them to attain to that form of Lord Viṣṇu first in their spiritual practice and hence they ought to concentrate on cultivating those divine qualities to start with for achieving any of their *puruṣārtha*s (goals worthy of human effort in the present life and hereafter).

As offering *havis* to these various basic forms of Viṣṇu is the means for this,[4] first this is elucidated below:

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[2] *viprāṇām sammatam loke yajña kalārtha siddhaye* ॥
— *Vedāṅga Jyotiṣa* by Lagadha-3

[3] *bhagavato rūpaṁ rūpaṁ prati jīvākhyaḥ pratibiṁbo babhūva* ।
babhūva iti . . . anāditvārthe ॥
— Madhvācārya's *Bhāṣya* on *Bṛhadāraṇyaka Upaniṣad*

Madhu Brāhmaṇa 4.5.19: *rūpaṁ rūpaṁ pratirūpo babhūva* ।

[4] *kṛttikādi-bharaṇyanta-nakṣatreṣṭi-arcitodaya* ।
— *Skanda Purāṇa, Sanatkumāra Saṁhitā*
— *Lakṣmī Sahasranāma, śloka* 106

Table 10.1: Nakṣatreṣṭi Mantras of Third Chapter (Adhyāya) of Kṛṣṇa Yajurveda

Nakṣatra	*Adhi-devatā*
Kṛttikā	Agni
Rohiṇī	Prajāpati
Mṛgaśirā	Soma (Candra)
Ārdrā	Rudra
Punarvasu	Aditi
Puṣyā	Aṅgirasas
Āśleṣā	Sarpa
Maghā	Pitṛ-Devas
Pūrvā-Phālguṇī	Bhaga
Uttarā-Phālguṇī	Aryamān
Hastā	Savitṛ
Citrā	Tvaṣṭṛ
Svāti	Vāyu
Viśākhā	Indra and Agni
Anurādhā	Mitra
Jyeṣṭhā	Indra
Mūlā	Asura
Pūrvāṣāḍhā	Āpaḥ
Uttarāṣāḍhā	Viśvedevas
Śravaṇā	Viṣṇu
Dhaniṣṭhā	Vasus
Śatabhiṣā	Varuṇa
Pūrvāproṣṭhapadā	One-legged Aja
Uttarāproṣṭhapadā	Ahirbudhnya
Revatī	Pūṣan
Aśvinī	Aśvins
Bharaṇī	Yama

Havis is:

- All our concentrated and one-pointed thoughts and words that transform us,

- the food and drink worshipfully offered to our *prāṇāgni* as part of its *adhyātma-vāyu upāsanā,*
- our *dhārmika* desires,[5] and
- ecological physical actions done as worshipful offering to the several forms of Lord Viṣṇu.

Mṛgaśirā (Soma)

King Soma that gratifies and delights all *jīva*s may arrive along with Mṛgaśirā (constellation of the form of "head of deer" containing three stars like cat's paws[6] or five[7]) that is His auspicious and dear abode and work-spot.

This Soma, one of the eight benevolent (*saumya*) forms of Lord Śiva,[8] nourishes (gives *dhātu-puṣṭi* to) people through a variety of herbs and forest products. We beseech Him to bestow us, His worshippers, with progeny. This implies:

- Infusing those *jīva*s that are to be borne as our progeny into the subtle bodies (*sūkṣma śarīra*) of males among us, and
- nourishing the *dhātu*s of our gross bodies up to the seventh stage of Śukra that evolves into semen in males and ovum and blood in females that act initially as carriers and evolve ultimately (after fertilizing) into appropriate gross bodies to those *jīva*s so that they can manifest as our progeny.

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5 *kāma ājyaṁ — Taittirīya Āraṇyaka*
— *Mahānārāyaṇopaniṣad* 80.1

6 *mūṣakāśanapadākṛtu vidhau vyoma-madhya-milite tri-tārake* ।
— quoted in Telugu book *Nakṣatramulu,* chap. 22
by Gobburi Venkatananda Raghava Rao

7 *ilvalā pañcatārakā* — in Kṣīrasvāmi's commentary on *Amarakośa,* Prathama Kāṇḍa-Digvarga 23: *ilvalā-tacchiro deśe tārakā nivasantiyāḥ* ॥

8 *bhūrambhāṁsyanaloṁbaramaharnāto himāṁśuḥ pumān ityābhāti carācarātmakamidaṁ yasyaiva mūrtyaṣṭakam* । *nānyatkiñcana vidyate vimṛśatāṁ yasmāti parasmāt vibhoḥ tasyai śrī guru mūrtaye nāma idam śrīdakṣiṇāmūrtaye* ॥ — *śloka* 9 of Ādi Śaṅkara's *Dakṣiṇāmūrtyāṣṭaaka*

This Mṛgaśirā *nakṣatra* is the dearest to Soma among His dear objects as it is the best-suited place to perform His tasks of:

- Nourishment of our gross bodies by providing us food in the form of herbs and other forest products,
- infusing *jīvas* into the minds of their prospective fathers, and
- evolving this food inside our bodies up to Śukra, the seventh *dhātu* (essential constituent), so that it may evolve into semen and ovum/blood that act initially as carriers for these *jīvas* to take birth and finally evolve into gross bodies for them.

We offer *havis* to you, Mṛgaśirā and its constituent stars[9] (*invakās*) separately. These stars are activated by Lord Śiva's arrow.[10] May You increase happiness to us, our parents, progeny and cattle.

Punarvasu (Aditi)

Aditi, the mother of all *devas*, is the single global all-pervasive principle and hence is the support for the changing world and upholds the diversity that occupies space. By virtue of her inherent nature, she is never pulled down by demerits. We pray to such Aditi, for whom the five[11] Punarvasu *nakṣatras* (two of these are known as Castor and Pollux in the European astronomical tradition) are her body, to grace our good actions done as worship of gods (*yajñas*, that nourish them) with Her presence along with the gods that are Her children again and again (that is, always) and satisfy us by bestowing wealth in a variety of forms *ābhūti* and progeny *prajāti*[12]

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[9] *invakābhyas-svāhā, oṣadhibhyas svāhā, rajyāya svāhā, abhijtyai svāhā*
— *Taittirīya Brāhmaṇa* 3.1.4.3

[10] *śiva bāṇena ilyante preryante ilvalāḥ* । — Lingayasuri's commentary on *Amarakośa*, Prathama Khaṇḍa, Digavarga 23

[11] *dhanurākāraṁ pañca* — Vararuci, *naukākāraṁ pañca* — by another author — Gobburi Venkatananda Raghava Rao's quote in his Telugu book *Nakṣatramūlu*, chap. 22.

[12] *ādityai svāhā, punarvasubhyāṁ svāhā, ābhūtyai svāhā, prajātyai svahā*
— *Taittirīya Brāhmaṇa* 3.1.4.5

on us as the result of our *yajña*s.

Aditi

- Is the constant support for the changing universe (*jagat*) and sustains and nourishes it unobstructed by anything else.
- Is a holistic principle of unity from which all other divine principles are born.
- fashions all our actions as *yajña*s so that they may result in plenty and riches.
- gets us rid of all our (i) tendencies for bad actions, and (ii) even their influences.
- suppresses our mental and physical illnesses and impurities and thus protects our purity and health (self-rootedness).
- fortifies us to protect from narrow and selfish qualities *ari-ṣaḍ-varga* of *adhārmika* (bad) desires, anger, greed, delusion, arrogance and avarice, and drives them afar so that they cannot influence and eclipse us as She is blemishless.
- will be the partaker of the *havis* offered by us which is liked by *deva*s.

Āśleṣā (Vaiṣṇava Sarpa — Ādiśeṣa)

Let this sweet offering be to the liking of the serpent-like motions that reside in the earth and sky, also in the rays of the sun and those that follow the *devatā* of *dyu-loka*. The Āśleṣā *nakṣatra*s are the bodies of these Divine Serpents and so they follow their will. We invite them to grace our *yajña*.

The presiding deity, Ādiśeṣa (Vaiṣṇaṇa *sarpa*) is the initial endless (Ananta). Energy-remainder after *sṛṣṭi* of the present universe and He is tuned to the sustenance of this universe (Vaiṣṇava Viṣṇu is in charge of Sthiti). He is ever ready to move (*nāga* = *nā* + *a-ga* = not unmoving) and be dynamic as per Viṣṇu's plan.

The Āśleṣā *nakṣatra*s (constellation of six stars[13]) follows the movements:

- of the earth as Ādiśeṣa resides at its core (*pātālaloka* as the magnetic field of the liquid iron) causing the diurnal rotation of earth around itself,
- in the intermediate space (*antarikṣa*) as sun's gravitational field (as Ādiśeṣa also resides at sun's centre as *saṁkarṣaṇa vyūha*[14]) causing the yearly rotation of earth around it, and
- in the space (*dyu-loka*) between the sun and the Śiṁśumāra *cakra* or Canis Minor (of which Yama, Mitra, Varuṇa, Agni, Indra, Kaśyapa and Atri are the members[15]) and in which the Pole Star is a part causing the precession of equinoxes.

Some *sarpa*s are in the light coming out of the sun and so the sunlight is known to be controlled in its propagation by them.[16]

Anurādhā (Mitra)

We approach God Mitra with an attitude of prostration to offer *havis* to Him in order to grow plentifully by the auspicious betterment (*śreyas*) bestowed by Him on us that consists of:

- expansion of our hearts,
- deepening of our intuitive (yogic) experiences, and

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13 *sarpa ṛta* — Vararuci and Āśleṣā are *cakrākṛti ṣaṭ nakṣatrātmakaṁ* — *Dīpikā* both quoted by Gobburi Venkatananda Raghava Rao in *Nakṣatramulu*, chap. 37.

14 *saṁkarṣaṇa mūrtisvarūpo yosāvādityaḥ paramapuruṣaḥ sa eva rudro devatā* — in *Mahānyāsa*

15 *yasmai namaḥ, tat-siro dharmo murdhānaṁ, brahmā-uttarā hanur-yajño adharā, viṣṇur-hṛdayaṁ, samvatsaraḥ prajananaṁ, aśvinau pūrvapādau, atrir-madhyaṁ, mitrā-varuṇau apara-pādau, agniḥ pucchasya prathamaṁ kāṇḍaṁ, tat indras-tataḥ prajāpatirabhayaṁ caturthaṁ-iti — Taittirīya Āraṇyaka* 2.19

16 *bhujaga namitāḥ sapta turagāḥ* — quoted by Gobburi Venkatananda Raghava Rao in *Nakṣatramulu*, chap. 37.

- by making us more broad-minded.

This will also result in the broadening of our circle of friends (*mitrādheyaṁ no astu*).

Let us live a full life of hundred years heroically along with our children nourishing the Anurādhā *nakṣatra*s by *havis*.

This wonderful Anurādhā *nakṣatra* (constellation containing three stars like an umbrella[17] according to Vararuci or five like a *toraṇa*: arched doorway[18] as per Kālidāsa and known as *b*, *d* and *p* stars of Scorpio) has risen in the east and Lord Mitra whose body is this Anurādhā *nakṣatra*, travels in the expansive and conscious (planned) and enlightened way of gods (*devayāna*) in the sky.

Mitra

- is friendly and benevolent to one and all that are in His line of sight,[19]
- *janān yātayati prajānan* — impels people into action with thorough knowledge of their present state,[20]
- *dādhāra pṛthivīṁ uta dyāṁ* — consciously holds the earth and the heavens (by his gravitational field) as the rising sun,[21] and
- *kṛṣṭīḥ animiṣā abhicaṣṭe* — constantly observes the efforts of striving people all the time.[22]

Whoever trains oneself thoroughly and diligently with Mitra's vow of constant playful effort, such a person never faces a failure

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[17] *anūrādhe chatrakāra-traya* — Vararuci, quoted by Gobburi Venkatananda Raghava Rao in *Nakṣatramulu,* chap. 62.

[18] *anūrādhe toraṇākṛtini pañca tārake* — Gobburi Venkatananda Raghava Rao's quote in his Telugu book *Nakṣatramulu,* chap. 62.

[19] *sarvabhūteṣu medyati snihyati-iti mitraḥ-mida snehane* — Lingayasuri on *Amarakośa*, Prathama Khaṇḍa, Digavarga 30

[20] *mitro janān yātayati prajānān* — *Taittirīya Saṁhitā* 3.4.10.45

[21] *mitro dādhāra pṛthivīṁ kuta dyāṁ* — Ibid.

[22] *mitraḥ kṛṣṭīḥ animiṣā abhicaṣṭe* — Ibid.

and is never touched by sin from afar or near.[23]

Gods like Indra stay close to Sūrya as his attendants, to obstruct His exceedingly compassionate and benevolent vision from falling on demons apprehensive of His granting boons to even them. Among these, the attendants known as Mātara, Piṅgala and Daṇḍa are the forms of Yama, Agni and Rudra, respectively. As he stays near to Sūrya, Yama is known as Mātara.[24] Thus we have a broad circle of friends and are always in a win–win position.[25]

Uttarāṣāḍhā

May Viśvedevas listen to our request and the Uttarāṣāḍhā *nakṣatra*s (constellation containing elepant-tusk-like two stars[26] that are known as Zeta and Omicron in the constellation of Sagittarius) grace our *yajña*. Let them be famous for the sake of cattle so that we, the worshippers may get good rain and our efforts at cultivation may be fruitful.

These Āṣāḍhas are pure, ever-youthful, beautiful, dexterous and procreative maidens that act auspiciously. They satisfy the thirteen Viśvedevas, their masters, with our offering and lead us to permanent success unattended by any failure.[27]

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23 *prāyasvān yaste āditya śikṣati vratena na hanyate na jīyate tvoto nainaṁ agmho aśnoti antito na dūrāt* — *Taittirīya Saṁhitā* Ibid.

24 *mātaraḥ piṅgalo daṇḍaḥ chandāṁśo pāriparśvikāḥ sūryasya dayālutvāt rakṣo-vara-pradāna-śankayā indrādayaḥ tannikaṭe vighnaṁ kurvantaḥ vartante। tatra yamāgni-rudrāḥ kramena mātaraḥ-piṅgala-daṇḍāḥ ityucyante। mathati nivasati sūrya-samīpe mātaraḥ। māta-nivāse।*
— Lingayasuri's commentary on a Amrakośa,
Prathama Khaṇḍa, Digavarga 31

25 *mitirāya svāhā, anurādhebhyas svāhā, mitradheyāya svāhā, abhijityai svāhā॥* — *Taittirīya Brāhmaṇa* 3.1.5.1

26 *gaja-dantākṛti dvi-tārakātmakā।* — quoted by Gobburi Venkatananda Raghava Rao in *Nakṣatramulu*, chap. 69.

27 *viśvebhyo devebhyas svāhā, āṣāḍhābhyas svāhā, anapajayyāya svāhā, jityai svāhā* — *Taittirīya Brāhmaṇa* 3.1.5.5

These *devas* are the highly capable and efficient (*mahāvīryāḥ*) universal postmen and escorts to human ancestors that

- are the sons of Viśvā and Dharma.[28] Viśvā is the daughter of Dakṣa Prajāpati and they enter the place of *śrāddha* first[29] in the following seven types of *pitṛ-yajña*[30] in order to carry the offerings given by humans with *śraddhā* (respectful attention) to their ancestors wherever they are and in whatever form. This is explained in *Śaṅkhasmṛti*[30] as follows:
- Dakṣa and Kratu come to *darśa and paurṇamāsa* (*śruta*) *iṣṭis* done on every *amāvasyā* and *pūrṇimā* by Āhitāgnis.
- Satya and Vasu come to *nāndīmukha* done before any major function in the family like Upanayana and Kanyādāna.
- Dhuri and Vilocana attend *tīrtha-vidhi* performed at the special occasion of visiting sacred places like Prayāga, etc.
- Purūrava and Ārdrava visit *pārvaṇa* done every year on the death anniversaries of one's parents or maternal grand-parents.
- Dhanu and Ruci come to *hiraṇya* (*hema*) *śrāddha* done by giving

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28 *śāddhāgre viśanti-iti viśve-viśa praveśane* (1.1.10) — Lingayasuri on *Amarakośa, Prathama Khaṇḍa, Swargavarga* 10

29 *daśa dharmāya kāyādāt dviṣata-triṇava chendave* ।
bhutāṅgiraḥ kṛśāśvebhyo dve dve tārkṣyāya cāparāḥ ॥
— *Śrimad Bhāgavata* 6.6.2

bhānurlambā-kakubjāmi-viśvā-sādhyā-marutvatī ।
vasurmuhūrtā-saṅkalpā-dharma-patnyas-sutān-śṛṇu ॥ — Ibid.

30 *dakṣasya duhitā sādhvi viśvā nāma prakīrtitā* ।
tasyāḥ putrāḥ mahāvīryāḥ viśve devāḥ trayodaśa ॥

iṣṭi śrāddhe dakṣa-kratū saṁkirtyau vaiśvadevikau ।
nāndīmukhe satya-vasūrtirthe dhuri-vilocanau ॥

purūravārdravau caiva pārvaṇe samupasthite ।
hema śrāddhe dhanu-ruci sapiṇḍe kāla-kāmukau ॥
ekoddiṣṭe rudra saṁjño viśvedevāḥ trayodaśa ॥ — *Śaṅkhasmṛti*

money during Puṣkara or when the doer is incapable due to illness, etc.

- Kāla and Kāmuka attend *sapiṇḍa śrāddha* performed to join the newly-departed elder with his/her previous generations.
- Rudra visits *ekoddiṣṭa śrāddha* done only once on the death of an ancestor.

Śravaṇā (Viṣṇu–Trivikrama)

Let the deities of this Śravaṇā *nakṣatra* (constellation containing fish-like three stars[31] known as Aquila) hear with their divine ears as

- the protector of the results of the meritorious deeds of all *jīva*s so that they are never lost,
- having divine and noble qualities,
- conscious of herself and others and playful,
- the executive power of the all-pervading Viṣṇu (*patnī* Lakṣmī) that is His eternally permanent companion (*nitya-Anapāyinī*),
- steadfast and never excited by adverse circumstances,
- receptive towards us, Her devotees.

We worship Her with offerings (*havis*) to be able to listen to Her divine prophetic voice regarding the results of our meritorious deeds.

This Śravaṇā *nakṣatra* moves in her path, desirous of glory for Trivikrama–Viṣṇu that builds bridges by His vast strides across the three planes of physical, vital and *jīva prajña*s, the last being potentially vastly expansive and who is greatly sung by the laws of nature (in Veda) for this.

Hence, She encourages practitioners of meritorious deeds that emulate Him by bestowing (their deserved) fame on them. We aspire to get such fame and divine ears by our persistence in our

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[31] *matsyākāra-trayaṁ śravaṇaṁ* — Vararuci, quoted by Gobburi Venkatananda Raghava Rao in *Nakṣatramulu*, chap. 76.

spiritual practice.[32]

Uttarāproṣṭhapadā (Ahirbudhnya)

The *proṣṭhapadā* (legs of a cot) are four *karma-deva*s that are gentle brāhmaṇas in nature and have drunk the divine experience of *soma-rasa*. *Karma-deva*s are those that attained to one of the thirty-three *deva* positions that can partake of the *havis* offerings (*havirbhuk*) by their self-transforming actions of previous birth(s).[33] They surround Ahirbudhnya with humility as His disciples who move expansively excelling among both human beings (that are experts in intellectual knowledge) and divinities (that are experts in intuitive knowledge).

Ahirbudhnya is

- The chief and most distinguished among Rudras that are experts in perceiving the divinity existing at a more fundamental level in the apparently disorderly and chaotic parts of the world. He is engrossed in reaching to greater depths (where the inner underlying order can be perceived) by piercing through the apparently disorderly levels of reality.
- excellent among humans, as He is highly thoughtful and knowledgeable.
- also the excellent among *deva*s, by virtue of His constant effort in continuously finding unforeseen and new ways (even if they are not straightforward) to fructify our actions. He

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[32] *viṣnave svāhā, śroṇāyai svāhā, ślokāya svāhā, śrutāya svāhā* ||
— *Taittirīya Brāhmaṇa* 3.1.5.7

[33] *ye karmaṇā devatvaṁ-abhi-sampadyante* |
— *Bṛhadāraṇyaka Upaniṣad* 4.3.33

agnihotrādi śrauta karmaṇā ye devatvaṁ prāpnuvanti te karma devāḥ |
– *Śaṅkara's commentary on it and also ye karmaṇā devānāpiyanti* |
— *Taittirīya Upaniṣad* 2.8.3

karma devāḥ ye vaidikena karmaṇā agnihotrādinā kevalena devān apiyanti | *devā iti trayastriṁśata havirbhujaḥ* || — Śaṅkara's commentary on it

is able to achieve this by being rooted in Himself and by His thoughtfulness of the deepest order.

The *proṣṭhapadā*s surround him at each level/depth stably like the four legs of a cot and form a protective armour around him to prevent the disorderly forces from approaching and distracting him from his single-minded concentration to formulate ways of bestowing the *karma-phala* for us, the human *jīva*s.

*Proṣṭhapadā*s are:

- *brāhmanāḥ* — pure, clean, workaholic, striving, calm in mind
- *somapāḥ* — drunk with divine experience
- *somyasaḥ* — gentle and calm
- *catvāraḥ* — stable like the four legs of a cot
- *karmadevāḥ* — attained godhead through their effort and spiritual *sādhanā*
- *stuvantaḥ* — praising the qualities of the Ahirbudhnya — their leader
- *namasā upasadya* — following him with devotion
- *pariṣad abhirakṣanti* — surround and protect him at various levels from the apparently chaotic forces.

We are blessed with stability by worshipping these *karma-deva*s, the *proṣṭhapadā*s and their leader, Ahirbudhnya.[34]

Bharaṇī (Yama)

The Bharaṇī *nakṣatra*s (constellation containing furnace-like three stars[35]) presided over by Yama, separate the sins of all *jīva*s from their meritorious deeds and store them away in individual sachets.

This Yama is the personification of the following set of five

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[34] *ahirbudhnyāya svāhā, proṣṭhapadebhyas svāhā, pratiṣṭhāyai svāhā* ।
— *Taittirīya Brāhmaṇa* 3.1.5.11

[35] chullikā trīṇi apabharaṇī — quoted by Gobburi Venkatananda Raghava Rao in Nakṣatramulu, chap. 88

fundamental qualities[36] that are the basis of all other good qualities. These are:

- *ahiṁsā* (non-violence),
- *satya* (truthfulness),
- *asteya* (non-stealing),
- *brahmacarya* (continence), and
- *aparigraha* (non-receiving).

These five qualities are so fundamental that they have been extolled in our scientific literature as the ultimate principles of ethical life.[37] Swami Vivekananda translates this Patañjali's *Yogasūtra* as follows:

> These, unbroken by time, place, purpose and caste-rules, are universal great vows. These . . . are to be practised universally by every man, woman and child . . . irrespective of nation, country or position.

Such Yama is *bhagavān*, that is one having the six divine qualities of *jñāna, aiśvarya, śakti*, *bala*, *vīrya* and *tejas* needed to evolve *sṛṣṭi*, maintain *sthiti* and withdraw (*laya*) this universe.

Those that experience this universe as *bhagavān*'s form realize and actualize themselves as *bhagavān*.

Thus *bhagavān* Yama worships this universe (*viśva*) by performing His self-appointed duty of doing *hita* (beneficial in the long range and at a global level) to the myriad forms of Vāsudeva-Nārāyaṇa manifesting as all these *jīva*s although His actions may appear temporarily as unpleasant to those *jīva*s.

May such Lord Yama formulate an easy and fearless way to us, meditators of His qualities.

This Yama, who is the personification of the five divine

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36 *ahiṁsā-satya-asteya-brahmacarya-aparigrahā yamāḥ*
— *Pātañjala Yogasūtra* 2.30

37 *ete jāti-deśa-Kāla samaya-anavacchinnāḥ sārvabhaumā mahā-vrataṁ*
— *Pātañjala Yogasūtra* 2.31

fundamental qualities, moves about constantly in Bharaṇī that contains the records of all our deeds, good and bad, without any contact with our bad deeds whatsoever.

The gods, who are the several forms of the various divine qualities of *bhagavān*, have recognized Lord Yama as the most appropriate among them for the examination and weighing of good and bad deeds of all the *jīva*s and hence anointed Him as the king to rule over the departed souls.

We worship this strange king Yama with offerings of *havis* requesting Him to keep our bad deeds dormant in His office Bharaṇī, thus allowing us to progress forward in our spiritual practice in spite of our past bad deeds.

The following four qualities manifest externally in Yama:

- Exactness
- Punctuality
- Justice
- Being the personification of *dharma* (righteousness).

The touchstone for perfection in our spiritual practice in the achievement of Yama's basic five qualities is the open manifestation of the above four derived qualities, verifiable and visible to others.

Only Yama that has concern for the spiritual progress of all the *jīva*s is fit enough to think, judge and deal with their good and bad deeds. All others need have no business regarding these.

We attain prior knowledge and mastery over death like the great Sāvitrī and win membership of Yama-Sabhā by our devotion to Lord Yama's unique characteristics.[38]

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[38] *yamāya svāhā, apa-bharaṇībhyas svāhā, rājyāya svāha, abhijityai svāha* ||
— *Taittirīya Brāhmaṇa* 3.1.5.14

11

Calculation of Longitudes of the Sun using Traditional Methods

E. Sreedharan

Nowadays, we get very accurate and correct information from modern astronomers, who use modern techniques to find out the astronomical matters like geo-centric longitudes of the sun and the planets and the modern almanacs are prepared using these methods. Can it be possible for us to calculate the accurate geo-centric longitude of the sun, using the traditional Indian astronomical methods? It is this enquiry that is made in this paper.

For this purpose, first, I sent a letter to the Positional Astronomical Centre (PAC), Kolkata, functioning under the Meteorological Department of Government of India, seeking some astronomical information. They supplied me the information what I requested, including the apparent geo-centric longitude of the sun at 5 h 29 min IST on 14 April 1995. They promised that all the data were prepared using latest astronomical formulae as per the norms of International Astronomical Union.

Then I tried to calculate the apparent geo-centric longitude of the sun at 5.30 a.m. on 14 April 1995, using our different traditional methods like *parahita* system, *vākya-paddhati* system and *dṛggaṇita* system. As the end, I came to a conclusion, that if the fundamentals of old methods are slightly corrected, we can reach the same result given by the Positional Astronomical Centre.

Traditional Process to Calculate Sun's Geo-centric Longitude

Our ancestors developed three steps to calculate and find out the right position of planets and they are *maddhyama gaṇita*, *mandasphuṭa gaṇita* and *bhūmadhya gaṇita*. It is explained in the book *Ketakigrahagaṇita Bhāṣya* thus:

> *draṣṭuḥ sthānāntarānusāreṇa dṛśyapadārthānāṁ diśo'pi nānātvamupayānti, nānāsthānādhiṣṭhitatvaṁ gaṇitakāryāya kalpyaṁ bhavati । tena sthānagaṇitasya vibhāgatrayaṁ prādurbhavati । ādyaṁ madhyamagaṇitam । dvitīyaṁ ravimadhyadṛśyasthānagaṇitam mandasphuṭagaṇitam tṛtīyaṁ ca bhūmadhyagaṇitaṁ bhūmadhyasthānagaṇitamiti* ।[1]

Here, one more step may be included, i.e. *ahargaṇa gaṇita*, which is used to calculate the totality of days between the starting point and the intended date. It is clearly proved that all the planets revolve round the sun. While revolving round the sun, suppose one wants to know in which point the planets come at a particular day? For finding this, the totality of days from starting point to intended date must be known. Which is the starting point? Siddhānta texts say that it is the time of creation. Hence, the totality of days since creation to the intended date is named *ahargaṇa*. *Ahargaṇa gaṇita* is that which explains the process of calculation to know the totality of days from creation to intended date.

There are three methods adopted by our ancestors for calculating the *ahargaṇa*: *siddhānta, tantra* and *karaṇa*. *Siddhānta* is that which follows the calculation of *ahargaṇa* since creation and *tantra* calculates it from the starting day of present Kali-yuga, not from creation. Through the *karaṇa* method, the *ahargaṇa* is calculated from a cut of date in the present Kali-yuga, which is called *karaṇa*.

The text, *Gaṇitaprakāśikā* of K.V.A. Ramapoduval, accepts

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1 *Ketakīgrahagaṇita Bhāṣya*, p. 43.

the date, in which the 5000th Kali year completed, as the cut-off date (*karaṇārambha*).[2] *Śuddhadṛgganita* of V.P.K. Poduval accepts the independence date, 15 August 1947 as the *karaṇārambha*.[3] *Gaṇitanirṇaya*, another text of *karaṇa* type, written by P.S. Puruṣottama Namputiri, accepts 1st Meṣa 1113 of Kollam era.[4]

> *tatrā gaṇitaśāstraṁ tridhā* । *siddhāntatantrakaraṇatvena* ।*yasmim kalpāderārabhya gatābdamāsadinādeḥ saurasāvanacāndramāsā-nyavagamya saurasāvanagataharganāt madhyamādīnāṁ karma ucyate tatsiddhāntalakṣaṇam* । *vartamānayugadeḥ varṣāṇyeva jñātvā ucyate tat tantram* । *vartamānaśakamadhye abhīṣṭadinādārabhya jñātvā ucyate tat karaṇalakṣaṇam* ।[5]

The distance of planets' travel during *ahargaṇa* period is named *grahabhoga*. It is calculated by the multiplication of *ahargaṇa* with the daily mean motion of planets. What does it mean by mean motion? It is an average distance of planets' daily motions. As the daily motions of planets are not equal, an average distance of daily motion is to be calculated and it is called mean motion.

> *anityagatyā sañcaratāṁ grahāṇāṁ sthānaniścayārthaṁ madhyamagatyānusaraṇaśālī kopi kalpitagraho jyotirvidbhiḥ svīkriyate* । *tena ādau sakalagrahāṇāṁ madhyasthānānyeva sādhyāni bhavanti* ।[6]

The distance of average daily motion is called mean motion and the average point found out through the calculation of average motions to the intended date is named as mean position (*grahamadhyama*). For example, the maximum of sun's daily motion is 61 *kalā*s and minimum is 57 *kalā*s. Hence, it is understood that the mean motion is 59 *kalā*s and the mean position for ten days is 590 *kalā*s.

The Tantra and Karaṇa texts make the mean position to the

2 *Gaṇitaprakāśikā*.

3 *Śuddhadṛggaṇita*.

4 *Gaṇitanirṇaya*.

5 *Gaṇitanirṇaya*.

6 *Ketakīgrahagaṇita Bhāṣya*.

intended date by adding *grahabhoga* prepared for *ahargaṇa* to *grahadhruva*. According to *tantra* method, the true positions of the planets to the starting point of Kali-yuga are *grahadhruvas* and in the case of *karaṇa* method, those are made to the cut-off date (*karaṇārambha*).

We can calculate *ahargaṇa* to 14 April 1995. Hence, the intended date accepted here is 14 April 1995. As per the *karaṇa* method, a cut-off date is to be taken. Here, I accepted the independence date of India, i.e. 15 August 1947 as the cut-off date, which is also explained in the text, *Śuddhadṛggaṇita* of V.P.K. Poduval.

PROCESS 1: CALCULATION OF AHARGAṆA

ahargaṇa (A) = Intened date (ID) – *karaṇārambha* (KA)

ID = 14 April 1995

KA = 15 August 1947

A = 14 April 1995 – 15 August 1915

= 47 years and 242 days

Total days in a solar year = 365.25636051[7]

47 years = 47 x 365.25636051 = 17167 days

Total days of *ahargaṇa* = 17167 + 242 = 17409 days

Grahabhoga (the distance of travel of the planet in a particular period) is to be calculated. The period of revolution of the sun is 365.25636051 days. From this, we can calculate the daily average motion of the sun. The circumference is 360° or 21,600 *kalās*. The sun takes 365.25636051 days for a revolution of 21,600 *kalās*. The daily average motion = 3600/365.25636051 = 0.985609113 degree or 59.13654719 *kalās*. Hence, it is clear that the sun takes 0.014390887 degree (–) to revolve a day.

PROCESS 2: CALCULATION OF GRAHABHOGA

Grahabhoga (GB) = (A) – (A x 0.014390887)

[7] *Wikipedia Dictionary*, internet.

A = 17,409 days

= 17409 – (17409 x 0.014390887)

= 17409 – 250.5309518 degree

= 17158.46905 degree

= 7 *rāśi* 28 degree 28 *kalā* 9 *vikalā*

A total of 30° is named a *rāśi*, a degree has 60 *kalā*s and a *kalā* has 60 *vikalā*s.

PROCESS 3: CALCULATION OF GRAHAMADHYAMA
(MEAN POSITION OF THE PLANET)

Grahamadhyama (GM) = GB + *grahadhruva* (GD)

Here, GD is the true position of the sun at KA.

GB = 7 *rāśi* 28° 28 *kalā* 9 *vikalā*

GD = 3 *rāśi* 29° 29 *kalā* 35 *vikalā*

= 11 *rāśi* 27° 57 *kalā* 44 *vikalā*

grahadhruva accepted in the text *Śuddhadṛggaṇita* is prepared to the sunrise time of 77° latitude. But, the geocentric longitudes of the planets prepared by Positional Astronomical Centre are to 5.30 a.m. (IST).

The sunrise time on 14 April 1995 at 77° was 6.17 a.m. Hence, we want to correct the difference of time in *grahamadhyama*.

PROCESS 4: CORRECTION IN GRAHAMADHYAMA

Time of sunrise at 77° = 6.17 a.m.

Time given by PAC = 5.30 a.m.

Difference = 47 minute (–)

GB for 24 hours (1440 minutes) = 0.985609113

GB for 47 minutes = 47 / 1440 x 0.985609113

= 0.032169186 degree

= 1 *kalā* and 56 *vikalā* (–)

Corrected *sūrya madhyama* = 11 *rāśi* 27° 55 *kalā* 48 *vikalā*

Two corrections are needed in *grahamadhyama,* i.e. *carasaṁskāra* and *prāṇakalāntara saṁskāra*. The meeting place of the earth and the sky is known as horizon. At the eastern horizon the sun rises and the western horizon the sun sets. The duration between the sunrise and the sunset is named as daytime and in reverse it is called night. At the place, where the 0° latitude comes the duration of daytime and night is equal to 12 hours, this is only in the equinox, but in other days there will be variation. At the place, where the latitude is other than 0°, the 12 hours of daytime will change. In the equinox also the change happens. This variation is corrected by *carasaṁskāra*.

We feel that the celestial sphere moves from the east towards the west. The ecliptic, which is also revolving with this celestial sphere, contains 21,600 *prāṇa*s. The difference between *nāḍīvṛtta* and *krāntivṛtta* is named *prāṇakalāntara saṁskāra*.

PROCESS 5: CORRECTION OF CARA AND PRĀṆAKALĀNTARA

1. First add the *ayanāṁśa* to *madhyama*, it will become *sāyana madhyama*

ayanāṁśa	=	23° 47 *kalā*
madhyama	=	11 *rāśi* 27° 55 *kalā* 48 *vikalā*
sāyana madhyama	=	0 *rāśi* 21° 42 *kalā* 48 *vikalā*

2. *Bhujā* (side of a triangle) of *sāyana madhyama* = 0 – 21 – 43 (–)

   caraphala for 0 *rāśi* 18° 45 *kalā* = 181 *kalā*

   caraphala for 0 *rāśi* 22° 30 *kalā* = 217 *kalā*

   Difference between 0 *rāśi* 21° 43 *kalā* and 0 *rāśi* 18° 45 *kalā* = 178 *kalā*

   Difference of *caraphala* between 0 *rāśi* 22° 30 *kalā* and 0 *rāśi* 18° 45 *kalā* (for 3° of 45 *kalā* = 225 *kalā*) = 36 *kalā*

   caraphala for 178 *kalā* = (36/225) x 178 = 28

caraphala for 0 *rāśi* 21° 43 *kalā* = 181+ 28 = 209 *kalā* (–)

3. *Bhujā* of the *sāyana madhyama* = 0 – 21 – 43 (–)

   prāṇakalāntaraphala for 0 *rāśi* 18° 45 *kalā* = 88 *kalā*

   prāṇakalāntaraphala for 0 *rāśi* 22° 30 *kalā* = 102 *kalā*

   Difference between 0 *rāśi* 21° 43 *kalā* and 0 *rāśi* 18° 45 *kalā* = 178 *kalā*

   Difference of *caraphala* between 0 *rāśi* 22° 30 *kalā* and 0 *rāśi* 18° 45 *kalā*

   (for 3 degree 45 *kalā* = 225 *kalā*) = 14 *kalā*

   prāṇakalāntaraphala for 178 *kalā* = 14/225 x 178 = 11

   prāṇakalāntaraphala for 0 *rāśi* 21° 43 *kalā* = 88 + 11 = 99 *kalā* (–)

4. *Aharmāna saṁskāra*: The two results of *cara* and *prāṇakalāntara* are to be multiplied by the mean motion of sun and then divided by the circumference of the circle. It becomes *aharmānaphala*.

   cara = 209 *kalā* (–), *prāṇakalāntara* = 99 *kalā* (–)

   Total of these two = 308 (–)

   aharmānaphala = 308 x 59.1361/21600 = 51 *vikalā* (–)

5. Correction to *madhyama*

   = 11 *rāśi* 27° 55 *kalā* 48 *vikalā*

   = 11 *rāśi* 27° 54 *kalā* 57 *vikalā*

Next step is the equation of centre (*mandaphala saṁskāra*). It is a correction to the mean position on the basis of the view from the centre to planet. Here, we calculated the mean position of the sun. But we cannot see the sun at the mean position in a particular time. The true position of the sun will be either in advance or in behind of the mean position. When the planet's position is calculated using mean motion, it is called mean planet and the true point where the planet is observed, it is true planet. The mean planet and true

planet join at the aphelion and periphelion. The mean planet will be in advance of the true planet, when they revolve in between aphelion to periphelion and it will be reverse at the other side. The correction between the positions of true planet and mean planet is called *mandaphala saṁskāra.*

PROCESS 6: CORRECTION IN THE APHELION

Aphelion of the sun on 15 August 1947 = 2 *rāśi* 18° 55 *kalā* 42 *vikalā*

Correction of sun's aphelion = 1/1885 *kalā* for a day

Correction for 17409 days = 17409 x 1/1885

= 9.2355 *kalā* = 9 *kalā* 14 *vikalā*

Corrected aphelion of the sun to 14 April 1995

= 2 *rāśi* 19° 4 *kalā* 56 *vikalā.*

The maximum variation of *mandaphala* is named *parama mandaphala* and it is calculated as 6928 *vikalā.* First, we want to know the difference between the aphelion and the sun's mean position and then it is to calculate *mandaphala* for that difference. The difference between aphelion and the sun's mean position is called *mandakendra.* When aphelion is subtracted from the mean position, we get *mandakendra* and *mandaphala* is to be calculated to that point.

PROCESS 7: CORRECTION IN MANDAPHALA

Mean position of the sun on 14 April 1995
= 11 *rāśi* 27° 54 *kalā* 57 *vikalā*

Aphelion of the sun on 14 April 1995
= 2 *rāśi* 19° 4 *kalā* 56 *vikalā*

mandakendra = 9 *rāśi* 8° 50 *kalā* 1 *vikalā*

Maximum *mandaphala* (for 3 *rāśi*s) = 6928 *vikalā*s

Bhujā of *mandakendra*

= 2 *rāśi* 21° 10 *kalā* 8 *vikalā* (+)

Mandaphala for 2 *rāśi* 18° 45 *kalā* = 6769 *vikalā*

Mandaphala for 2 *rāśi* 22° 30 *kalā* = 6851 *vikalā*

Difference between 2 *rāśi* 21° 10 *kalā* and 2 *rāśi* 18° 45 *kalā* = 145 *kalā*

Difference of *mandaphala* between 2 *rāśi* 22° 30 *kalā* and 2 *rāśi* 18° 45 *kalā* (for 3° 45 *kalā* = 225 *kalā*) = 82 *vikalā*

Mandaphala for 144 *kalā* = 82/225 x 145 = 53

Mandaphala for 2 *rāśi* 21° 7 *kalā* = 6769 + 53 = 6822 *vikalā*s (+)

6822 *vikalā*s = 1° 53 *kalā* 42 *vikalā* (+)

True position of the sun = mean position + *mandaphala*

Mean position of the sun on 14 April 1995
= 11 *rāśi* 27° 54 *kalā* 57 *vikalā*

Mandaphala of the sun on 14 April 1995
= 0 *rāśi* 1° 53 *kalā* 42 *vikalā*

After the correction, true position of sun
= 11 *rāśi* 29° 48 *kalā* 39 *vikalā*

When we add *ayanāṁśa* to the corrected true position of the sun, that will be the sun's geocentric longitude on 14 April 1995, 5.30 a.m. (IST). *Ayanāṁśa* on 14 April 1995 is 23° 47 *kalā*. Hence, the result will be 0 *rāśi* 23° 35 *kalā* 39 *vikalā*. As per PAC, it is 23° 35' 18.

From this experience, it is proved that we can calculate the accurate and true geocentric longitudes of the sun, using our traditional methods.

12

Āryabhaṭīyam
A Contribution to Astronomy

Narayanan Nampoothiri N.T.

yathā śikhā mayūrāṇāṁ nāgāṇāṁ maṇayo yathā ।
tadvad vedāṅgaśāstrāṇāṁ jyotiṣaṁ mūrdhni saṁsthitam ।।

> Like the crests on the heads of peacocks, like the gems on the hoods of the cobras, astronomy (mathematics) is at the top of the Vedāṅga Śāstras.

The above verse shows the supreme and singular importance given to astronomy over the other branches of knowledge in the Indian tradition. Like many other branches of secular knowledge the origins of the science of astronomy in India have to be traced back to the Vedas. In the Vedic lore, Jyotiṣa is one of the six auxiliaries (*ṣaḍaṅga*s) of the Vedic corpus of the knowledge.

The six Vedāṅgas are Śikṣā (Phonetics), Vyākaraṇa (Grammar), Chandas (Metrics), Nirukta (Etymology), Jyotiṣa (Astronomy) and Kalpa (Rituals).

Mathematics was generally treated as a part of Jyotiṣa. *Vedāṅga Jyotiṣa* is the earliest astronomical text available to us.

Siddhāntic Astronomy

There was a long gap between the period of *Vedāṅga Jyotiṣa* and the Siddhāntic period. Systematic development in planetary astronomy started with *Pañcasiddhāntikā* (five systems of astronomy), composed as an anthology by Varāhamihira (CE 550). The five systems are:

1. Pauliṣa, 2. Romaka, 3. Vasiṣṭha, 4. Saura, and 5. Paitāmaha.

Date and Place of Āryabhaṭa

Āryabhaṭa obliges us by clearly mentioning the year of his birth as also composition of his famous text. He says:

> *ṣaṭyabdānāṁ ṣaṣṭiryadā vyatītastrayaśca yugapadāḥ* ।
> *tryadhikā viṁśatirabdāstadeha mama janmano 'tītāḥ* ॥
>
> When sixty times sixty (i.e. 3,600) years and three quarter *yugas* have elapsed (i.e in the running Kali-Yuga) twenty-three years have then passed since my birth.

According to K.S. Shukla, Āryabhaṭa was exactly 23 years of age on 21 March 499, Sunday. In other words, Āryabhaṭa was born on 21 March 476.

Āryabhaṭīyam

Āryabhaṭīyam is consisted of four parts (*pādas*): Daśagītikā, Gaṇita, Kālakriyā and Gola.

GĪTIKĀPĀDA

The first part consist of thirteen stanzas of which ten are in Gītikā metre and hence the name. In this part we are introduced to:

1. The large number of time (*kalpa*, *manu*, *yuga*)
2. Circular units of arc (degree, minute)
3. Linear units (*yojanā*, *hasta* and *aṅgula*).

As he wrote in this chapter:

> *vargākṣarāṇi varge 'varge 'vargākṣarāni kāt ṅamau yaḥ* ।
> *kadvinavake svarā nava varge 'varge navāntyavarge vā* ॥

In the Sanskrit alphabet the letters *ka* to *ma* have been classified into five *vargas*: Kavarga, *cavarga*, *ṭavarga, tavarga* and *pavarga*. These letters are therefore referred to above as *varga* letters. These are supposed to bear numerical values of 1 to 25.

The letters *ya* to *ha* are called *avarga* letters. These letters bear numerical values like *ya* = 30, *ra* = 40, *la* = 50, *va* = 60, *śa* = 70, *ṣa* = 80, *sa* = 90, *ha* = 100.

Āryabhaṭa gives a unique method of representing huge number by using the alphabets. This is different from the popular *kaṭapayādi* system adopted by later astronomers. The advantage of Āryabhaṭa's method is the beauty in expressing large number.

Āryabhaṭa's Yuga Theory

Āryabhaṭa makes use of the *yuga* theory to expound the motion of the heavenly bodies. Āryabhaṭa doesn't subscribe to the concept of creation or destruction of the universe. Contradiction the popular traditional belief based on Purāṇas and Smṛtis. The time is a continuous existence without beginning and end, i.e. it is *anādi* and *ananta*.

Āryabhaṭa dispenses with the queer traditional theory of the *yugas*. He replaces it with simpler and astronomically more viable theory.

1 *kalpa* = 14 *manus*

1 *manu* = 72 *mahāyuga* (instead of 71)

1 *mahāyuga* = 4,32,000 years

In this arrangement 1 *kalpa* = 1,008 *mahāyugas* (instead of 1,000) since 1,008 is divisible by 7, every *kalpa* commence on the same weekday. Āryabhaṭa completely dispensed with time spent in "creation" and the "twilight" periods. In this *pāda*, Āryabhaṭa discussed about sine (*jyā*) of angles, etc.

GAṆITAPĀDA

This *pāda* contains thirty-three stanzas dealing with mathematics. This part deals with the following important mathematical topics: geometrical figure, their properties and menstruation, problems on the shadow of *śaṅku chāyā*. Arithmetic progression, etc. simple and compound interest, simple, simultaneous quadratic, square root, cube root, rule of the three, etc.

The Value of π

The ratio of the circumference of a circle to its diameter is a constant, denoted by π its value is given by Āryabhaṭa in the following stanza:

caturadhikaṁ śatamaṣṭaguṇaṁ dvāṣaṣṭistathā sahasrāṇām ।
ayutadvayaviṣkambhasyāsanno vṛttapariṇāhaḥ ॥
— *Āryabhaṭīyam* 2.10

> Add 4 to 100 multiply by 8 and add 62,000. This is approximately the circumference of a circle, whose diameter is 20,000.

This means a circle of a diameter of 20,000 units has its circumference approximately equal to (100 + 4)8 + 62,000, i.e. 62,832 so that we get

$$\pi = \text{circumference/diameter}$$
$$= 62{,}832/2{,}000 = 3.1416$$

It is remarkable that Āryabhaṭa is the first Indian mathematician who has given the value of π which is correct to four decimal places.

KĀLAKRIYĀPĀDA

The third part of *Āryabhaṭīyam* contains twenty-five *śloka*s explaining the various units of time and the methods of determination of the position of the planets for any given day. Calculations concerning the *adhikamāsa, kṣaya tithi*s, speeds of planetary motions and the weekdays are also included in this part of the text.

Time Divisions and Circular Divisions

varṣadvādaśa māsastriṁśaddivaso bhavet sā māsastu ।
ṣaṣṭhirnāḍyo divasaḥ ṣaṣṭiśca vināḍikā nāḍī ॥

gurdakṣarāṇi ṣaṣṭivināḍikārkṣī ṣaḍeva vā prāṇāḥ ।
evaṁ kālavibhāgaḥ kṣetravibhāgastathā bhagaṇāt ॥

> A year consists of twelve months, a month consists of thirty days, a day consists of sixty *nāḍī*s and a *nāḍī* consists of sixty *vināḍikā*s.
>
> A sidereal *vināḍikā* is equal to sixty long syllables or six respirations. This is the division of time.

GOLAPĀDA

This fourth part contains fifty stanzas. In this chapter he discussed about the important features of the ecliptic, the celestial equator, the node, etc.

Earth's Shape and Rotation

Now even a child knows that the earth is spherical and that it rotates about its own axis causing day and night. But it took thousands of years in the history of science to discover these truths. It was believed strongly for long that the earth is flat and that it is stationary while all heavenly bodies revolve round that all important mother earth.

> *bhūgola sarvato vṛttaḥ* — *Āryabhaṭīya* 4.6

In the following stanza Āryabhaṭa states:

> *bhūgrahamānaṁ golārdhāni svacchāyayā vivarṇitāni* ।
> *ardhāni yathāsāraṁ sūryābhimukhāni dīpyante* ॥
> — *Āryabhaṭīyam* 4.5

> Halves of the globes of the earth, the planets and the stars are dark due to their own shadows, the other halves facing the sun's bright light.

It is creditable that Āryabhaṭa was the first among the Hindu astronomers to recognize that the earth and other planets are not self-luminous, but receive and reflect the sun's light.

Again Āryabhaṭa is the first among the Indian astronomers in stating that the rising and setting of the sun, the moon and other heavenly bodies are due to the relative motion of the earth caused by the rotation of the earth about its own axis.

Eclipse

> *chādayati śaśī sūryaṁ śaśinaṁ mahatī ca bhūcchāyā* ।
> — *Āryabhaṭīyam* 4.37

The moon eclipses the sun and the great shadow of the earth eclipses the moon.

Conclusion

Mathematics is like an ocean rough, boisterous and fearful on the surface, but having pearls and gems of the purest ray serene in the bottom. From the finite, mathematics leads us on to the region of the infinite.

The credit of systematizing the knowledge of astronomy and mathematics existed prior to him and providing them a social foundation surely goes to Āryabhaṭa, Like Plato in Greek philosophy, Āryabhaṭa is the uncrowned emperor of Indian astronomy and mathematics.

13

Indian Astronomy in Direct Contrast to that of the West

With Special Reference to Siddhānta Sārāṁśa

B.H. Tukaram

THE earth is neither rotating around its own axis nor orbiting the sun. In reality the sun, moon, stars are going around the stationary, spherical earth just as observed and as our ancient astronomical texts say. But for the manuscript heritage of Indian astronomy, which was handed over to us through generations by our *maharṣi*s, we would have fallen prey to the assertions of mainstream science's existing deceitful, fraud-ridden, unverifiable and state-funded model of the universe, the so-called heliocentric model. Let me elaborate pointwise:

1. There is no proof that the earth rotates on an "axis" daily and orbits the sun annually.
2. All the precise calculations for the space programme are based on a non-moving earth.
3. All of the precise calculations describing eclipses are based on a non-moving earth.
4. Indeed calculations, based on navigation, satellite movements, on anything which demands accuracy, are formulated on the basis of a stationary earth.
5. As per Marshall Hall, who wrote a book, *The Earth Is Not Moving*, which is published in USA, no experiment has shown the earth to be moving at thirty-two times rifle bullet speed

(RBS) in solar orbit and 250 times RBS around a galaxy. One would think such speeds would flap one's collar a little even if the "science" establishment says no!

Nowadays, this idea is picking up in the West. The logic against moving earth is overpouring. The learned listeners may take pains to go through Hall's book.

Our Itihāsas, Purāṇas and astronomical texts all said long ago about the geocentric model of the universe.

In *Rāmāyaṇa*, while telling the greatness of Hanumān to Rāma, Sage Agastya says:

asau punarvyākaraṇaṁ grahīṣyan sūryonmukha praṣṭumanāḥ kapīndraḥ ।
udyadrirerastagiriṁ jagāma granthaṁ mahāddhārayanaprameyaḥ ॥

— Uttara Kāṇḍa 36.45

Which tells us that Hanumān learnt *vyākaraṇa* and got his doubts cleared by sun god, moving along with him from east to west.

In *Mahābhārata*, priest Dhaumya narrates various facts about the universe to King Yudhiṣṭhira in Vanaparva:

enaṁtvaharaharmeruṁ sūryācandramasau dhruvam ।
pradakṣiṇamupāvṛtya kurutaḥ kurunandana ॥

O! son of Kurus! the sun and the moon, everyday, go round this Meru, coursing in an opposite direction.

jyotīṁṣicāpyaśeṣeṇa sarvānyanagha sarvataḥ ।
pariyānti mahārāja girirājaṁ pradakṣiṇam ॥

And O sinless one! O mighty monarch, the other luminaries also go round this king of mountains in the self-same way.

evameṣa caranpārtha kālacakramatandritaḥ ।
prakarṣan sarvabhūtāni savitā parivartate ॥

O Pārtha! Ranging thus, the sun unerringly turns on the wheel

of time, influencing the created things.

santatāgatiretasya naiṣa tiṣṭhati pāṇḍava ।
ādāyaiva tu bhūtānāṁ tejo visṛjate punaḥ ।।

His course is unceasing, he never rests, O Pāṇḍava! withdrawing the energy of all beings, he again renders it back.[1]

Now let us take a look at our Siddhānta books which reflect the greatness of our ancients.

From *Sūrya Siddhānta*:

paraṁ jyotistamaḥ pāre sūryoyaṁ saviteti ca ।
paryeti bhuvanānyeṣu bhāvayan bhūtabhāvanaḥ ।।

This Sun, likewise named Savitā, the supreme source of light upon the border of darkness — he revolves bringing beings into being, the creator of creatures.

rathe viśvamaye cakraṁ kṛtvā saṁvatsarātmakam ।
chandāṁsyaśvāstatra yuktvā paryaṭatyeṣa sarvadā ।।

Having made for his chariot, which is composed of the universe, a wheel consisting of the year, and having yoked the metres as his steeds, he revolves continually.

madhye samantādaṇḍasya bhūgolo vyomni tiṣṭhati ।
vibhrāṇaḥ paramāṁ śaktiṁ brahmaṇo dhāraṇātmikām ।।

Quite in the middle of the egg, the earth globe (*bhūgola*) stands in the ether, bearing the supreme might of Brahmā, which is of the nature of self-supporting force.[2]

From *Āryabhaṭīyam*:

vṛttabhapañjaramadhye kakṣyāpariveṣṭitaḥ khamadhyagataḥ ।
mṛjjalaśikhivāyumayo bhūgolaḥ sarvato vṛttaḥ ।।

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1 These English translations are taken from the book of Pratapacandra Roy, which was published by Oriental Publishing Co., Calcutta.

2 This translation of the verses is taken from the book of Ebenezer Burgess, *Sūrya-Siddhānta: A Text Book of Hindu Astronomy*.

> The globe of the earth stands (support less) in space at the centre of the circular frame of the asterisms (i.e. at the centre of the *bhūgola*) surrounded by the orbits (of the planets). It is made up of water, earth, fire and air and is spherical (circular on all sides).[3]

From *Pañcasiddhāntikā*:

> *pañcamahābhūtamayastārāgaṇapañjare mahīgolaḥ* ।
> *khe 'yaskāntāntastho loha havāvasthito vṛttaḥ* ।।

From *Mahāsphuṭa Siddhānta*:

> *śaśi saumya bhṛgu ravi kuja guru śani kakṣyāveṣṭito bhakṣyāntaḥ* ।
> *bhūgolaḥ satvānāṁ śubhāśubhaiḥ karmabhirupāttaḥ* ।।

The above verses also are in support of the geocentric and stationary universe.

Our ancients were well adept in the *vedha* of the planets, i.e. they used to find with utmost accuracy the true *sāyana* longitudes of the planets with the help of their own instruments which were explained in our Siddhānta books. Jagannātha was the last one as per the records who wrote a Siddhānta text with the necessary corrections in the mean positions of the planets with the help of *yantra*s like *bhitti-yantra, yantra-sārāṁśa, rāma-yantra* and *jayaprakāśa-yantra* along with the other regular *yantra*s of the earlier Siddhāntic texts. He also calculated the maximum declination of the ecliptic.

He says in his *Siddhānta Sārāṁśa*:

> *atra yantraiḥ paramakrānti niścayaḥ kṛta* 23° 28' ।

> The maximum declination of the ecliptic was found to be 23° 28'.

> *anyo'pi kaścidagre niścayaṁ kartumicchati cettenāpi yantraiḥ krāntyādināṁ niścayaḥ kāryaḥ* ।
> *yatosya kālāntareṇa vyavasthā bhinnā asti* ।।

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[3] This translation is of K.S. Shukla and K.V. Sarma, in their book, *Āryabhaṭīyam of Āryabhaṭa*, Published by Indian National Science Academy, New Delhi, 1976.

Anyone who wants to decide the declination, etc. of the planets, in future, has to observe through *yantras* and take into account the observations of one's time as they keep varying with time.

ye vedhe āyāti sa eva grahaḥ phaladāno ayanāṁśāḥ 19° 47' śake 1652 *vedhitagraheṣu śodhyāḥ* । *tadā te grahāḥ nirayanāvaśiṣyante*। *ayanāṁśānāṁ gatistu saptabhirvarṣaiḥ eko 'ṁśa niścitāsti*।

Which means only those planets, whose longitudes are corrected as per *vedha,* are effective in giving the desired results. *Ayanāṁśa* 19° 47' has to be deducted in the year CE 1730.

Ayanagati (rate of precession of equinoxes) is 1° per 70 years, i.e. 0° 0' 51.43". Even Bhāskarācārya in his *Siddhāntaśiromaṇi* says:

sāmpratikopalabdhyānusāriṇī kāpi gatiḥ aṅgīkartavyā

One has to accept the rate of precession of equinoxes of one's time.

Presently, it is 0° 0' 50.27", i.e. 1° per 72 years approximately. The *ayanāśūnya* year is 421 Śālivāhana Śaka, i.e. CE 499 as per our Indian astronomical texts. Therefore the present *ayanāṁśa* should be 21° 7', but not 24° 1' as is being calculated by Rāṣṭrīya Pañcāṅga which is against Indian astronomy. Rāṣṭrīya Pañcāṅga took the zero *ayanāṁśa* year as CE 285 which is against the view of our astronomers. Even Varāhamihira confirms in his texts that the *ayanāṁśa* was zero in his time and in the calculation of *krānti* of the planets, he takes CE 505 as zero *ayanāṁśa* year.

Finally, I conclude with these few words. The greatest superstition of today is the thinking that until the age of Galileo or Newton, man was ignorant. This fictitious belief has been systematically spun by a section of the Western thinkers and assiduously contrived by some of their Indian counterparts. Before Darwin, there was Kaṇāda in India, before Newton there was Bhāskara and before any other physicist or biologist worth his name came on the scene, there were sages like Parāśara and scientists like

Varāhamihira who were creative innovators and who recognized the simple but profound truth that man and the universe were not unrelated. The strivings of these sages are our heritage and they found the way by means of which we can unlock the doors of time.

Our ignorance, pride and prejudice come in the way of our appreciating the wisdom of our ancients while we have acquired a knack to nod our heads in approbation, if the same principles come out of the mouths of the so-called modern scientists. This unhealthy tendency should be put to an end.

14

Astronomical Knowledge of the Telugu Classical Poets

M. Prabhakara Rao

yad vāc vadanti avicetanāni rāṣṭrīdevānāṁ niṣāda mandrā ।
catasra ūrjaṁ duduhe payāṁsi kva svidasyāḥ paramaṁ jagām ॥
— *Ṛgveda* VIII.100.10

THE seer of this *mantra* is Nema, and the presiding deity of this *mantra* is Vāg Devī. The translation of H.H. Wilson, runs as follows:

> When Vāc, the queen, the gladdener of the gods, sits down (in the sacrifice) uttering things not to be understood as she milks the water and food for the four quarters (on the earth). Whither now is her best portion gone?

The greatest importance of *sarasvatī maṇḍala* or *vīṇā maṇḍala* in the Milky Way galaxy is that moon is rotating around the earth and the earth is rotating around the sun. The sun, in turn going in a high velocity of speed from south to north direction towards the star Abhijit (Vega) in *vīṇā maṇḍala*.

Actually *vīṇā maṇḍala* and *viṣṇu maṇḍala* are one and the same. This *vīṇā* or *sarasvatī maṇḍala* which is located in the centre of Milky Way galaxy is the celestial broadcasting station of radio waves for the entire universe. This secret has been conceived by the Vedic seer Nema in *Ṛgveda*.

Now, I will try to explain the Vedic *mantra*: *vāc vadanti avicetanāni*. *Vadanti* means "uttered". What was uttered? *vāc avicetanāni*. Sāyaṇa

in his commentary on *Ṛgveda* explains thus: *vāc avicetanāni = vijñāna rahitān, aprajñātānarthān, vadanti = prajñāpayanti*.

Hence, *avicetanāni* means *avijñātāni*. The exact translation of H.H. Wilson is "uttering things not to be understood". Monier-Williams in his dictionary states "unintelligible" for the word *vāc avicetanāni*.

Thus, we can arrive at a conclusion about the nature of *vāc* in the Milky Way (*vīṇā maṇḍala*).

Stage 1: *cetanā = caitanya*, intelligible (*jñāta*)

Stage 2: *vicetanā = caitanyarahita*, *ajñāta* (not known)

In *Atharvaveda* it is said *avicetanā* means "senseless, unconscious, dead".

The opposite meaning of *vicetanā* is *avicetanā*.

Stage 3: *avicetanā = caitanyātīta*, *avijñāta* (unintelligible) (utterance not to be understood).

That which is *caitanyātīta* (over and above the conscious) *varṇanātīta* (inexplicable utterance) is the *vagatīta* (= supramundane *vāc*).

Hence, we may arrive at a conclusion that *avicetanā vāc* is entirely different from *cetanā vāc* (i.e. *vaikharī*), so, *avicetanā vāc* is none other than *parā vāc*.

We may safely corroborate this concept with *sahasrāra padma* in the human mind of a *kuṇḍalinī yogī*. *Sarasvatī maṇḍala* is none other than *sahasrāra padma* in the *kuṇḍalinī yoga*. The hissing sound of *kuṇḍalinī* serpent is corroborated with *avicetanā vāc* in *vīṇā maṇḍala.*

That is why, in *Lalitāsahasranāma* it is said:

gambhīrā gaganāntastha-gandharvā gānalolupā-sāmagana
priyā saumyā-gurumaṇḍala rūpiṇī ।

This entire verse points out to *vīṇā maṇḍala,* situated in the Milky Way galaxy, which sends radio waves to the entire universe.

In Latin language *vīṇā* is called *lyra*, and in English language it is "lyre". Below this *vīṇā maṇḍala* there is a scene which is totally covered by snow. Western scientists called it as Ring Nebula. Indian seers called it *padma* (i.e. lotus flower).

The great poet Śrīnātha in his *prabandha Śṛṅgāra Naiṣadha* (1.100) called it as:

poḍavu migilina pondammi pūvu ।

A lotus flower with its elongated twig.

From this lotus flower scene one star emerged. It doubled into two stars and that two became four stars. These four stars are called Caturmukha Brahmā, God Brahmā with his four faces. He is sitting on the lotus flower. Brahmā performed a great penance and created Vāc, called Sarasvatī. This Vāc, at the earliest stage, is called Parā Vāc (supramundane Vāc) which was unintelligible. This Vāc is described in *Ṛgveda* as *vāc avicetanāni.*

Hence, Vāg Devī is called as:

mano vācāmagocarā

By mind or speech, it is a hard nut to crack.

antarmukha samārādhya bahirmukha sudurlabhā

By internal penance only we may conceive the presence and not by outward worship.

yato vāco nivartante aprāpyamanasā saha
— *Taittirīyopaniṣad*

Our human utterance through vocal cavity (i.e. *vaikharī vāc*) will turn back to us, because mind's capacity is very low to go to that unreachable heights of truth.

The main reason for this unintelligible utterance is that in the celestial space *vāc* is *avyākṛta* (unsystematic). Moreover the *vāc* in the *parama vyoma* is *sahasrākṣarā* says *Ṛgveda*:

gaurīrmimāya salilāni takṣat ekapadī dvipadī sā catuṣpadi ।
aṣṭapadī navapadī bebhūvuṣī sahasrākṣarā parame vyoman ॥
— I.164.11

The *sahasrākṣarā parama vāc*: This thousand-syllabled speech is called Sarasvatī and she is in the form of *salila* (primordial waters before creation) in the form of a stream.

ambitame nadītame devītame sarasvatī

She flows from *brahma saras* in the form of a stream. *Brahmasaras* in modern psychology is collective unconsciousness. From this collective unconscious state of mind the stream Sarasvatī flows. To that goddess all the poets pray for divine celestial inspiration to produce best poetry in this mundane world.

In the classical Telugu literature the first and foremost poet Nannayabhaṭṭa (CE 990–1055) described *rājahaṁsa* (Cygnus) on a full-moon day in the August (Śarad *ṛtu*).

bhū satikin divam bunaku bolpasagaṅga śaratsamāgamaṁ
pā sakala pramodakaramai vilasille maharṣi maṇḍalo
pāsita rājahaṁsa gati bhāti prasanna sarasvatīkam
bhyasana śobhitaṁbagucu nabjajuyānamuto samānamai

First of all he praised *dyāvāpṛthivī dāmpatya* as said in *Taittirīyopaniṣad*. *Rājahaṁsa* is nothing but *haṁsa* in the Veda.

bībhatsūnām sayujam haṁsa
muhurapām divyānām sakhye carantam
— *Ṛgveda*

In the previous *mantra, takṣat* means disturbance in the primordial waters. This disturbance is controlled to steadiness by *haṁsa*, i.e. the *avyākṛta* state of syllables is brought into *vyākṛta* state. (Hence, *haṁsa* is called as *nīra-kṣīra viveka*). Thus, Sarasvatī will become Prasanna Sarasvatī.

haṁsa = hag - msa

hag-msaḥ śuciṣad vasurantarikṣa sat

— *Ṛgveda*

Near the Jyeṣṭha and Śrāvaṇa stars, the Milky Way is situated. This is the Kṣīrasāgara, according to Vedic seers. Lord Viṣṇu on thousand-hood serpent reclaims on the Kṣīrasāgara. Viṣṇu is called as Harikuleśa (Hercules). Hence, among northern direction of stars this Hercules can be seen. This is the *paramapada* or Lord Viṣṇu.

tadviṣṇoḥ paramapadam sadā paśyanti sūrayaḥ

Two Sanskrit Incriptional Evidences Describing the Milky Way

We come across two inscriptions made. During the reign of Āravīḍu dynasty of Vijayanagara.

1. Virūpākṣa copper-plate inscription, CE 1576
2. Śrīrāma copper-plate inscription, CE 1644

These two inscriptions describe the Kṣīrasāgara (Milky Way) in the celestial space.

jayati kṣīra jaladherjātam savyekṣaṇam hareḥ ।
alaṁbanam cakorāṇām amarāyuṣkarammaḥ ॥
— *śloka* 5

The moonlight is described like thus. The moon is born from the Milky Way (Kṣīrasāgara) and it is the left eye of Lord Viṣṇu. And it is the supporting pillar of *cakora* birds, and the angel's life is prolonged by the full-moon light.

yasyāti prauḍhatejassavitara vimatadhvānta bhedinyudīte
kṣīrārnantaspuṭatara vikasatpuṇḍarīkopamasya ।
śvetachatrasya madhye kanaka lasikā bhāsate karṇikābhā
tasyopānte marāḷadvyamiva vicalita ccāmara dvandvamāste ॥
— *śloka* 23

King Tirumalarāya's valour is like the sun. Like the sun which dispels darkness, he conquered his enemies. At that juncture in the Milky Way white lotus *śveta padma* blossomed and that lotus looked like a white umbrella (*śveta chatra*) in the middle of which golden

spot shined like a *karṇika* of the white lotus flower". Very near to this white umbrella there is a pair of swans which looks like a pair of fans (white *cāmara*s) in the Milky Way.

Kālidāsa in his *Raghuvaṁśa* says that a king's royal attire depends on three things. 1. *śaśiprabhā* (moon decked plexy), 2. *śveta chatra* (white umbrella), and 3. two *cāmara*s (two fans prepared with the tail of *cāmarī mṛga*). All these three things are described in the above verse.

Allasāni Peddan Who Described God Brahmā

Andhra Kavitā Pitāmaha Allasāni Peddan, the first court-poet of Kṛṣṇadevarāya, true to his title described Brahmā in his introduction to *Manucaritra*.

> *nālugu momulan nigamanādamuluppatilan bracaṇḍa* ।
> *vātūla hatin janiñcu rodatoḍi guhāvali . . .* ॥

In these two lines *roda* (hissing sounds), *guha* (unintelligible and un-understandable) is our question in this context.

From the four faces of Brahmā the Vedic chants are uttered but because of the large gust of air surrounding Brahmā the sounds are becoming unintelligible and difficult to understand.

Sculptural Evidence

In the Mukhaliṅgam Temple there is a beautiful sculpture of Sarasvatī, which is described as follows:

> The remarkable carving of Goddess Sarasvatī playing the *vīṇā* is done on one of the 895 pillars decorating the Sarasvatī Maṇḍapa of Madurā (Tamil Nadu). It is a great sculpture in the Nāyaka style belonging to fifteenth century. —*Bharati*, February 1926

Likewise in the interior ceiling of the *mukhamaṇḍapa* of the Mahānandī Temple, a beautiful sculpture of Sarasvati can be seen (*Bharati* 1947).

King Bhoja of Dhārānagara who worshipped Vāg Devī can

be seen now in the British Museum, London. And Viśveśvara Kavicandra, a rhetorician, who wrote *Camatkāra Candrikā,* started his work eulogizing Vāg Devī who is none other than Vedic Sarasvatī.

Correlating with a Modern Painting

Beyond the boundaries of death there is heard an euphonic sound of music. That all-pervading universal music is heard by the painter. And he tried to depict that experience in a painting. This music bears the existence of this universe which is sacred and celestial. This universal rhythmic sound is called *chanda* or *spanda*. In Vedic times it was called *ṛtam*, the modern rhythm. The word *ṛta* which is an everlasting *dharma,* which bears this entire universe.

Chirico made a modern painting. In it a human skeleton is depicted and that skeleton is holding a lyre (*vīṇā*) in its hands. The universal *dharma* is represented in the form of skeleton. A critic says:

> The artist is haunted by the unheard sounds of Apollo's lyre, the music that has called him.

Correlation with English Literature

The oldest name for lyre is shell. In the Greek mythology the goddess of speech is called Apollo. In the early stages, the shell of a tortoise was used for preparing a lyre. Hence, shell is the oldest name for lyre. Jubal first prepared a lyre with the tortoise's shell. It was a primitive lyre.

John Dryden and Thomas Gray recalled to their memories the oldest lyre called the shell.

John Dryden (CE 1631–1700) in his elegy called "*St. Cecilia*" says:

What passion cannot music raise and quell
when Jubal struck the chorded shell
His listening brethren stood around
and, wondering on their faces fell

to worship that celestial sound
Less than a god they thought there could not dwell
within the hollow of that shell
that spoke so sweetly and so well
what passion cannot music raise and quell.

John Dryden also wrote a poem called "Alexander's Feast" in which he invoked the goddess of muse.

Thomas Gray (CE 1716-71) also in his poem "Progress of Poesy" says:

Awake, Aeolian lyre, awake
And give to rapture all thy trembling strings
From Helicon's harmonious springs (lines 1-3). . .
... ...
O sovereign of the willing soul
parent of sweet and solemn breathing airs
enchanting shell! The seven cares (lines 13-15)

Greek Philosophers and Their Contributions

Ptolemy, in the year CE 137 prepared *Almagest*, which is called Ptolemy's *Great Catalogue*. This work is a revised and enlarged version of a catalogue prepared by Hipparchus in CE 140. In addition to this Aratus who hails from Soli, wrote a book called *Phenomena* in the year 280 BCE. This work describes in detail about all the galaxies in the universe.

For this work, Eudoxus's astronomical work written in 370 BCE is the basis.

What is a star? A self-luminous gaseous body is called a star. *Taittirīya Brāhmaṇa* (1.5, 2.5) say:

salilam vā idamantarasit yadantaram
tattarakanam tarakatvam ।

From the primordial waters (*salila*) when creation was started, at that stage some water bubbles with gas (*vāyu*) inside became stars.

According to modern astronomy, Albert Einstein says "Each star is a sun". In Indology also *koṭisūrya samaprabha*, *udyat bhānu sahasrabhā* all these dictums confirm that there are crores and crores of suns and ultimately each star is a sun.

Aratus in his book *Phenomena* described the Milky Way thus:

Broad and ample road whose dust is gold
And permanent stars as stars to thee appear
Seen in the galaxy, that Milky Way
Which nightly on a circling zone thou seest
powdered with stars

Edwin Hubble pointed out in 1925 that his 100-inch telescope of the Wilson Observatory had located what are called stellar universes in the form of spiral Nebulae. Our Milky Way is one of such spiral Nebulae and it is estimated that it consists of about ten thousand crores of suns among which our sun is a humble yellow dwarf! There are gaints and super-gaints too among these suns. It is reported that a super-gaint star could accommodate millions of stars like our sun. Remember that the diameter of our sun is reported to be 8,64,000 miles, now imagine the dimension of a super-gaint star.

Again it is estimated that the universe consists of nearly ten thousand crores of galaxies. This means that the universe consists of ten thousand crores multiplied by ten thousand crores of suns and as such is termed as metagalaxy. Also, light travelling at the speed of three lakh kilometres per second and it is reported; takes billions of years to reach us from the distantest galaxy. What a wonderful universe we have stumbled into!

Ptolemy who hailed from Alexandria completely explained about the Milky Way. Aratus in his *Phenomena* described *vīṇā maṇḍala* as follows:

There is the shell but small, and this whilst yet
Encradled, Hermes pierced and called it Lyre
Fronting the unknown form (i.e. the kneeler) he set it down
When brought to Heaven.

With bear eye an astronomer C. Easton surveyed the total Milky Way and has drawn a big diagram. *La Voie Loctec Dans L' Hemisphere Borcal* in his boot. In the Milky Way galaxy Cygnus (*haṁsa*) was drawn. Before him Hermann Kleen, Julius Schmidt, Heyes, Gould Trovelout and Bodeckker tried their level best to explain the secrets of Milky Way.

Aratus in his *Phenomena* described the Cygnus (*haṁsa*) as follows:

> *There is in front another arrow cast*
> *without a bow, and by it flies the bird*
> *nearer the north and nigh a second sails*
> *Lesser in size but dangerous to come*
> *from ocean when right flie the Eagle named.*

Modern Researchers

KARL GUTHE JOHNSKY: WHO FIRST DISCOVERED RADIO WAVES

In the twentieth century serious and a series of researches on the Milky Way led to the discovery of radio waves emerging from the galaxy. As a consequence radio astronomy, a new branch of knowledge has been emerged.

Karl Guthe Johnsky (1916-50), an young scientist of 19 years, working at Holmdell (New Jersey-America) joined in the Bell Telephone Research Centre as a technical expert. He became the father of radio astronomy.

Johnsky wrote three research papers on the "cosmic hiss" emanating continuously from the centre of the Milky Way.

1. A Steady Week Hiss of Unknown Origin.
2. Electrical Disturbances Apparently of Extra-terrestrial Origin.
3. A Note on the Source of Interstellar Interference.

All these three papers were published in the *Proceedings of the Institute of Radio Engineers*, in 1932, 1933 and 1935.

First of all he thought that continuous sound from the Milky

Way is due to aerial disturbances, next he opined as sun, and later to that of stars. Finally he came to a conclusion that interstellar interference is the cause for the continuous sound.

On the researches of Johnsky, *New York Times* (5 May 1933) published a news with a caption, "The New Radio Waves Traced to the Centre of Milky Way" on the front page.

A commentator working in the American Radio Program announced like this: "I want you to hear for yourself this radio hiss from the depths of universe". People listened to it for ten minutes. A newspaper reporter described the "hiss" like this: "It sounded like steam escaping from a radiator".

Unfortunately Johnsky died in 1950 at the age of 44. His contribution towards the radio astronomy is always remembered. To put it in a nutshell:

> Close to the centre of the Milky Way, in Sagittarius (Dhanuṣ), it was from here that Karl Johnsky first heard radio noise from the stars. The circling planets singing on their way is very curious to listen.

HARLOW SHAPLEY: THE MAPPER OF THE MILKY WAY

Harlow Shapley, a professor in the Harvard University, exactly located the spot from which the cosmic hiss is coming out. It is from the constellation of lyra (*vīṇā maṇḍala*), that is very near to the star Vega (Abhijit). This sound is emerging continuously without any interruption.

His discoveries about the Milky Way are as follows:

1. Our sun is also one of the stars in the Milky Way.
2. He discovered a new star Cepheid, with which he subsequently discovered globular clusters around the Milky Way. The arrangement of clusters gave him a clue to scale the distance between the Milky Way galaxy and its centre point from which the sound is emerging.

Hence, Shapley is described as the mapper of the Milky Way. As a Director of the Harvard Observatory he with his associate Adelaide Ames both prepared a book entitled *Shapley–Ames Catalogue of Bright Galaxies*, which is an authoritative book on the Milky Way.

RAYAPROLU SUBBARAO

A pioneer among the modern Telugu poetry along with Gurajāḍa Apparao, Rayaprolu Subbarao (1892–1980) compared Telugu language and literature with the Milky Way amidst other Indian languages.

sobagu leyayu tārakala rāsulaku naḍuma
darśanīyamau kṣīra pathambu pagiḍi
deśa bhāṣā pravāha vidhikalalona
tenugupāya rañjilu tene toṇukulāḍa
— *Āndhrāvali*

VIŚVANĀTHA SATYANĀRĀYAṆA AND HIS ASTRONOMICAL KNOWLEDGE

A stalwart among modern Telugu poets who wrote more than 100 creative works to his credit, Kavisamrāṭ Viśvanātha Satyanārāyaṇa's (1895–1976) first poem "Āndhra Pauruṣamu" (1916) starts with the invocation of Sarasvati, who is residing in the Milky Way and playing the *vīṇā* continuously without any interruption.

śrī padmākaracāmarānila hṛta svedāma buvoumena di
vyāpāngammula nīvu lokamula brovan vīṇā vayiñcu co

nīpārāma nirantara dhvanita tantrīnāda santāna
mamma palkiñcagadamma! vīśva jagadambā! rājarājeśvarī!

This invocation relates to Vaijñānika Sarasvatī or Vaidika Sarasvatī. Why the Goddess Sarasvatī playing the *vīṇā* continuously? Viśvanātha answers that to protect and safeguard this mundane world from the confusion and chaos. Speech is the pivot of the human life. Without speech no human being survive happily. Clear utterance of one's idea in speech clears the confusion between the

mutual friendship among the people. Hence speech is the divine gift for human beings.

The third line in the above poem is most important in the context which reveals the astronomical knowledge of the poet:

nīpārama nirantara dhvanita tantrīnāda santāna

Nīpā is a Sanskrit word which means a *kadamba* tree. This is also a Sanskrit word. In Telugu it is called *kaḍimi ceṭṭu*. The *upāpaka*s of Śakti or Devī cult worship Goddess Durgā/Lalitā, etc., who is sitting under the shade of a *kadamba* tree. Hence, Goddess Durgā/Lalitā is called as Kadamba Vanavāsinī, Kadamba Kusumapriyā, Kadamba Mañjarī, Klapta Karṇapūra Manoharā (*Lalitā Sahasranāma*).

The flowers of *kadamba* tree are very small one like the twinkling stars in the sky. Hence, the poet compared the fully blossomed *kadamba* tree with the constellation of stars in the Milky Way.

And the goddess is playing *vīṇā* continuously. This continuous performance without any interruption is described by the poet like this.

nirantara dhvanita tantrīnāda santānamu

which means,

nirantara	=	continuous
dhvanita	=	sounding or resounding
tantrīnāda	=	stringed euphonic sound
santānamu	=	flow of musical notes

How the goddess looks is described by the poet as follows:

Divya apāṅga: By her divine compassionate, merciful looks, she is playing *vīṇā* (lyre), with a aim to protect the entire universe.

Viśva Jagadambā: *Viśva* means universe. Jagadambā means *jagat* + *ambā*. What is *jagat*? This mundane world is called *jagat*. The etymology of *jagat* is *gacchatiti jagat*. That which goes on without a halt is called *jagat*. It is a continuous stream of human beings coming and going. When the Goddess Sarasvatī playing the *vīṇā* (lyre), it

means she is invoking the universal rhythm and *dharma* on which this mundane world (*jagat*) stands and survives.

Ambā means mother. Veda called goddess Sarasvatī as Ambā and Devī. For the survival of our day-to-day life for ever, she is playing the divine *vīṇā* called *kacchapī*. The name of the *vīṇā* of Sarasvatī is called *kacchapī*. The *vīṇā* is compared with the six *cakra*s of *kuṇḍalinī yoga*. The seventh one *sahasrāra* is fixed, which is in the form of thousand-petalled lotus flower with upside down in the human brain.

Hence, we may arrive at a conclusion that Kavisamrāṭ Viśvanātha, exactly knows the secret of celestial sound of *vīṇā maṇḍala* which is continuously flowing to activate this entire universe from the deep slumber. That is why Thomas Gray invoked this divine muse like this:

Awake, Aeolian lyre, awake

In the same way Kavisamrāṭ Viśvanātha also says: *palkiñcagadamma*! — O Goddess Sarasvatī! give me this divine and sacred utterance in my poetry to uplift this mundane world with a great message.

Conclusion

"The universe is a restless place: stars nebulae, galaxies and all the vast gravitational system of outer space are incessantly in motion", says Albert Einstein (*The Universe and Dr. Einstein*).

The gods are always immersed in good activities. Those incessant activities are represented in the Milky Way in the form of a continuous cosmic music which has been developed into several languages in the world for communication through which we humanity achieved prosperity and welfare.

15

Āryabhaṭa on Truths of Astronomy

P. Chinnaiah

Āryabhaṭa (CE 476–550) is one of the greatest astronomers the world has ever produced. He was born in Pāṭaliputra in Magadha, modern Patna in Bihar. Many are of the view that he was born in the south of India, in Kerala and lived in Magadha at the time of the Gupta rulers. However, there exists no documentation to ascertain his exact birthplace. There is no evidence that he was born outside Pāṭaliputra and travelled to Magadha, the centre of instruction, culture and knowledge for his studies where he even set up a coaching institute. However, early Buddhist texts describe Aśmaka as being further south, in Dakṣiṇāpatha or the Deccan, while other texts describe the Aśmakas as having fought Alexander.

But there is no doubt that he lived in Pāṭaliputra where he wrote his famous treatise the *Āryabhaṭa Siddhānta* but more famously *Āryabhaṭīya,* the only work to have survived. Evidences justify that in Taregana Bihar, Āryabhaṭa set up an Astronomical Observatory in the Sun Temple in sixth century. It is believed that here he proposed the Heliocentric Model, and suggested for the first time in history that earth revolves around the Sun. Āryabhaṭa is the father of scientific astronomy and mathematics of the Hindus. He wrote his *Kāla-Kriyā* (calculation of time) here at the age of 23, i.e. CE 499.

It is fairly certain that, at some point, he went to Kusumapura for advanced studies and that he lived there for some time. Both Hindu and Buddhist traditions, as well as Bhāskara I (CE 629),

identify Kusumapura as Pāṭaliputra, modern Patna. A verse mentions that Āryabhaṭa was the head of an institution (*kulapati*) at Kusumapura, and, because the University of Nalanda was in Pāṭaliputra at the time and had an astronomical observatory, it is speculated that Āryabhaṭa might have been the head of the Nalanda University as well. *Āryabhaṭīya* presented a number of innovations in mathematics and astronomy in verse form, which were influential for many centuries. The extreme brevity of the text was elaborated in commentaries by his disciple Bhāskara I (*Bhāṣya*, *c.* CE 600) and by Nīlakaṇṭha Somayāji in his *Āryabhaṭīya Bhaṣya* (CE 1465).

Āryabhaṭa knew that the earth spins on its axis, the earth moves round the sun and the moon rotates round the earth. He talks about the position of the planets in relation to its movement around the sun. He refers to the light of the planets and the moon as reflection from the sun. Āryabhaṭa gives the radius of the planetary orbits in terms of the radius of sun orbit as essentially their periods of rotation around the sun. He believes that the moon and planets shine by reflected sunlight: incredibly he believes that the orbits of the planets are eclipses. He correctly explains the causes of eclipses of the sun and the moon. The Indian belief up to that time was that eclipses were caused by a demon called Rāhu.

Bhāskara I who wrote a commentary on *Āryabhaṭīya* about 100 years later wrote of Āryabhaṭa:

> Āryabhaṭa is the master who, after reaching the furthest shores and plumbing the inmost depths of the sea of ultimate knowledge of mathematics, kinematics and spherics, handed over the three sciences to the learned world.

Āryabhaṭa mentions in *Āryabhaṭīya* that it was composed 3,630 years into the Kali-yuga, when he was 23 years old. This corresponds to CE 499 and implies that he was born in CE 476.

Āryabhaṭa is the author of several treatises on mathematics and astronomy, some of which are lost. His major work, *Āryabhaṭīya,* a compendium of mathematics and astronomy, was extensively

referred to in the Indian mathematical literature and has survived to modern times. *Ārya Siddhānta*, a serious work on astronomical computations, is known through the writings of Āryabhaṭa's contemporary, Varāhamihira, and later mathematicians and commentators, including Brahmagupta and Bhāskara I. This work appears to be based on the older *Sūrya Siddhānta* and uses the midnight-day reckoning, as opposed to sunrise in *Āryabhaṭīya.* It also contained a description of several astronomical instruments: the gnomon (*śaṅku-yantra*), a shadow instrument (*chāyā-yantra*) possibly angle-measuring devices, semicircular and circular (*dhanur-yantra*/ *cakra-yantra*), a cylindrical stick *yaṣṭi-yantra*, an umbrella-shaped device called the *chatra-yantra*, and water clocks of at least two types, bow-shaped and cylindrical. A third text, which may have survived in the Arabic translation, is *Al-natf* or *Al-nanf*. It claims that it is a translation by Āryabhaṭa, but the Sanskrit name of this work is not known. Probably dating from the ninth century, it is mentioned by the Persian scholar and chronicler of India, Abu Rayhan al-Biruni.

Direct details of Āryabhaṭa's work are known only from the *Āryabhaṭīya*. The name *Āryabhaṭīya* is due to later commentators. Āryabhaṭa himself may not have given it a name. His disciple Bhāskara I calls it *Aśmaka Tantra* (or the treatise from Aśmaka). It is also occasionally referred to as *Ārya-śataṣṭā* (literally, Āryabhaṭa's 108), because there are 108 verses in the text. It is written in the very terse style typical of Sūtra literature, in which each line is an aid to memory for a complex system. Thus, the explication of meaning is due to commentators. The text consists of the 108 verses and thirteen introductory verses, and is divided into four *pāda*s (chapters):

1. *Gītikāpāda* (13 verses): Large units of time — *kalpa*, *manvantara* and *yuga* — which present a cosmology different from earlier texts such as Lagadha's *Vedāṅga Jyotiṣa* (*c.* first century BCE). There is also a table of sines (*jyā*), given in a single verse. The duration of the planetary revolutions during a *mahāyuga* is

given as 4.32 million years.

2. *Gaṇitapāda* (33 verses): Covering mensuration *kṣetra vyavahāra*, arithmetic and geometric progressions, gnomon/ shadows *śaṅku-chāyā*, simple, quadratic, simultaneous and indeterminate equations.
3. *Kālakriyāpāda* (25 verses): Different units of time and a method for determining the positions of planets for a given day, calculations concerning the intercalary month *adhikamāsa, kṣaya tithi*s and a seven-day week with names for the days of week.
4. *Golapāda* (50 verses): Geometric/trigonometric aspects of the celestial sphere, features of the ecliptic, celestial equator, node, shape of the earth, cause of day and night, rising of zodiacal signs on horizon, etc. In addition, some versions cite a few colophons added at the end, extolling the virtues of the work, etc.

Āryabhaṭa's system of astronomy was called the *audāyaka* system, in which days are reckoned from *udaya*, dawn at Laṅkā or "equator". Some of his later writings on astronomy, which apparently proposed a second model (or *ardha-rātrikā*, midnight) are lost but can be partly reconstructed from the discussion in Brahmagupta's *Khaṇḍakhādyaka*. In some texts, he seems to ascribe the apparent motions of the heavens to the earth's rotation. He may have believed that the planet's orbits as elliptical rather than circular.

Āryabhaṭa correctly insisted that the earth rotates about its axis daily, and that the apparent movement of the stars is a relative motion caused by the rotation of the earth, contrary to the then-prevailing view in other parts of the world, that the sky rotated. This is indicated in the first chapter of *Āryabhaṭīya,* where he gives the number of rotations of the earth in a *yuga*, and made more explicit in the Golādhyāya chapter:

> In the same way that someone in a boat going forward sees an unmoving (object) going backward, so (someone) on the equator sees the unmoving stars going uniformly westward. The cause of rising and setting (is that) the sphere of the stars together with the planets (apparently) turns due west at the equator, constantly pushed by the cosmic wind.

Āryabhaṭa described the motions of the planets are each governed by two epicycles, a smaller *manda* (slow) and a large *śīghra* (fast). The order of the planets in terms of distance from earth is taken as: Moon, Mercury, Venus, Sun, Mars, Jupiter, Saturn and the asterisms.

The positions and periods of the planets were calculated relative to uniformly moving points. In the case of Mercury and Venus, they move around the earth at the same mean speed as the sun. In the case of Mars, Jupiter and Saturn they move around the earth at specific speeds, representing each planet's motion through the zodiac. Most historians of astronomy consider that this two-epicycle model reflects elements of pre-Ptolemaic Greek astronomy. Another element in Āryabhaṭa's model, *śīghrocca*, the basic planetary period in relation to the sun, is seen by some historians as a sign of an underlying heliocentric model.

Solar and lunar eclipses were scientifically explained by Āryabhaṭa. Āryabhaṭa states that the moon and planets shine by reflected sunlight. Instead of the prevailing cosmogony in which eclipses were caused by pseudo-planetary nodes Rāhu and Ketu, he explains eclipses in terms of shadows cast by and falling on earth. Thus the lunar eclipse occurs when the moon enters into the earth's shadow (verse *gola* 37). He discusses at length the size and extent of the earth's shadow (verses *gola* 38-48) and then provides the computation and the size of the eclipsed part during an eclipse. Later Indian astronomers improved on the calculations, but Āryabhaṭa's methods provided the core. His computational paradigm was so accurate that eighteenth-century scientist Guillaume Le Gentil, during a visit to Pondicherry, India, found the Indian computations of the duration of the lunar eclipse of

30 August 1765 to be short by 41 seconds, whereas his charts (by Tobias Mayer, 1752) were long by 68 seconds.

Considered in modern English units of time, Āryabhaṭa calculated the sidereal rotation (the rotation of the earth referencing the fixed stars) as 23 hours, 56 minutes and 4.1 seconds; the modern value is 23:56:4:091. Similarly, his value for the length of the sidereal year at 365 days, 6 hours, 12 minutes and 30 seconds (365.25858 days) is an error of 3 minutes and 20 seconds over the length of a year (365.25636 days).

As mentioned, Āryabhaṭa advocated an astronomical model in which the earth turns on its own axis. His model also gave corrections (the *śīghra* anomaly) for the speeds of the planets in the sky in terms of the mean speed of the sun. Thus it has been suggested that Āryabhaṭa's calculations were based on an underlying heliocentric model, in which the planets orbit the sun, though this has been rebutted. Āryabhaṭa's work was of great influence in the Indian astronomical tradition and influenced several neighbouring cultures through translations. The Arabic translation during the Islamic Golden Age (*c.* CE 820) was particularly influenced. Some of his results are cited by Al-Khwarizmi and in the tenth century Al-Biruni stated that Āryabhaṭa's followers believed that the earth rotated on its axis.

Āryabhaṭa's astronomical calculation methods were also very influential. Along with the trigonometric tables, they came to be widely used in the Islamic world and used to compute many Arabic astronomical tables (*zijes*). In particular, the astronomical tables in the work of the Arabic Spainish scientist Al-Zarqali (eleventh century) were translated into Latin as the Tables of Toledo (twelfth century) and remained the most accurate ephemeris used in Europe for centuries.

Calendric calculations devised by Āryabhaṭa and his followers have been in continuous use in India for the practical purposes of fixing the *pañcāṅga* (the Hindu calendar). In the Islamic world,

they formed the basis of the Jalālī calendar introduced in CE 1073 by a group of astronomers including Omar Khayyām, versions of which (modified in 1925) are the national calendars in use in Iran and Afghanistan today. The dates of the Jalālī calendar are based on actual solar transit, as in Āryabhaṭa and earlier *Siddhānta* calendars. This type of calendar requires an ephemeris for calculating dates. Although dates were difficult to compute, seasonal errors were less in the Jalālī calendar than in the Gregorian calendar.

India's first satellite Āryabhaṭa and the lunar crater Āryabhaṭa are named in his honour. An institute for conducting research in astronomy, astrophysics and atmospheric sciences is the Aryabhata Research Institute of Observational Sciences (ARIOS) near Nainital, India. The inter-school Aryabhata Maths Competition is also named after him, as is Bacillus Aryabhata, a species of bacteria discovered by ISRO scientists in 2009.

16

Dāna During Eclipses
An Epigraphical Approach

T. Surendra Reddy

References to eclipse go back to the Ṛgvedic period. In *Ṛgveda,* Svarbhānu (later became a synonymn for Rāhu) is found and he is considered as a demon and is said to envelop the sun with darkness. The term Rāhu is found for the first time in *Atharvaveda. Chāndogya Upaniṣad* also refers to the idea of Rāhu devouring the moon during the eclipse.[1] Various religious practices are associated with the eclipses, be it solar or lunar. Some of the practices followed during eclipses are bathing, fasting, putting *darbha* grass on prepared food, offered oblations to the manes, prayers and *japa.* Wearing band (*paṭṭā*) on the forehead and offering it to brāhmaṇas afterwards is prescribed for one in whose natal star the eclipse occurs. Besides, there are certain activities forbidden during eclipse like indulging in sex (*maithuna*), studying or recitation of Vedas.[2]

All Dharmaśāstra texts prescribe performance of *śrāddha* at the time of eclipse. They also assert that one should do *dāna* at *rāhu darśana. Dāna* done at the time of eclipse is considered as highly meritorious. That is why we find a number of epigraphical references to *dāna*s made on the occasion of eclipses. The present paper is aimed at the study of this aspect based on the inscriptions of the Vijayanagara period as a case study. The period of study is

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[1] Jayasri Hariharan, 1995, *Eclipses in Hindu Life and Thought,* Madras, p. 1.

[2] Ibid., p. 54.

from fifteenth to the seventeenth centuries. It is interesting to note that the number of occasions of solar eclipse is comparatively less, compared to lunar eclipses.

An inscription of Devarāya I records the grant of land to the Goddess Talakaṇṭi Devī on the occasion of lunar eclipse by the king. This inscription is dated Śaka 1328 *vyaya*, Mārgaśīrṣa Śukla 15 (25 November 1406).[3] The donation was intended for providing *amṛtapadi* (sacred food offering) and *aṅga-raṅga vaibhava*s to the deity.

An inscription of Kṛṣṇadevarāya, dated Śaka 1440 *bahudhānya vikśākha paurṇamī* (25 April 1518) states that the well-known Telugu poet Alsāni Peddana gifted some land to the God Sakaleśvaradeva of the village Kokaṭa[4] on the occasion of lunar eclipse. It is stated that he made the grant in presence of the God Mallikārjuna of Bejawāḍ on the banks of the River Kṛṣṇa. Obviously he had holy bath in the river at the time of eclipse. Here it may be noted that the Dharmaśāstras state that taking bath, particularly in holy rivers at the time of eclipse, is highly meritorious. The grant was made for maintaining a perpetual lamp (*nanda-dīpa*) in the temple.

An inscription from Raydurg (Anantapur district) dated Śaka 1478 Nala, Kārttika *amāvasyā* (2 November 1556) records a grant of village called Bāgināynipalli along with the *aṣṭa-bhoga-teja-svāmya* to the God Mādhaveśvara on the occasion of solar eclipse by a local chief.[5] The grant was intended for maintaining all services like daily food offering, festivities of every *daśamī* day, *māsotsava*s, *rathotsava*s, etc. Further, the grant was made for the religious merit (*puṇyaṁ gānu*) of the donor's overlord.

One of the inscriptions from the renowed Vaiṣṇava *kṣetra* Śrīperuṁbudūr (Tamil Nadu) records the gift of income derived from certain taxes to the God Ādikeśava Perumāḷ on the occasion

[3] *South Indian Inscriptions,* vol. XIV, no. 21.

[4] Ibid., no. 65.

[5] Ibid., no. 218.

of solar eclipse which took place in Śaka 1494, Āṅgīrasa, Āṣāḍha *amāvasyā* (9 July 1572).[6] Obviously the tax income was in the form of money. The grant was made for the conduct of worship of the God Tiruvārādhana.

An inscription from Amīnābād (Guntur district) records the gift of half of the village Mullaṅguru for worship of offering to the Goddess Durgā-Parameśvarī Mullaṅguru-Śakti on the occasion of lunar eclipse which occurred on the *pūrṇimā* day of the Jyeṣṭha month, cyclic year being *bhāva* in Śaka 1496 (4 June 1574).[7]

An inscription from Madhurāpura (Anantapur district) records the restoration of incomes in cash and grain from certain lands in Devarapaḷḷi by one Chinnappa in favour of the God Chennakeśava-Alagh-Perumāḷ of that village on the occasion of solar eclipse, which occurred on the *amāvasyā* day of Āṣāḍha in cyclic year of *vikṛti* in Śaka 1512 (21 July 1590).[8] The grant was made for the religious merit of the donor's overlord.

Another inscription from Anumpalli (Anantapur district) records the grant of land to the God Yāgaṇṭīśvara on the occasion of solar eclipse. The inscription is dated Śaka 1548 (current), *krodhan*, Phālguna, *amāvasyā* (17 March 1626). However, the solar eclipse mentioned in the inscription occurred a month earlier on the Thursday, 16 February1626.[9] The grant was made by a *uyyāla-vāhaka* Naraṇḍu, for maintaining a lamp in the temple, for the religious merit of his parents.

The above few references attest to the practice of making endowments in the form of village or land or money to temples as it was considered highly meritorious. There are large number of instances recording grants made on the occasion of eclipses in the Indian history. It is interesting to note that often such grants

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[6] *South Indian Inscriptions,* vol. XIV, no. 282.

[7] Ibid., no. 285.

[8] Ibid., no. 302.

[9] Ibid., no. 319.

were made for the religious merit of their own parents or the rulers of land or overlords. Transfer of religious merit is unique to the Hindu culture.

The Hindus follow the religious customs prescribed to be observed during eclipses to a great extent. It must be noted that even today Hindus take bath twice at the commencement time as well as the concluding time of eclipses. Those who cannot afford to have such a bath in holy rivers will certainly take bath in their respective houses. Practice of putting a piece of *kuśa* grass on food items at the time of eclipses, as prescribed by the Dharmaśāstras, is followed even today. Further, the Hindus avoid taking food during the time of eclipse. In fact, their practice has a scientific reason also. A comprehensive study of endowments made during the eclipses over centuries is bound to be rewarding.

17

Exploration of the Science of Natural Disaster Prediction in Ancient Indian Astronomical Manuscripts

Pravesh Vyas

utpātāḥ pārthivāntarikṣāḥ śaṁ no divācarā grahāḥ ||

śaṁ no bhūmirvepamānā śamulkānirhataṁ ca yat |
nakṣatramulkābhihataṁ śamastu naḥ śaṁ no 'bhicārāḥ śamu santu kṛtyāḥ |
śaṁ no nikhātā valgāḥ śamulkā deśopasargāḥ śamu ni bhavantu ||

— *Atharvaveda Saṁhitā* 19.1.9.7-9

THIS means that strange things happening in the sky should not be harmful for us. Like comets, asteroids, other strange lightening objects, even when an asteroid is hitting any star, even when the earth is shaking. But there should be no harm for people.

In this verse of *Atharvaveda* ancient seers are praying to the god, that these kinds of strange things should not harm the people. This verse shows that ancient seers knew the harmful effect of these kinds of phenomena. In ancient India our intellectual ancestors observed the sky very deeply. They wrote about every surprising change in the sky and the effect of that particular change on the earth and human being. They tried to calculate repetition of these events. This desire of calculating was the only reason behind the origin of Indian astronomy. As Varāhamihira wrote in his legendary

text *Bṛhat Saṁhitā*:

tāni śubhāśubhanimittāni sāmānyāni ca jagataḥ pratipuruṣaṁ pārthive ca pratikṣaṇamananyakarmābhiyuktena daivajñena cintayitavyāni । na caikākinā śakyante 'harniśamavadhārayituṁ nimittāni । tasmātsubhṛtenaiva daivajñenānye 'pi tadvidaścatvāraḥ kartavyāḥ । tatraikenaindrī cāgneyī ca digalokayitavyā । yāmyā nairṛti cānyenaiva vāruṇī vāyavyā cottarā ceśānī ceti । yasmādulkāpātādīni śīghramapagacchantīti । tasyāścākāravarṇasnehapramāṇādi grahārkṣopaghātādibhiḥ phalāni bhavanti ।

— *Bṛhat Saṁhitā, Sāṁvatsarasūtrādhyāya, śloka* 21

Which means that every second observation of the sky is very necessary for the welfare of mankind, but a single person is not able to observe the sky from all sides every time, so an intelligent astronomer should appoint another four astronomers to observe the sky. Because only by these observations future predictions can be done. And this continuous observation of the sky, compiled in various books of Indian astronomy, started from the time of Vedas. Texts like *Sūrya Siddhānta*, *Paitāmaha*, *Vasiṣṭha*, *Pauliṣa, Romaka Siddhānta*, *Pañcasiddhānta*, *Gārga*, *Parāśara*, *Vasiṣṭha Bṛhat* and *Bhadrabāhu Saṁhitā* were written. As the time passed, most of these books got lost. In *Adbhutasāgara* of Ballalsen many names of ancient books and scholars are given, like the works of Pīlukārya, Bījavāya, Bādarāyaṇa, Vidhugupta, Devala, Nṛpaputra, thirty-six works of Brahmarṣi and many more:

granthe 'tra vṛddhagargagargaparāśaravasiṣṭhgārgīyān ।
bārhaspatyabṛhaspatikaṭhaśrutibrahmasiddhāntān ।।

ātharvaṇādbhutāśitaṣaṭtriṁśad brahmarṣikṛtīḥ ।
gārgīyamatauśanase kālāvalisūryasiddhāntau ।।

vindhyavāsī-bādarāyaṇośanaḥ śālihotravidhuguptasuśrutān ।
pīlukāryanṛpaputradevalān bhārgavīyabijavāyakāśyapān ।।

— *Adbhutasāgara*, Upodghāta

Table 17.1: Astronimical Manuscripts at ORI

Sl. No.	*Manuscript No.*	*Title*
29256	P.10387/3	Indracāpaphala
29259	P.10440/3b	Indracāpaphala Ṭīkā
29371	B.586/4	Uparāgacintāmaṇi
30123	P.3804/18	Grahayuddhaphalam
31512	A.47/19	Pitāmaha Saṁhitā
31979	P.9942/4	Mahā Saṁhitā
32850	P.4665	Vṛddhagārgya Saṁhitā
32853	P.4880/2	Vṛddhayāvanam
32854	P.5955/17	Vṛddhavāsiṣṭham
330120	P.5048/1	Saṁhita Śiromaṇi
31182	P.7629/1	Nāradīya Saṁhitā

Our knowledge is limited only to the published books. Some of them are still in the form of manuscripts in various centres in India like ORIs (oriental research institutes). Table 7.1 shows names of some unpublished manuscripts available at ORI Mysore.

Saṁhitā texts are less studied and little famous among the people due to which not much research is done upon Saṁhitā texts of Jyotiṣa Śāstra. Today modern science has totally failed to predict disasters, so they just do disaster management after they take place. Our ancient seers, saw the nature as a living element and they went up to every basic reason behind every change in the nature, and after a deep and long time of observation they found many methods of predicting natural disasters as well. After studying the available Saṁhitā texts, I acknowledge various natural disaster prediction methods they had put in place.

Ancient Disaster Prediction Methods (Āpadāṁ Prācīna Pūrvānumānavidhayaḥ)

- *grahacāraḥ* (transits of planets)
- *grahavarṇaḥ* (colour changing of planets)

- *grahayuddhaḥ* (planetary wars)
- *grahodayāstaḥ* (rise and set of planets)
- *grahaṇam* (eclipse)
- *pratisūryaḥ* (monk suns)
- *rohiṇī-śakaṭa bhedaḥ* (Rohiṇī-Sakaṭa-bheda)
- *ulkāpātaḥ* (rings of meteors)
- *sūryacandrapariveśaḥ* (characteristics of halos)
- *digdāhaḥ* (glow at the horizon)
- *vidyuttaraṅgaḥ* (light)
- *meghākṛtiḥ* (cloud formation)
- *ativṛṣṭiḥ anāvṛṣṭiḥ pāṁśuvṛṣṭiḥ*
  (various types of rainfall)
- *indrāyudham* (signs of rainbow)
- *śakunam* (omens through birds and beasts)
- *tāmasa kīlakaḥ* (role of sunspots)
- *candraśṛṅgaḥ* (horns of moon)
- *gandharvanagaraḥ* (signs of aerial city)

Grahacāra (Transits of Planets)

Transit of planets in various *nakṣatra*s indicates disasters on the planet. These days astrologers use this method and some of them made very accurate predictions also.

bhitvā maghāṁ viśākhāṁ bhindan bhaumaḥ karoti durbhikṣam ।
makaraṁ karoti ghoraṁ yadi bhitvā rohiṇīṁ yāti ।।
— *Bṛhat Saṁhitā*, Bhaumacārādhyāya, *śloka* 9

If Mars transit from Maghā to Viśākhā *nakṣatra*, it creates famine in the world.

saumyatvāṣṭra śraviṣṭhāsu sthite saure mahīsthitāḥ ।
sarve pīḍāṁ samṛcchanti janā yānti yamālayam ।।
— *Adbhutasāgara*, p. 241

A study done by seven scientists (Ioannis Pappos, Konstantinos Raikakos, Basiaka Eirini, Tsixli Anastasia, Moumtzidou Panagiota, N. Tselikas and A.C. Boucouvalas) from Department of Telecommunications, Science and Technology, University of Peloponnese, Tripoli, Greece in their research demonstrated that nearly all of the significant earthquakes (7+ Richter) between 2004 and 2011 have occurred on dates of planetary alignments within k1 day. Table 17.2 lists the planetary alignment of 8+ Richter earthquakes.

Grahavarṇa (Colour Changing of Planets)

In Saṁhitā texts it is described that if colour of planets looks different from their normal colour that will create problem in various areas.

aṇḍajahā ravijo yadi citraḥ kṣubdhayakṛdyadi pītamayūkhaḥ ।
śastrabhayāya ca raktasavarṇo bhasmanibhau bahuvairakaraśca ॥

— *Bṛhat Saṁhitā,* Śanaiścarādhyāya, *śloka* 20

Table 17.2: Planetary Alignments of Specific 8 + Richter Earthquakes

Date	Alignments	Magnitude	Deviation Region
03.11.2011	Jupiter–Mercury–Saturn	9	Near East Coast Honshu, Japan
27.02.2010	Jupiter–Sun–Earth	8.8	Offshore Maule, Chile
29.09.2009	Earth–Moon–Jupiter	8.1	Samoa Islands Region
09.12.2007	Jupiter–Earth–Venus	8.4	Southern Sumatra, Indonesia
04.01.2007	Mercury–Sun–Earth	8.1	Solomon Islands
13.01.2007	Jupiter–Mars–Mercury	8.2	East of Kuril Islands
15.11.2006	Jupiter–Venus–Earth	8.3	Kuril Islands
28.03.2005	Earth–Mercury–Sun–Venus	8.6	Northern Sumatra, Indonesia
26.12.2004	Moon–Earth–Mercury–Venus–Mars–Venus–Sun	9.3	Off West Coast of Northern Sumatra

When Saturn looks like pinto colour in the sky that creates problems related to birds. The same condition happened when "bird flue" spread in the world.

> *śikhibhayamanalābhe śastrakopaścarakte*
> *Kanakanikaṣagaure vyādhayo daityapūjye* ।
> — *Bṛhat Saṁhitā*, Śukracārādhyāya, *śloka* 44

When Venus looks like fire colour that creates fire disasters in the world, and if blood colour causes war in the world.

Grahayuddham (Planetory Wars)

Ancient seers like Parāśara described four types of planetary wars in all Saṁhitā and Siddhānta texts: 1. *bheda,* 2. *ullekha*, 3. *aṁśumardana*, and 4. *apasavya*. Effect of war between different planets also showers problem in various areas.

> *guruṇā jite 'vanisute vāhlīkāyāyino 'gnivārtāśca* ।
> *śaśijena śūrasenāḥ kaliṅgaśālvāśca pīḍyante* ।।

If Mars is defeated by Jupiter it will cause problems in Vāhlīka area, and if it is defeated by Mercury it will cause problems in Śūrasena, Kaliṅga and Śālva areas.

Grahodayāsta (Rise and Set of Planets)

Rise and set of planets due to sun also indicates the disasters on earth. If Venus set or rise in Kārttika month, there will be no rain for three months:

> *akāle uditaḥ śukraḥ prasthito vā yadā bhavet* ।
> *tadā trisāṁvatsarikaṁ grīṣme vapetsarasu vā* ।।
> — *Bhadrabāhu Saṁhitā,*
> pañcadaśo 'dhyāyaḥ, *śloka* 5

Whenever Mercury rise, that causes problems on earth:

> *notpātaparityaktaḥ kadācidapi candrajo vrajatyudayam* ।
> *jaladahanapavanabhayakṛddhānayārghakṣayavivṛddhayai* ।।
> — *Bṛhat Saṁhitā*, Budhacārādhyāya, *śloka* 1

Grahaṇa (Eclipse)

Ancient scholars divided eclipses of sun and moon into ten different parts: *savya, apasavya, leha, grasana, nirodha, avamardana, āroha, āghrāta, madhyatama, tamo 'ntya.*

If two eclipses seen from the same place in between a month that will cause problem to the place:

> *sarvagrastau durbhikṣamarakadau pāpasandṛṣṭau* ||
> — *Bṛhat Saṁhitā*, Rāhucārādhyāya, *śloka* 27

> *yadaikamāse grahaṇaṁ jāyate śaśisūryayoḥ* |
> *śastrakopaiḥ kṣayaṁ yānti tadā bhūpāḥ parasparam* ||
> — *Sugama Jyotiṣa*, Saṁjñādhyāya, *Durbhikṣayogāḥ*

During the time of Mahābhārata war there were two eclipses seen in one *pakṣa* (period of fifteen days):

> *caturdaśīṁ pañcadaśīṁ bhūtapūrvaṁ ca ṣoḍaśīm* |
> *candrasūryāvubhau grastāvekapakṣe trayodaśīm* |
> *aparvaṇi graheṇobhau prajāsaṁkṣipayiṣyataḥ* |
> — *Mahābhārata,* Bhīṣmaparva 3.32

Pratisūrya (Monk Suns)

If two suns seen in the sky, that also creates problems.

> *yadyupasūryakamasyāṁ sandhyāyamarthanāśanaṁ pracuram* |
> *kṣitipatikalahaḥ śīghraṁ salilabhayaṁ vā bhavennūnam* ||
> — *Vasiṣṭha Saṁhitā,* Arkacārādhyāya, *śloka* 22

Rohiṇī-śakaṭa-bheda

Rohiṇī *nakṣatra* is a group of stars in the sky which seems like a cart. If any planet pass through these stars, specially Mars, Saturn and Rāhu, that causes problems on the earth,

> *vṛṣe saptadaśe aṁśe yasya yāmyo 'ṁśakadvayāt* |
> *vikṣepo 'bhyadhiko bhindyādrohiṇyāḥ śakataṁ to saḥ* ||
> — *Sūrya Siddhānta,* Bhagrahayutyadhikāra, *śloka* 13

rohiṇī śakaṭamarkanandano yadi bhinatti rudhiro 'thavā śikhī ।
kiṁ vadāmi yadaniṣṭasāgare jagadaśeṣamupayāti na saṁśayaḥ ।।
— *Bṛhat Saṁhitā*

CASE 1

Hiroshima: 6 August 1945 8:15 a.m. (Little Boy)

Nagasaki: 9 August 1945 11:01 a.m. (Fat Man)

Mars: 16 Ta 12' 57.75" , Rohiṇī

CASE 2

WTC: 11 September 2001 8:45:00 New York

Saturn: 20 Ta 58' 22.17", Rohiṇī

CASE 3

US Iraq War: 22 February 2003

North Node: 10 Ta 21' 12.86", Rohiṇī

Saturn: 28 Ta 14' 19.03", Mṛgaśirā

SOME OTHER EVENTS

Regina Cyclone: 30 June 1912 4:30:00 p.m. Regina, Canada (Saturn 6 Ta 47' 29.20")

Empire State Building Crash: 28 July 1945 9:40:00 a.m. New York (Mars 10 Ta 33' 49.67", Rohiṇī)

NASA Columbia mishap: 1 February 2003 14:00:00 (North Node 11 Ta 27' 41.94", Rohiṇī)

Bhuj Earthquake: 26 January 2001 8:46:00 (Saturn 0 Ta, 11' 36.60")

US Civil War: 12 April 1861 (Mars 14 Ta 24' 58.31", Rohiṇī)

Vietnam War: March–April 1972 (16 April Mars 20 Ta, Rohiṇī)

Ulkāpāta (Rings of Meteors)

In ancient India scholars said asteroids as "Ketu" and described so many types of Ketus. Like:

dhūmrākāraḥ supucchaśca ketuviśvasya pīḍakaḥ ।।

kṛttikāsu samudbhūto dhūmaketuḥ prajāntakṛt ।
saṁvartaketuḥ sandhyāyāṁ triśirā neṣṭadāruṇaḥ ।।
— *Sugama Jyotiṣa*, Saṁjñādhyāya, *Durbhikṣayogāḥ*

In *Adbhutasāgara* of Ballālasen thousands of asteroids are described. Even the time period of their rise:

Vasāketu: 130 years

Kapālaketu: 125 years, 45 days

Kaliketu: 300 years, 9 months

Paitāmaha Calaketu: 115 years

Śvetaketu: 110 years

After studying *Adbhutasāgara* one can know for how long time they were observing the universe. Because a person can't see a comet two times in his whole life and hundreds of comets described in the text. Not even the years of their arise, but they also described the good or bad effect on the earth:

divā patati yolkā sā hanyāddeśaṁ sabhūpatim ।
mahāśāntiṁ tatra kuryādamṛtāṁ viśvabheṣajīm ।।
— *Adbhutasāgara*, Ulkādbhutāvarta, p. 561

Śākunam (Omens through Birds and Beasts)

There are a number of evidences in many Sanskrit texts that various animals behave strangely before disasters. In *Bhaviṣya Purāṇa* it is written that there will be rain of frogs before disaster or a number of frogs will be seen on the area. Same behaviour was seen before the China earthquake. Even after the tsunami there were no dead bodies of animals found in the area. Varāhamihira also describes strange behaviour of many animals in *Bṛhat Saṁhitā*.

sandhyādvaye 'pi maṇḍalamābadhnanto mṛgā vihaṅgā vā ।
dīptāyāṁ diśyathavā krośantaḥ saṁhatā bhayadāḥ ।।
— *Bṛhat Saṁhitā*, Utpātādhyāya, *śloka* 67

If beasts sit together facing towards sunset direction, it is a sign of disaster.

śvānāḥ prarudanta iva dvāre krośanti jambukā dīptāḥ ।
praviśennarendrabhavane kapotakaḥ kauśiko yadi vā ।।
— *Bṛhat Saṁhitā*, Śivārutādhyāya, *śloka* 16

If dogs are weeping facing towards the sun and foxes are making noise near the city, and owls and pigeons enter the houses, that is also a sign of disaster.

ūrdhvamukhā vilokante vindyājjanapade bhayam ।।

heṣante sūryamudvīkṣya tadā 'gnibhayamādiśet ।
anyo 'nyaṁ samudīkṣante heṣyasthānagatā hayāḥ ।।
— *Bhadrabāhu Saṁhitā,* Caturdaśo 'dhyāḥ, *śloka*s 151, 170

If horses continuously make strange noise looking towards the sun or looking at each other, it indicates fear of the place.

Tāmasakīlakam (Role of Solar Spots)

In Saṁhitā texts sunspots are called as *tāmasakīlaka*s and also describe that whenever these kind of spots are seen on the sun surface, it will create problems to these areas:

chidre 'rkamaṇḍale dṛṣṭe tadā rājavināśanam ।
ghaṭākṛtiḥ kṣudbhayakṛtpurahā toraṇākṛtiḥ ।।
— *Sugama Jyotiṣa,* Saṁjñādhyāyaḥ, *Durbhikṣayogāḥ*

Those areas will be more affected where these sunspots are seen:

yasmin yasmin deśe darśanamāyānti sūryabimbasthāḥ ।
tasmiṁstasmin vyasanaṁ mahīpatīnāṁ parijñeyam ।।
— *Bṛhat Saṁhitā,* Ādityacārādhyāya, *śloka* 12

Historically, research has been conducted to link the eleven-year cycle of the sun to changes in human behaviour and society. The most famous research had been done by A.L. Tchijevsky, a Russian scientist, who presented a paper to the American Meteorological Society at Philadelphia in the late nineteenth century. He prepared a study of the history of mass human movement compared to the

solar cycle. He constructed an "Index of Mass Human Excitability" covering each year from 500 BCE to CE 1922. He investigated the histories of seventy-two countries in that period, noting signs of human unrest such as wars, revolutions, riots, expeditions and migrations, plus the number of humans involved. Tchijevsky found that fully 80 per cent of the most significant events occurred during the years of maximum sunspot activity. He maintained that the "exciting" period may be explained by an acute change in the nervous and psychic character of humanity, which takes place at sunspot maxima.

Sūryacandrapariveśa (Characteristics of Hallows)

Ancient Indian scholars observed the effect of the hallows of sun and moon very well. If hallow of sun is seen whole day there will be death of people due to hunger and disease at the place where it is seen:

ādityapariveśastu yadā sarvadinaṁ bhavet ।
kṣudbhayaṁ janamāriñca śastrakopaḥ ca nirdiśet ।।
— *Bhadrabāhu Saṁhitā,* Caturtho 'dhyāya, *śloka* 47

Digdāha (Glow at the Horizon or Earthquake Light)

This is a great field of interest now in modern science also that people see strange light before earthquake. This is described in our astrology books as *digdāha.*

dāho diśāṁ rājabhayāya pīto deśasya nāśāya hutāśavarṇaḥ ।
yaścāruṇaḥ syādapasavyavāyuḥ sasyasya nāśaṁ sa karoti dṛṣṭaḥ ।।
— *Sugama Jyotiṣa,* Saṁjñādhyāya, *Durbhikṣayogāḥ*

Vidyuta Taraṅga (Light)

Observation of various types of light can also indicate about the upcoming problems in the area.

samantādyadi dṛśyeran dikṣu sarvāśu vidyutaḥ ।

saptarātraṁ mahāvarṣaṁ ghorañcaiva vinirdiśet ।।
— *Mayūracitrakam*

If the light is seen in all the directions, that will cause flood and rain for seven nights.

Meghākṛti (Clouds Formation)

In *Bṛhat Saṁhitā* Ācārya Varāhamihira describes the special formation of clouds before earthquake:

praharaṇasadṛśairjaladaiḥ sthagitaḥ sandyādvaye 'pi raṇakārī ।
mṛgamahiṣavihagakharakarabhasadṛśarūpaiśca bhayadāyī ।।
— *Bṛhat Saṁhitā,* Ādityacārādhyāya, *śloka* 35

calitācalavarṣmāṇo gambhīravirāviṇastaḍidvantaḥ ।
gavalālikulāhinibhā visṛjanti payaḥ payovāhāḥ ।।
— *Bṛhat Saṁhitā,* Bhūkampalakṣaṇādhyāya, *śloka 17*

Since 1994, Zhonghao Shou, a retired Chinese chemist living in New York, has made dozens of earthquake predictions based on cloud patterns in satellite images and claims to have 70 per cent accuracy. Stress and friction in the ground can vaporize water long before the earthquake happens, according to Shou, and clouds formed through these mechanisms are distinctively shaped.

Shou predicted in August 1999, 7.0 magnitude quake in the Mojave Desert, east of Los Angeles. He studied cloud patterns and shapes. Also on 25 December 2003, one day before the Bam earthquake, Shou predicted an earthquake of magnitude. 5.5+ within 30 days over a fault line in Iran.

Indrāyudha (Signs of Rainbow)

If two or more than two rainbows are seen from a place that will give problem to the area.

avanīgāḍhamacchinnaṁ pratikūladhanudvayam ।
nṛpāntakṛddhi bhavedānukūlyaṁ na tacchubham ।।
— *Nārada Saṁhitā, Indracāpalakṣaṇādhyāya, śloka* 8

Candraśṛṅga (Horns of Moon)

If the horns of moon are affected by other planets that gives fear of weapons and starvation on the earth.

yadā 'kāśe śṛṅgadvayamamṛtaraśmervidhivaśā-
dadhovaktraṁ vyaktaṁ dinakarakarāṇāmapagame ।
kharāṁśoḥ santāpānalaśataśikhābhirvikalitā
narā hāhākāraṁ diśi diśi lapanti kṣititale ।।
— *Vanamālā*, Caturtho 'dhyāya, *śloka* 14

Gandharvanagara (Signs of Aerial City)

Structure like a city in the sky also causes problem for the place:

gandharvanagaraṁ dikṣu dṛśyate 'niṣṭadaṁ kramāt ।
bhūbhujāṁ vā camūnāthasenāpatipurodhasām ।।

indracāpāgnidhūmābhaṁ sarveṣāmaśubhapradam ।
citravarṇaṁ citrarūpaṁ prakāradhvajatoraṇam ।

dṛśyate cenmahāyuddhamayo 'nyaṁ dharaṇī bhujām ।
—*Nārada Saṁhitā*,
Gandharvanagaradarśanādhyāyā, *ślokas* 1-4

This phenomenon was seen in Russia in October 2009, and also in Montreal in 2011. This kind of city was seen in the year 1887 near New Holland, and the news was also in the newspapers. In *Harivaṁśa Mahāpurāṇa* it is described as a disaster-causing event.

Ativṛṣṭi, Anāvṛṣṭi, Pāṁśuvṛṣṭi (Various Types of Rainfall)

sitena rajasācchannādiggrāmavanaparvatāḥ ।
yathā tathā bhantyete nidhanaṁ yānti bhūmipāḥ ।।
— *Nārada Saṁhitā,* Rajolakṣaṇādhyāya, *śloka* 1

The phenomenon which indicates the killing of landlords.

During research period, I came to know precious ancient heritages in our astronomological (combination of astronomy and astrology) texts. Even after great revolution in modern science, there is no method for forecasting natural disasters. But after a deep and

practical study of these topics (which have mentioned above), we can give a new science to the world.

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मातृकापरम्परायां तम्मयज्वविरचितस्य कामदोग्ध्रीव्याख्यानस्य प्राधान्यम्

गोपालकृष्ण हेगडे

खगोळविज्ञानस्य विशिष्टा परम्पराः

इमं विवस्वते योगं प्रोक्तवानहमव्ययम्।
विवस्वान् मनवे प्राह मनुरिक्षाकवेऽब्रवीत् ।। 1 ।।
एवं परम्पराप्राप्तम् इमं राजर्षयो विदुः ।।[१]

एवं यथा गीताचार्येण योगपरम्परा प्रदर्शिता तथा खगोळविज्ञानस्यापि महती विशिष्टा च परम्परा प्रतीयते समग्रे विश्वे। एतच्च खगोळविज्ञानं ज्योतिषशास्त्रान्तर्गतम्। खगोलः आकाशमण्डलमिति शब्दकल्पद्रुमकारः उल्लिखति।

अपरिमिते गगनमण्डले खगोले यानि हि तेजोमयानि बिम्बानि दृश्यन्ते तानि सर्वाण्येव समदृष्ट्या ज्योतिःशब्देन उच्यन्ते। तेष्वपि यानि सदैकसमगतीनि तानि नक्षत्रशब्देन, प्रतिदिनं भिन्नभिन्नगतीनि तु ग्रहशब्देन च ज्ञायन्ते। एवंविधनक्षत्रग्रहतारकादिज्योतिःपिण्डानां स्थितिगतिप्रभावादिवर्णनपरं शास्त्रमेव ज्योतिषपदेन अभिधीयते।

खगोळविज्ञानस्य अस्तित्वं वैदिकमन्त्रेषु सर्वप्रथमं विकीर्णरूपेण स्थितं द्रष्टुं शक्यते। यथा — ओं यत्पुण्यं नक्षत्रं तद्बत् कुर्वीतोपव्युषं यदा वै सूर्य उदेति अथ नक्षत्रं नैति यावति तत्र सूर्यो गच्छेत् यत्र जधन्यं पश्येत् तावति कुर्वीत यत्कारीस्यात् पुण्याह एव कुरुते। तानि वा यमनक्षत्राणि यान्येव देवनक्षत्राणि तेषु कुर्वीत यत्कारी स्यात् पुण्याह एव कुरुते।[२]

इत्येतैः वैदिकमन्त्रैः नक्षत्राणां मध्ये कानिचित् देवनक्षत्राणीति कानिचित्, यमनक्षत्राणीति

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[१] श्रीमद्भगवद् गीता, चतुर्थाध्यायः, 1, 2 श्लोकौ ।

[२] कृष्णयजुर्वेदीयतैत्तिरीयब्राह्मणम् ।

प्रतिपादितानि महर्षिभिः। देवनक्षत्राण्येव पुण्यनक्षत्राणीति तेषां काल एव पुण्याहमिति च निर्दिष्टम्। बहुकालात्पूर्वं एतत्समयपर्यन्तमपि भारते वर्षे नक्षत्राणामेव प्राधान्यमुपदिष्टम्।

कृत्तिकानक्षत्रमग्निर्देवता, रोहिणीनक्षत्रं प्रजापतिर्देवता.........[३]

इत्यादिना सूर्यमार्गस्थितानां क्रान्तिवृत्तीयानां नक्षत्राणाम्, चन्द्रमार्गस्थितानां क्रान्तिवृत्तसमीपस्थत्वात् चन्द्रमार्गस्य च परस्परसम्बन्धः प्रतिपादितो दृश्यते। अयमेव विषयः वैपुल्येन नक्षत्रेष्टिरिति प्रसिद्धे प्रश्ने व्याख्यातो दृश्यते।

एवं खगोलसम्बन्धिचिन्तनमन्थनं वैदिकसंहितासु प्रस्फुटितं दृश्यते। पश्चाच्च नवनवानुभवसंयोजनपूर्वकं लौकिकग्रन्थेष्वपि। तेन हि खगोलशास्त्रस्य विकासः पञ्चसु अवस्थासु विभक्तो दृश्यते। प्राग्वैदिककालः, वैदिकसंहिताकालः, वेदाङ्गकालः, सिद्धान्तकालः, आधुनिककालश्चेति अथवा अज्ञातकालः, आदिकालः, पूर्वमध्यकालः, उत्तरमध्यकालः, आधुनिककालश्चेति। तस्मिन् काले मुद्रणयन्त्राणामनुपलम्भात् खगोलज्ञानप्रसाराय, प्रचाराय च मातृकाः एव प्रधानसाधनाः भवन्ति स्म ।

दिव्यं ज्ञानमतीन्द्रियम्

खगोळविज्ञानं ब्राह्मं अतीन्द्रियं दिव्यं ज्ञानं वेदेषु निक्षिप्तं सत् अतिरहस्यं च वर्तते। एतादृशप्रत्यक्षसिद्धं ज्ञानं वसिष्ठादिमहर्षयः लोकोपकाराय स्वशिष्येभ्यः उपदेशयामासुः। तद्वारा पारम्पर्यक्रमेण एतद्रहस्यं अवनीं नीतवन्तः। अस्मिन् विषये प्रख्यातखगोळविज्ञानिनां भास्कराचार्याणां वचनं —

> दिव्यं ज्ञानमतीन्द्रियं यदृषिभिर्ब्राह्मं वसिष्ठादिभिः पारम्पर्यवशाद् रहस्यमवनीं नीतं प्रकाशं ततः इति।[४]

एवं ब्रह्मा नारदाय, सोमः शौनकाय, नारायणः वसिष्ठाय रोमशाय च, वसिष्ठः माण्डव्यवामदेवाभ्याम्, व्यासः स्वशिष्याय, सूर्यः मयाय अरुणाय च, पुलस्त्याचार्यगर्गात्रिरोमकाः स्वस्वशिष्येभ्यः, पराशरः मैत्रेयाय च प्रोचुः इति शास्त्रेतिहासाध्ययनेन ज्ञायते। एवं क्रमेण खगोळविज्ञाने गुरुशिष्यपरम्परा आसेतुहिमाचलं अद्यापि दरीदृश्यते।

अस्माकं पूर्वजैः अत्यमूल्यग्रन्थाः ताडपत्रेषु वा भूर्जपत्रेषु वा कर्गजपत्रेषु वा लिखितरूपेण संरक्षिताः दृश्यन्ते। इयमेव मातृका परम्परा। अस्यैव आङ्ग्लभाषायां Manuscripts Heritage इति कथ्यते।

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[३] कृष्णयजुर्वेदीयतैत्तिरीयसंहिता 4.4.10 ।

[४] सिद्धान्तशिरोमणिः, गोलाध्यायः, ज्योत्पत्तिः, 9 श्लोकः ।

खगोळशास्त्रप्रवर्तकाः

सूर्यः पितामहो व्यासो वसिष्टोऽत्रिः पराशरः।
कश्यपो नारदो गर्गो मरीचिर्मनुरङ्गिराः।।
लोमशः पौलिशश्चैव च्यवनो यवनो भृगुः।
शौनकोऽष्टादशैते ये ज्योतिःशास्त्रप्रवर्तकाः।।[५]

सूर्यादि अष्टादशज्योतिःशास्त्रप्रवर्तकाः स्वस्वनाम्ना ज्योतिषशास्त्रसम्बन्धि ग्रन्थान् रचयामासुः। ते सिद्धान्तरूपेण संहितारूपेण होरारूपेण च प्रसिद्धिं प्रापुः। ते एव अपौरुषेयशब्देन कीर्त्यन्ते। भारतीयानामस्माकं सर्वेषु धार्मिककृत्येषु रवेरेव प्राधान्यं विद्यते। सूर्य आत्मा जगतस्तस्थुषश्च इति वेदोक्त्या जडचेतनानां सर्वेषां वस्तूनां उद्भावकः रविरेवेति स्वीक्रियते। स एव रविः भारतीय-खगोळविज्ञानस्यापि प्रधानः प्रवर्तको विद्यते।[६] खगोळेऽपि स एव राजा इति तु प्रत्यक्षसिद्धमेव। अस्माकं सौभाग्यवशात् अस्य कृतिः सूर्यसिद्धान्तरूपेण अस्माकं हस्तगता विद्यते। सर्वेषामपि स्कन्धानां मूलभूतत्वात् सर्वदा युक्तिमत्वात् च सिद्धान्तस्कन्धः सर्वतः श्रेयानित्यत्र नास्ति सन्देहः। यतः

उपपत्तिमानागम एव प्रमाणमिति भास्कराचार्योक्तिः खगोलविज्ञानमधिकृत्यैव।[७]

अष्टधा निर्गतं शास्त्रम्[८]

एतच्च मत्तः शीतांशोः पुलस्त्याच्च विवस्वतः।
रोमकाच्च वसिष्ठाच्च गर्गादपि बृहस्पतेः ।।9।।

अष्टधा निर्गतं शास्त्रं स्वयं परमदुर्लभम्।

इति शाकल्यसंहितान्तर्गतब्रह्मसिद्धान्तोक्त्या ब्रह्मसोमपुलस्त्यसूर्य रोमकवसिष्ट-गर्गबृहस्पतिसिद्धान्ताश्चेति अष्टावेव सिद्धान्ताः आगमभूताः निगद्यन्ते। तेषु केचन ग्रन्थाः कालकबलिताः आसन्। केचन ग्रन्थालये मातृकारूपेणैव (manuscript) अप्रकटिताः सन्ति। अद्यत्वे केचन अपौरुषेयाः, केचन पौरुषेयाश्च अनेके सिद्धान्तग्रन्थाः अस्माकं दृष्टिपथमुपगताः भवन्ति।

खगोलविद्याविषये वदामश्चेत् भारतीयसिद्धान्ताः सिद्धान्ततन्त्रकरणभेदेन त्रिधा विभक्ताः दृश्यन्ते ।

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[५] ज्योतिर्विज्ञानं पृष्टम् 5 (कश्यपवचनम्)।

[६] कृष्णयजुर्वेदीयतैत्तिरीयसंहिता 1.4.43.2 ।

[७] सिद्धान्तशिरोमणिः, ग्रहगणितम्, मध्यमाधिकारः, भगणाध्यायः, पृष्टम् 11।

[८] ब्रह्मसिद्धान्तः, प्रथमाध्यायः, 9, 10 श्लोकौ ।

खगोलविज्ञाने सन्ति बहवो हि ग्रन्थाः, शास्त्रस्यास्य प्रतिपादकाश्च। अद्यत्वे षष्ट्यधिकाः (60) पौरुषेयाः ग्रन्थाः सन्ति। खगोलविज्ञाने अत्यन्तप्राचीनः आर्षः सर्ववरेण्यः व्याख्यानुभूयिष्टः स्वयं सूर्येण प्रोक्तश्च ग्रन्थः सूर्यसिद्धान्तः इत्यत्र नास्ति विप्रतिपत्तिः। अत एव अस्य ग्रन्थस्योपरि आभारतं विपुलानि व्याख्यानानि समुद्भूतानि। श्रीमद्भगवद्गीतायाः अनन्तरं सूर्यसिद्धान्तस्यैव पञ्चाशत् (50) सङ्ख्याकानि अधिकानि व्याख्यानानि समुपलभ्यन्ते इतीदन्तु भारतीयानामस्माकं प्रमोदस्थानम्। अत्र त्रिंशदधिकाः व्याख्याः मातृकारूपेणैव स्थिताः सन्ति। ताश्च व्याख्याः तालिकारूपेण स्पष्टतया प्रदर्शिताः वर्तन्ते। इदानीं खगोलविज्ञानपरम्परायां तम्मयज्वविरचितस्य कामदोग्ध्रीव्याख्यानस्य प्राधान्यमधिकृत्य किञ्चित् प्रस्तूयते। सूर्यसिद्धान्तस्य उपलब्धासु व्याख्यासु अर्वाचीनेयमप्रकाशिता कामदोग्ध्रीव्याख्यापि अन्यतमा।

अर्वाचीनस्यास्य व्याख्यानस्य प्राचीनदेवनागर्यां तिगळारिलिप्यां, देवनागर्यां, कन्नडलिप्याञ्च हस्तप्रतयः (manuscripts) समुपलभ्यन्ते।

ऐतावत्पर्यन्तं कामदोग्ध्रीव्याख्यानसम्बन्धिमातृकाचतुष्टयस्य अध्ययनं कृतम्। तद्विवरणमुपस्थाप्यते। यथा —

मातृकोपलब्धिस्थानम् — प्राच्यविद्यासंशोधनालयः, मैसूर्, कर्णाटक

पत्र संख्या — 1-282	आकारः — 45 cm X 4.5 cm
पङ्क्ति संख्या — (पृष्टे) 8	अक्षर संख्या — (पङ्क्तौ) 90
लिपिः — प्राचीन देवनागरी	आधारः — ताड पत्रम्
क्रमाङ्कः — 3240	विशेषः — सम्पूर्णम्

मातृकोपलब्धिस्थानम् — सुब्रह्मण्यप्राच्यविद्यापीठम्, हस्तप्रतिसङ्ग्रहालयः, कवलकि 581334, होन्नावर, उ.क. कर्नाटक

पत्र संख्या — 2-269	आकारः — 33 cm X 20.5 cm
पङ्क्ति संख्या — (पृष्टे) 28	अक्षर संख्या — (पङ्क्तौ) 25
लिपिः - देवनागरी	आधारः — कर्गज पत्रम्
क्रमाङ्कः — 208	विशेष — सम्पूर्णम्

मातृकोपलब्धिस्थानम् — ग.कु. हेगडे स्मारकग्रन्थालयः, हेगडे-589330, कुम्टा, उ.क. कर्नाटक

पत्र संख्या — 1-309	आकारः — 23 cm X 30 cm
पङ्क्ति संख्या — (पृष्टे) 26	अक्षर संख्या — (पङ्क्तौ) 30

लिपिः — कन्नड आधारः — कर्गज पत्रम्

क्रमाङ्कः — 72 विशेष — सम्पूर्णम्

मातृकोपलब्धिस्थानम् — श्रीकूगलबळ्ळी मठः, होसतोट, हेग्गरणि-581331, सिद्दापुर, उ.क. कर्नाटक

पत्र संख्या — 36-242 आकारः — 46.5 cm X 6 cm

पङ्क्ति संख्या — (पृष्टे) 10 अक्षर संख्या — (पङ्क्तौ) 54

लिपिः — तिगळारी आधारः — ताड पत्रम्

क्रमाङ्कः — 96 विशेष — असंपूर्णम् (1-35 पत्राणि न सन्ति)

कामदोग्ध्रीटीकायाः अस्याः उपलब्धासु मातृकासु हेगडे ग्रामस्थे ग.कु. हेगडे स्मारकग्रन्थालये संरक्षितां कन्नडलिपिमातृकां मूलमातृकारूपेण परिगणय्य तस्याः लेखनं कृतम्।

तम्मयज्वा टीकायाः अस्याः कर्तेति सर्वास्वपि मातृकासु उल्लेखो विद्यते। होन्नार्यस्य प्रपौत्रः, मल्लयज्वनः पौत्रः, वेङ्गटाम्बामल्लाध्वरिणोः पुत्रश्च आसीत् व्याख्यानकर्ता तम्मयज्वा। राजाज्ञा पित्राज्ञा च व्याख्यानकरणे मूलकारणमिति व्याख्यानकृता उल्लेखितम्। घनगिरिनिकटस्था परिशियुपुरी व्याख्यानस्थानमिति स्पष्टतया ज्ञायते। यथा —

> तत्र श्रीवेङ्कटपतिरायपट्टाभिषेकमुहूर्तसमये ममजनकस्य तत्रस्थिततान्त्रिकाणां च विवादो जातः। तत्समये श्री सूर्यसिद्धान्तस्य उदाहरणपूर्वकटीका यैः क्रियते ते महान्तः किं वृथा विवादेन इति राज्ञा सर्वैश्च निश्चिते ममपित्राज्ञया घनगिरिनिकटस्थपरिशियुपुर्यां सत्र्यंशत्र्यङ्गुलविषुवच्छायावत्यां हुताशक्षोणीरामाग्निपरिमितलम्बज्यावत्यां स्थित्वा मैलारेश्वरप्रसादजनितोऽहं श्रीसोमेश्वरप्रीतये होन्नमाम्बाप्रीत्यै च कामदोग्ध्रीं टीकां करोमि।। इति।[९]

ग्रन्थकृता निर्देशितमार्गानुसारेण परिचायकं चित्रं प्रदर्शितमस्ति। यथा — एतद् व्याख्यानावसरे भूमध्यरेखायाः प्राग्भागे दशयोजनान्तरिते लंकायाः उत्तरतो रामचन्द्रनयन 213 मितयोजनान्तरिते श्रीविद्यानगरस्य आग्नेयदिग्भागे श्रीशैलस्य नैर्ऋत्यदिग्भागे श्रीधनगिरिनगर्यां स्थितोऽहम्। इति।[१०]

अत्र भूमध्यरेखायाः प्राग्भागः, लंकायाः उत्तरभागः, श्रीविद्यानगरस्य आग्नेय दिग्भागः, श्रीशैलस्य नैर्ऋत्यदिग्भागश्च इदानीं कर्नाटकराज्यस्य कश्चनप्रदेशः भवति। अतः अयं दाक्षिणात्यः इति निश्चयेन वक्तुं शक्यते।

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[९] कामदोग्ध्रीव्याख्यानम् ।

[१०] कामदोग्ध्रीव्याख्यानम् ।

व्याख्यानकर्तुः कालः

अस्य कालविषये स्पष्टोल्लेखः समुपलभ्यते। तथा — [११]अथ मदीयव्याख्यावसरात् पूर्वं त्रेतायुगम् 12,96,000 द्वापरयुगम् 8,64,000 कलियुगे युधिष्ठिरविक्रमशकयोः कालः 3979 शालिवाहनशककाले चन्द्राक्षिशरभूमितानि 1521 सौरवर्षाणि गतानि। एतेषां योगः 21,64,700। एतत् कृतयुगान्तसौराब्देषु संयोज्य जाता विकारिसंवत्सरचैत्रशुक्लप्रतिपदिसृष्ट्यादि अब्दाः 1,955,884,700। व्याख्याने एवमस्ति।

तदनुरोधेन ग्रन्थकालः निर्णीयते। यथा —

अस्मिन्वर्षे (खरसंवत्सरे) सृष्ट्यादिगताब्दाः = 1,955,885,112
कामदोग्ध्री व्याख्यानरचनाकाले सृष्ट्यादिगताब्दाः = 1,955,884,700
तयोरन्तरम् = 412 वर्षाणि
अपि च अस्मिन्वर्षे (खरसंवत्सरे) शालिवाहनशकवर्षाः = 1933
कामदोग्ध्री व्याख्यानरचनाकाले शालिवाहनशकवर्षाः = 1521
तयोरन्तरम् = 412 वर्षाणि

एवं च 412 वर्षात् प्रागेव कृतमेतत् व्याख्यानं रङ्गनाथकृतगूढार्थप्रकाशिकापेक्षया प्राचीनमिति निश्चयेन वक्तुं शक्यते। आङ्ग्लकालमानानुगुणं क्रिस्तोः अनन्तरं 1599 तमे वर्षे टीकेयं निर्मितेति ज्ञायते। अपि च श्रीवेङ्कटपतिरायपट्टाभिषेकमुहूर्तसमयः अनेन प्रस्तावितः व्याख्याने। तस्य राज्ञः कालविषये अन्तर्जालमध्ये यदुपलब्धं तदधो प्रदर्शितमस्ति —

> Venkata II (A.K.A. Veṅkaṭapati Rāya) (r. CE 1586– 1614) the younger brother of Śrīraṅga I became the ruler of Vijayanagara Empire. His reign of three decades saw a revival of strength and prosperity of the empire. He dealt successfully with the Deccan *sultān*s of Bījāpur and Golkoṇḍā, the internal disorders, promoting economic revival in the country. He brought rebelling Nāyakas of Tamil Nadu and parts of present-day Andhra Pradesh under control.
> — Wikipedia

अत्र वेङ्कटपतिरायस्य कालः क्रि.श. 1586 तः क्रि.श. 1614 पर्यन्तं इति निर्देशितः। ग्रन्थकर्तुः कालः शा.श. 1521+78 = क्रि.श. 1599 इति पूर्वमेव उपस्थापितः। अतः अस्य कालस्तु निर्दुष्टः निर्दिष्टश्च सिद्ध्यति। अनेनायं तम्मयज्वा 16 शताब्दस्योत्तरार्धे 17 शताब्दस्य पूर्वार्धे च देशमिमम् अलञ्चकार इत्यत्र तु न काचित् विप्रतिपत्तिः।

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[११] कामदोग्ध्रीव्याख्यानम् ।

कामदोग्ध्रीटीकायामपि तम्मयज्वा तत्पूर्ववर्तिनः कतिपयग्रन्थान् कानिचनव्याख्यानानि च समाश्रितानीति अनुसन्धानेन अवगम्यते। कस्मात् कस्मात् ग्रन्थात् कतिवारं तत्रस्थविषयाः उद्धृताः इत्यपि संशोधितमस्ति। यथा — टीकाकृदयं द्विचत्वारिंशत् (42) स्थलेषु ब्रह्मसिद्धान्तस्य, अष्टाविंशति (28) स्थलेषु सिद्धान्तशिरोमणेः, चतुर्विंशति (24) स्थलेषु आर्यभटीयस्य, अष्टादश (18) स्थलेषु दैवज्ञाभरणस्य, चतुर्दश (14) स्थलेषु श्रीपत्याचार्यस्य सिद्धान्तशेखरस्य, मौहूर्तिकमण्डनस्य च एकादश (11) स्थलेषु लल्लाचार्यस्य शिष्यधीमहातन्त्रस्य दश (10) स्थलेषु सिद्धान्तसार्वभौमस्य, नव (9) स्थलेषु सिद्धान्तसारस्य, अष्ट (8) स्थलेषु गर्गाचार्यस्य, षट् (६) स्थलेषु वराहमिहिरस्य, पञ्च (5) स्थलेषु, सिद्धान्ततिलकस्य, चतुर्षु (4) स्थलेषु पितामहस्य, वसिष्टसिद्धान्तस्य, ब्रह्मगुप्तस्य च त्रिषु (3) स्थलेषु मौहूर्तिकालङ्कारस्य, रोमशसिद्धान्तस्य मल्लिकार्जुनस्य विष्णुधर्मोत्तरपुराणस्य च द्वि (2) स्थलेषु विस्तृतगोळस्य विद्यारण्यश्रीचरणानाम्, लीलावत्याः मल्लप्पनाचार्यस्य च एकस्मिन् (1) स्थले मञ्जुलाचार्यस्य सोमनाथपद्धत्याः सिद्धान्तप्रकाशस्य, सूर्याचार्यस्य, उत्तरसौरस्य, मूलपैतामहस्य व्यासस्य, वृद्धवासिष्टस्य, पराशरस्य, बृहस्पतेः, सोमसिद्धान्तस्य, प्राभाकरतन्त्रस्य, मल्ललक्षणाचार्यस्य, श्रीभगवद्गीतायाश्च श्लोकान्वाक्यानि च समुल्लिखति।

कर्तायं तम्मयज्वा न केवलं ज्यौतिषिकः अपि तु शास्त्रान्तरेष्वपि कृतभूरिपरिश्रमः, बहुश्रुतश्च इति स्पष्टमवगम्यते।

टीकाकृता रचिताः अन्ये ग्रन्थाः

व्याख्यानमध्ये तत्र तत्र मदुक्त सोमनाथपद्धत्याम्, मदुक्त सिद्धान्तसार्वभौमे, मदुक्त ग्रहगणितभास्करे, मदुक्त मौहूर्तिकमण्डने इत्यादि — उल्लेखनात् सोमनाथपद्धतिः सिद्धान्तसार्वभौमः, ग्रहगणितभास्करः, मौहूर्तिकमण्डनम् इति चत्वारः ग्रन्थाः अपि तम्मयज्वना विरचिताः इत्यनुमीयते।

एवमेव प्रमाणपुरस्सरं व्याख्यानकर्तुः वैदुष्यं, व्याख्यानस्य वैशिष्ट्यञ्च विशेषेण विशदेन च अनुसन्धानं कृतमस्ति। यथा —

उदाहरणपूर्वकं श्लोकानां विवरणं क्रियते चेत् तदा तस्य व्याख्यानस्य प्रस्तुतत्वं सिद्ध्यति। अत्र टीकाकृता तम्मयज्वना महान् परिश्रमः कृतः। एतत् व्याख्यानस्याविर्भावात् पूर्वं सूर्यसिद्धान्तस्य केवलशास्त्रव्याख्यानपरम्परा एव आसीत्। अयं टीकाकारः व्याख्यानकालस्य उदाहरणं दत्वा सूर्यसिद्धान्तश्लोकानां तस्मिन् उदाहरणे अन्वयं प्रतिपादितवान् प्रदर्शितवान् च। अद्य यथा केतकीग्रहगणितं उदाहरणपूर्वकं विद्यते तथा तस्मिन्काले एतत् व्याख्यानं उदाहरणपूर्वकमासीत्। अस्मिन् व्याख्याने दत्तमुदाहरणमाधारीकृत्य अद्यापि सूर्यसिद्धान्तानुसारिपञ्चाङ्गं कर्तुं शक्यते इति तस्मिन्काले एव प्रदर्शितवान्। तादृशः प्रयत्नः आधुनिकज्यौतिषिकैः करणीयः। तदा एव

सूर्यसिद्धान्तः इदानीमपि प्रस्तुतः इति वक्तुं शक्यते। एवं सूर्यसिद्धान्तस्य इदानीमपि प्रस्तुतत्वं साधयितुं एतत् व्याख्यानं प्राधान्यं प्राप्नोति। इदमेवास्य व्याख्यानस्य वैशिष्ट्यम्। व्याख्यानमिमं प्रकाश्यते चेत् जिज्ञासूनां विद्यार्थिनां विदुषां च महदुपकाराय भवति इति विज्ञापयामि।

19

प्राचीनभारतीयानां खगोळपरिशीलनम्

चि. शिवरामकृष्ण शर्मा

प्राचीनभारतीयानां खगोळपरिशोधनं प्रशंसनीयं भवति। रविमण्डले तेषां परिशीलनेन एतानि लक्षणानि दृष्टान्यभवन्।

रविर्महान् परिमण्डलः, कुक्षिमान् विपुलः, घृतमण्डनिभः, सुवर्णरजतपद्मप्रभः, विमलः स्निग्धश्च विविधकालेषु वैविध्येन दृष्टो भवति। एतत्पराशरवचनम्।[1]

वराहसंहितायाम्

अमलवपुरवक्रमण्डलः स्फटिकविपुलामलदीर्घदीधितिः अविकृततनु वर्णचिह्नभृज्जगति करोति शिवं दिवाकरः। इत्युक्तम्।[2]

श्वेतः शिरीषपुष्पाभः पद्माभो रुक्मसन्निभः।
वैडूर्य घृतमण्डाभः हेमाभश्च दिवाकरः।
वर्णैरेभिः प्रशस्तःस्यात् महास्निग्धः प्रतापवान्।।

इति गर्गपराशरवचने।[3]

"शिशिरे ताम्रः, कपिलो वा वसन्ते, कौंकुमो वा हरितः ग्रीष्मे कपिलवैडूर्यः, प्रावृषि सर्ववर्णः शरदि पद्माभः, हेमन्ते लोहितः, सर्वर्तुश्वेतः पाण्डुवर्णश्च प्रशस्यते" इति पराशरवचनम्। अत्र गर्गसम्मतिरप्यस्ति। सितपीतसमायुक्ते पाण्डुशब्दः प्रयुज्यते।[4]

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[1] अद्भुतसागरः, श्री वल्लालसेन देवः, 10 तम पत्रम्।

[2] तत्रैव, 10 तम पत्रम्।

[3] तत्रैव, 13 तम पत्रम्।

[4] तत्रैव, 15 तम पत्रम्।

अपि च पराशरः एवमवदत्।

रविर्विवर्णो भूरिवर्णोऽभ्राभावाय। श्यावोजन मरणाय। ताम्रो रुधिराभोवा शस्त्रकोपं करेति। कृष्णवर्णो जगतः क्षयाय। व्यामिश्रवर्णो यावत् दृश्यते परस्परविनाशाय, कृष्णरुधिरवर्णौ जगतः क्षयकरः, वैडूर्य कृष्ण बभ्रुवर्णाः पांसुवर्ण उत्सादकरः। इति फलसूचनपूर्वकं विविध वर्णानि रवौ दृश्यन्त इत्यकथयत्।[5]

एवं वराहसंहितायां वृद्धगर्गवचनेषु पराशरवचनेषु च रविवर्णभेदात् शुभाशुभफलान्युक्तानि।

गार्गीये —

ध्वांक्षो वा कृष्णशंकुर्वा कबन्धोवार्कमण्डले दृश्यते यत्र तत्राशु भूमिपालो विनश्यति।[6] इति रविमण्डले ध्वांक्ष कृष्ण शंकु कबन्धांक दर्शनान्यपि तदा तदा भविष्यन्तीति स्मृतम्। अपि च शकटधनुः क्षेत्र रूपाश्च सूर्यमण्डले दृष्टिमायातीति अनो धनुः क्षेत्ररूपाः नृपवित्त क्षयावहाः। इति वचनेन गार्गीये उक्तम्।[7]

रविबिम्बे दण्डदर्शनमप्यस्ति।
दण्डे नरेन्द्रमृत्युर्व्याधिभयं कबन्धसंस्थाने।
ध्वाङ्क्षे च तस्करभयं दुर्भिक्षं कीलकेऽर्कस्थे।।

इति वराहसंहितावचनादवगम्यते।[8]

गार्ग्यस्तु श्वशृगालादि रूपाण्यपि अर्कमण्डले तदा तदा दृश्यन्ते इत्यब्रवीत्।

श्वशृगालाश्व कीलानां तथा धूम कबन्धयोः।
दर्शनं सूर्यबिम्बे चेद्विनाशो भूपतेस्तदा।।[9]

वृद्धगार्ग्योऽपि

शृगालान् गर्दभानश्वान् तथान्यान्मृगपक्षिणः।
आदित्यमण्डले दृष्ट्वा देशभङ्गं विनिर्दिशेत्।।[10]

इति मृगपक्षिणोऽपि आदित्यमण्डले दृश्यन्त इत्यब्रवीत्।

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5 तत्रैव, 16 तम पत्रम्।

6 तत्रैव, 19 तम पत्रम्।

7 तत्रैव, 20 तम पत्रम्।

8 तत्रैव, 20 तम पत्रम्।

9 तत्रैव, 20 तम पत्रम्।

10 तत्रैव, 20 तम पत्रम्।

गर्गस्तु पताका प्रासाद तोरणाकारा अपि रविमण्डले दृष्टा भवन्तीति।

अहस्करे पताकादीन् प्रासादांस्तोरणानि च।
सन्ध्ययोरुभयोः पश्येन्महदुत्पद्यते भयम्।। इत्युक्तवान्[11]

वराहसंहितायान्तु

राजोपकरणवर्णच्छत्रध्वजचामरादिभिर्विद्धः।
राजान्यत्वकृदर्कः स्फुलिङ्गधूमादिभिर्जनहा।।[12]

इति छत्र ध्वज चामरादीनि धूमादयोऽपि रविमण्डले वर्तन्त इत्यवोचत्। वटकणिकायां "ज्वाला स्फुलिङ्ग धूमाः अर्कमण्डले दृश्यन्त इति ज्वाला स्फुलिङ्ग धूमैर्जनक्षयः" इति वचनेनाप्रकटयत्।[13]

मुण्डाकृतिःखण्डत्वं रवौ दृश्यत इति।
खण्डो वा कृष्णरेखा वा मुण्डः पिङ्गलकोऽपि वा।
देशविभ्रममादित्यो राजमृत्युञ्च सूचयेत्।।[14]
— इति वचनात् विज्ञायते

उलूकसंस्थानो रवौ दृश्यत इति।
मुण्डाकार उलूकसंस्थान उन्मादापस्मारकृत्
— इति पराशरवचनं वर्तते[15]

स्थाली पिठराकृतिः, अञ्जनवर्णम्,
ह्रस्वमण्डलत्वं तदा तदा दृष्टा भवन्तीति।
विरूक्षेण भवेत् क्षेमः स्थाली पिठर सन्निभे।
अनावृष्टिश्च वैरञ्च संक्षिप्तेसूर्यमण्डले।।

रुक्षोऽरुणोञ्जनश्यामः सूर्यो वा ह्रस्वमण्डलः।
— इति वृद्धगर्गवचनात् ज्ञातं भवति

(अत्र पिठरशब्दः घटापरपर्यायः रूक्षशब्देन चिक्कणमुच्यते)

भास्करे निष्प्रभत्वं, धूम्रवर्णञ्च दृश्येते इति स एवाह।

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[11] तत्रैव, 20 तम पत्रम्।

[12] तत्रैव, 20 तम पत्रम्।

[13] तत्रैव, 20 तम पत्रम्।

[14] तत्रैव, 21 तम पत्रम्।

[15] तत्रैव, 21 तम पत्रम्।

निष्प्रभे धूम्रवर्णेऽर्के सर्वतो जायते भयम्
— इति रविर्वज्रसन्निभो दृश्यत इति[16]

अतिरूक्षे भयं ब्रूयात् स्थाली पिठरसन्निभे।
संक्षोभात् क्षीयते लोको दुर्भिक्षं वज्रसन्निभे।।[17]
— इति गर्गवचनात् गम्यते

महाभारते कदापि सूर्यः द्विधाभूतो दृश्यत इति।

द्विधाभूत इवादित्य उदये प्रत्यदृश्यत इति उक्तम्।[18]

त्रिधा भिन्नो दृश्यत इति वृद्धगर्गवचनम्।

आदित्यमण्डलं छिन्नं द्विधा वा यदि वा त्रिधा।
तद्राजमरणं ब्रूयात् दण्डो वा यदि दृश्यते।।[19] — भारते भीष्मपर्वणि

ज्वलन्त्या शिखया भूयो भानुमानुदितो रविः।
इति ज्वलच्छिखया उदयरविः दृष्टो भवदिति वर्तते।।[20]
— मयूरचित्रे आदित्ये विषाणानि दृश्यन्त इति

विषाणैरिव चादित्यस्त्रिकूट इव लक्ष्यते।
जनमाराग्नि शस्त्राद्यं घोरमुत्पद्यते भयं इति स्थितम्।।[21]

गगने द्विसूर्यदर्शनमपि सम्पद्यत इति विष्णुधर्मोत्तरमकथयत्।
द्विसूर्ये गगने युद्धं क्षित्रियाणां विनिर्दिशेत् ।।[22]
— इति वराहसंहितायां त्रिचतुष्प्रभृतिसूर्याणां दर्शनं द्वि चन्द्रदर्शनं तदा तदा भवतीति वर्तते। यथा

दिविभाति यदा तुहिनांशुयुगं द्विजवृद्धिरतीव तदाशु शुभम्।

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16 तत्रैव, 22 तम पत्रम्।

17 तत्रैव, 22 तम पत्रम्।

18 तत्रैव, 22 तम पत्रम्।

19 तत्रैव, 22 तम पत्रम्।

20 तत्रैव, 22 तम पत्रम्।

21 तत्रैव, 23 तम पत्रम्।

22 तत्रैव, 23 तम पत्रम्।

तदनन्तरवर्णरणोऽर्कयुगे जगतः प्रळयस्त्रिचतुष्प्रभृति।।[23]

आग्नेयपुराणे सप्तसूर्यदर्शनमपि तदा तदा भविष्यतीति वर्तते।

सप्तधूमनिभा घोरा सूर्या दिवि समुत्थिताः इति।[24]
तैत्तिरीयारण्यकेऽपि "सप्तसूर्या दिवमनुप्रविष्टाः"।।
— इति सप्तसूर्यप्रसक्तिर्वर्तते (1.7.3)

आदित्ये रथदर्शनं भवतीति भार्गवीये स्थितम्। यथा —

आदित्यस्य रथः श्वेतः सन्ध्यायां यदि दृश्यते।
प्रत्यासन्नं भयं विद्यात्तस्मिन्नुत्पातदर्शने।।[25]

सूर्यमण्डले सेनादृष्टा भवतीति गर्गवचनम्। यथा —

आदित्ये स रथा सेना सन्ध्याकाले यदा भवेत्।
प्रत्यासन्नं विजानीयात् भूमिपस्य पराजयम्।।[26]

रविः कांस्यपात्रनिभः, शशांक इव रश्मिरहितश्च तदा तदा भवतीति वृद्धगर्ग उवाच।

कांस्यपात्रनिभस्सूर्यश्शशांक इव लक्ष्यते।
विरश्मिर्नभसोमध्ये महद्भयकरः स्मृतः।।[27]

मयूरचित्रे आदर्श इव रविर्भवतीति आदर्श इव सूर्ये च जनदेश — भयं भवेत् इति वचनात् विज्ञायते।[28]

रवौ छिद्रदर्शनं भवतीति स्थितम्। यथा —

युवराजवधश्छिद्रे वधो माण्डलिकस्य च
रविबिम्बस्थछिद्रं बुधाच्छादनकृतमिति व्याख्यातृवचनाद्विज्ञायते।
"रवौ अधः भार्गवकृतछिद्रमपि भवतीति तद्वचनाद्ज्ञातव्यम्"।।[29]

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[23] तत्रैव, 23 तम पत्रम्।

[24] तत्रैव, 23 तम पत्रम्।

[25] तत्रैव, 24 तम पत्रम्।

[26] तत्रैव, 24 तम पत्रम्।

[27] तत्रैव, 25 तम पत्रम्।

[28] तत्रैव, 25 तम पत्रम्।

[29] तत्रैव, 26 तम पत्रम्।

पराशरस्तु सर्वतश्छिद्रवन्तं सूर्यमप्यवोचत्।

"सर्वतश्छिद्रो द्विधा वा दृश्यमानो राज्ञः मृत्युं देशविनाशं व्याचष्टे" इति[30]

भास्करार्धदर्शनं, कम्पनं, भ्रमणं तदा तदा भवन्तीति मयूरचित्रवचनमस्ति।

दृश्यते भास्करस्यार्धं गृहीतमिवचापरम्।
कम्पते यदि वाप्येव तदा विद्याज्जनक्षयम्।।

उदयास्तमये भानौ चक्रवद्भ्रमणे सति।
परचक्रागमो व्याधिर्देशस्य च परिक्षयः।।[31]

एवं रविबिम्बे विविधान्यद्भुतानि प्राचीनभारतीयैर्दृष्टानि वर्तन्ते।

अगस्त्यः शातकुम्भनिभः, स्फटिकसदृशश्च दृश्यते।

यथा वराहसंहितायाम्

शातकुम्भनिभं स्फटिकाभम्। तर्पयन्निव महीं किरणाद्यैः।।
दृश्यते यदि मही प्रचुरान्ना। भूर्भवत्यभयरोगजनाढ्या।।[32]
कदाचनागस्त्यः स्वल्परूपेणापि दृश्यते। स्पन्दनस्सन् वर्तते।

यदाह पराशरः

संवृतः पुररोधाय स्पन्दनो भयाय।
कपिलधूम्रमाञ्जिष्ठवर्णैरपि तदा तदा वर्तते।

यथा वराहसंहितायामेव

रोगान् करोति कपिलः परुषस्त्ववृष्टिम्।
धूम्रो गवामशुभकृत् स्फुरणो भयाय।।

माञ्जिष्ठरागसदृशः क्षुधमाहवञ्च।
कुर्यादणुश्च पुररोधमगस्त्यनामा।।

नीलः अग्नि परुषश्च कदापि दृश्यते।[33]

यथा पराशरः

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[30] तत्रैव, 27 तम पत्रम्।

[31] तत्रैव, 28 तम पत्रम्।

[32] तत्रैव, 202 तम पत्रम्।

[33] तत्रैव, 202 तम पत्रम्।

नीलोतिवर्षाय अग्निपरुषरुक्षाभो रोगाय इति।

सप्तर्षयः कदापि कान्तिहीना भवन्ति

यथा भीष्म पर्वणि

सप्तर्षीणामुदाराणां समवच्छाद्यते प्रभा।[34]

गर्गस्तु

हता विवर्णास्स्वल्पा वा किरणैः परिवर्जिताः।

इति सप्तर्षीणां स्वल्परूपदर्शनमपि भवतीत्याह।[35]

विष्णुधर्मोत्तरे सप्तर्षीणां वर्णवैविध्यं वर्तत इत्युक्तम्।[36]

अगस्त्योऽरुणो रुक्षः श्यावो रेणूल्कयोपहतः शिखि शिखाध्वस्तो भयाय

एवंविधाः सप्तर्षयश्च पीडाकराः एवं विधे धृवे त्रैलोक्यमपि पीड्यते।[37]

भीष्मपर्वण्यपि

धृवः प्रज्वलितो घोरमपसव्यं प्रवर्तते इति।[38]

यद्यप्येते मुनयः सूर्यादीनां वर्णविपरिणामात् जनानां शुभाशुभसूचनं वदन्ति। तत्काले तेषां परिशीलनेन दृष्टानि तैर्लिखितानि। अद्य तद्विषयपरिशोधनेन निर्धारयितव्यानि सन्ति। एतानि तत्र भवता राजाधिराज वल्लालसेनेन अद्भुतसागरनामकसंकलनग्रन्थे विविधसंहिताग्रन्थेभ्य उद्धृतानीति तस्मै धन्यवादान् समर्पयामि।

नक्षत्राणां चलनं नास्तीति केषाञ्चित् ज्यौतिषिकानां अभिप्रायोऽस्ति।[39] किन्तु वेदे नक्षत्राणां चलनमस्तीति वर्तते। "कृत्तिकाः प्रथमम्, विशाखे उत्तमम्, तानि देवनक्षत्राणि, अनूराधाः प्रथमम्, अपभरणीरुत्तमम्, तानि यमनक्षत्राणि, यानि देवनक्षत्राणि, तानि दक्षिणेन परियन्ति, यानि यमनक्षत्राणि तान्युत्तरेण"[40] इति नक्षत्राणां सञ्चारः तत्रवर्णितः। मैत्रेयोपनिषदि

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[34] तत्रैव, 204 तम पत्रम्।

[35] तत्रैव, 204 तम पत्रम्।

[36] तत्रैव, 204 तम पत्रम्।

[37] तत्रैव, 205 तम पत्रम्।

[38] तत्रैव, 206 तम पत्रम्।

[39] सूर्यसिद्धान्तः, सुधाकर द्विवेदी ग्रन्थमाला, संपूर्णानन्द संस्कृत-यूनिवर्शिटी, वाराणसि, 1987, 12 पत्रम्।

[40] तैत्तिरीयब्राह्मणम् 1.5.2.7।

ध्रुवचलनमपि श्रुतमभवत्।[41]

यूरप् स्पेस् ऐजन्सीस् संस्था उपग्रहात् प्लांक् टेलिस्कोप् द्वारा एकसंवत्सरकाले सकलस्यास्य विश्वस्य छायाचित्रनिर्माणमकरोत्। जूलै पञ्चमतारीकायां दशोत्तर द्विसहस्रतमाब्दे तच्चित्राविष्करणमकुर्वन्।[42]

तस्मिन् वेदोक्त शिशुमारः, प्रणवश्च स्थितौ। तैत्तिरीयारण्यके शिशुमारवर्णनमेवमस्ति "यस्मै नमस्तच्छिरो धर्मो मूर्धानं ब्रह्मोत्तरा हनुर्यज्ञोऽधरा विष्णुर्हृदयं संवत्सरः प्रजननमश्विनौ पूर्वपादावत्रिर्मध्यं मित्रावरुणावपरपादावग्निः पुच्छस्य प्रथमं काण्डं तत इन्द्रस्ततः प्रजापतिरभयं चतुर्थं सवा ऐष दिव्यश्शाक्वरश्शिशुमारः"।[43]

अत्र वर्णिताः मूर्धा, हनु, हृदय, प्रजनन मध्य, पुच्छ काण्डाः विश्व चित्रे दृश्यन्ते। अपि च चित्रेऽस्मिन् प्रणवलिपिः वर्तते। प्रणवस्य प्रशंसा उपनिषत्सु अस्ति। माण्डूक्योपनिषदि प्रणवोपासनमस्ति। या प्रणवलिपिः विश्वचित्रे अस्ति सैव हरप्पासंस्कृत्यवयवेषु पशुपतिमुद्रिकायां दक्षिणभागे वर्तते। तस्य वाचकः प्रणवः इति पतंजलिमुनेः योगसूत्रेषु ईश्वरस्य प्रणवस्य च वाच्य वाचक भावोऽस्ति। सैव प्रणवलिपिरद्यापि व्यवहारे वर्तत एव।[44]

वेधशाला टेलिस्कोप् इत्याद्याधुनिकोपकरणरहिते काले प्राचीनभारतीयाः एतादृश खगोळपरिशीलनमकुर्वन्निति एते विषया निरूपयन्ति।

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41 मैत्रेयोपनिषत् प्रथमोऽध्यायः, 2 अष्टोत्तर शतोपनिषदः, वाविळ्ळ प्रेस, मद्रासु, चेन्नपुरि, 1954, 451 पत्रम्।

42 http://www.esa.intCP/SEMF2FRZ5BG_index_0.html।

43 तैत्तिरीयारण्यकम् 2 प्र. 19 अनु.।

44 योगसूत्रवृत्तिः, श्री सदाशिवेन्द्रसरस्वति, वाणीविलासमुद्रणालयम्, 1927, 15 पत्रम्।

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सूर्यसिद्धान्ते अन्तरीक्षशास्त्रम्

ई.एन्. ईश्वरन्

अत्र अन्तरीक्षं नाम "द्यावापृथिव्याः अन्तर् ईक्ष्यते"[1] इति व्युत्पत्त्या प्रदीयमानोऽर्थो वा "नभोऽन्तरीक्षं गगनम्....।"[2] इत्यादि कोशगतार्थे वा गृह्यते। अन्तर् ऋक्षाण्यस्य इत्यर्थे "पृषोदरादित्वात्"[3] इत्वम् कल्पयित्वा अन्तरिक्षम् इत्यपि प्रयुज्यते। अन्तरीक्षसम्बन्धि शास्त्रम् अन्तरीक्षशास्त्रम् *Atmospheric Science* इति विशालार्थे। Meteorology इत्यर्थे अन्तरीक्षशास्त्रमिति प्रयोगः एकदेशार्थे।

सूर्यसिद्धान्तः त्रिविधः इति पण्डितमतम्। तत्रैकः आर्षः द्वितीयः वराहमिहिरप्रतिपादितः तृतीयः अधुना उपलभ्यमानश्चेति। अर्वाचीनसूर्यसिद्धान्तस्य आर्यभटमतस्य बहुसाम्यता दृश्यते। अर्वाचीनमिति कथनमस्ति चेदपि अस्य रचनाकालः "शकेन्द्रपञ्चमशतकादर्वाचीनम् कदापि न सम्भवति"[4] इति आचार्यलोहमणिदहालः भारतीयज्योतिषशास्त्रस्येतिहासे स्फुटं वदति। कालः कदापि भवतु अयं सिद्धान्तग्रन्थः सर्वादृतः आसीदिति अनन्तरकालिकानामुद्धरणेभ्यः ज्ञायते।

सम्प्रति उपलभ्यमाने सूर्यसिद्धान्ते चतुर्दशाधिकाराः दृश्यन्ते। ते च मध्यम-स्पष्ट-त्रिप्रश्न-छेद्यक-चन्द्रग्रहण-सूर्यग्रहण-ग्रहयुति-भग्रहयुति-उदयास्त-चन्द्रश्रृङ्गोन्नति-पात-भूगोल-ज्योतिषोपनिषद्-मानादयः भवन्ति।

अचिन्त्याव्यक्तरूपाय निर्गुणाय गुणात्मने।
समस्तजगदाधारमूर्तये ब्रह्मणे नमः।।[5]

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1 अ.को.रा.व्या.पु. 36।

2 अ.को. 1.2.1.

3 पा.सू. 6.3.109.

4 भा.ज्यो.इ.पु. 74.

5 सू.सि. 1.1.

इति मङ्गलश्लोकेन जगदाधारस्वरुपं परब्रह्मं नमस्कृत्य सूर्यसिद्धान्तस्यास्योत्पत्तिं प्रतिपादयति। यथा —

अल्पावशिष्टे तु कृते मयो नाम महासुरः।
रहस्यं परमं पुण्यम् जिज्ञासुर्ज्ञानमुत्तमम् ।।

वेदाङ्गमग्र्यमखिलं ज्योतिषां गतिकारणम् ।
आराधयन् विवस्वन्तं तपस्तेपे सुदुश्चरम्।।[6] इति ।

ज्योतिर्गोलानां गतिकारणः सविता तपसा तुष्टः मयासुराय ज्ञानोपदेशं कृतवान् इत्यतः अस्य सूर्यसिद्धान्तः इति नाम।

तोषितस्तपसा तेन प्रीतस्तस्मै वरार्थिने।
ग्रहाणां चरितं प्रादान्मयाय सविता स्वयम्।।[7]

एवं मयासुरकृतेऽस्मिन्ग्रन्थे भूगोलाधिकारे बहुविधान् अन्तरीक्षशास्त्रविषयान् द्रष्टुं शक्नुमः।

भूमेरुपर्युपर्यूर्ध्वाः किमुत्सेधाः किमन्तराः।
ग्रहर्क्षकक्षाः किं मात्राः स्थिताः केन क्रमेण ताः ।।[8]

इत्यादिभूमेः अन्तरीक्षविषयकः मयासुरप्रश्नः। तत्र सूर्यसमाधानमिति दृष्ट्या अनेके विषया प्रतिपादिताः। सूर्य एव कालस्य कारणम् कालनियन्त्रकः इत्यादि विचारः दृश्यते। यथा —

अहोरात्रव्यवस्थां च विदधाति कथं रविः।

कथं पर्येति वसुधां भुवनानि विभावयन्।।[9] इति मयासुरप्रश्नः। ततश्च देवासुरादिकालभेदः दिवसादीनामधिपाः ग्रहकक्षाक्रमः नक्षत्रस्थितिः इत्यादिभिस्सह धनसञ्चारमार्गः कः इत्यपि सूर्यः स्पष्टयति ।

ब्रह्माण्डमेतत् सुषिरं तत्रेदं भूर्भुवादिकम् ।
कराहद्वितयस्येव सम्पुटं गोलकाकृति ।।

ब्रह्माण्डमध्ये परिधिर्व्योमकक्षाभिधीयते ।
तन्मध्ये भ्रमणं भानामधोऽधः क्रमशस्तथा ।।

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[6] तत्रैव 1.2-4.

[7] तत्रैव 1.4.

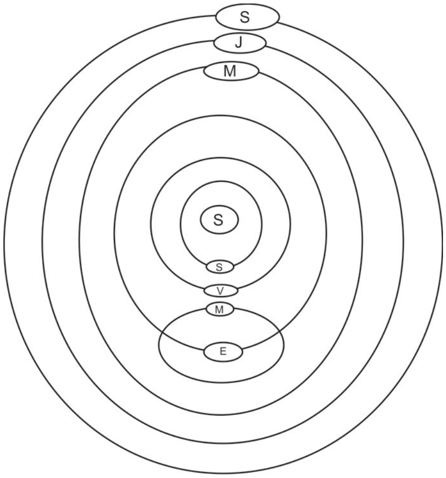
[8] तत्रैव 12.7.

[9] तत्रैव 12.3.

मन्दामरेज्यभूपुत्रसूर्यशुक्रेन्दुजेन्दवः।
परिभ्रमन्त्यधोऽधस्था सिद्धाः विद्याधराः घनाः।।[10] इति।

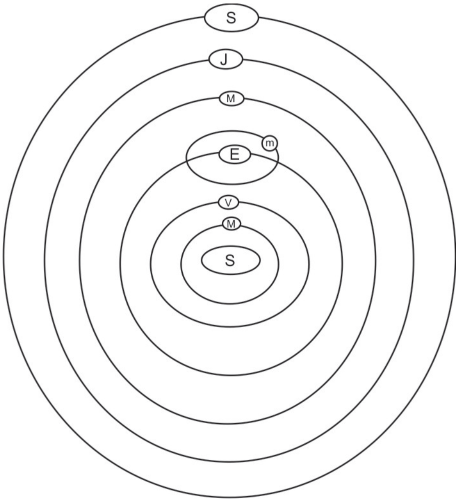
ब्रह्माण्डपरिधिः व्योमकक्षा इति विचारः। चन्द्रादधः एव मेघानां सञ्चारमार्गः इत्यादि विषयाः स्फुटाः।

प्राचीनम् सौरयूथम्



[10] तत्रैव 12.29-31.

आधुनिकम् सौरयूथम्



केचन वदन्ति यत् प्राचीनं सौरयूथं न भौमयूथं एवेति। तत्तु सर्वधा असमञ्जसमिति अनेनैव ज्ञायते। अत्र शुक्रेन्दुजोः परिवर्तनं विचिन्त्यम्।

"ज्योतिषां गतिकारणम्" इत्यतः ज्योतिर्गोलानां गतिकारणः सविता एवेति भावः। "कथं पर्येति वसुधां भुवनानि विभावयन्" इत्यतः वसुधां भुवनानि च विभावयन् गृह्णन् रविः कथं पर्येति इति व्याख्येयोऽयम् ग्रन्थः।

ऋतोः अनुसारेण सूर्यरश्मिभेदाः कीदृशाः इति यथा —

ग्रीष्मे तीव्रकरो भानुर्न हेमन्ते तथाविधः ।[११]

अत्यासन्नतया तेन ग्रीष्मे तीव्रकराः रवेः।[१२] इत्यादि च ।

एवं बहुविधा अन्तरीक्षशास्त्रविषया अत्र सूर्यसिद्धान्ते प्रतिपाद्यन्ते ।

[11] तत्रैव 12.8.

[12] तत्रैव 12.46.

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सिद्धान्तशेखरः

ए. श्रीपाद भट्टः

यत्तेजः पितृधाम्नि शीतमहसः पाथोमये मण्डले
संक्रान्तं कुमुदाकरस्य कुरुते काञ्चिद्विकासश्रियम् ।
चञ्चच्चञ्चुपुटेश्चकोरनिकरैश्चापीयतेऽसौ चिरं
त्रैलोक्यालयदीपको विजयते देवो निधिस्तेजसाम् ।।

सिद्धान्तशेखरः प्राचीनभारतीयप्रसिद्धज्योतिषग्रन्थेषु अन्यतमः। 1039 क्रिस्ताब्दे श्रीपतिर्नामा ज्योतिर्विद् ग्रन्थमिमं व्यरचयत्। काश्यपगोत्रोद्भवस्य श्रीपतेः पितुर्नाम नागदेव इति। उज्जैनीतः 150 क्रोशस्थिते रोहिणीखण्डे अयं न्यवसदिति ज्ञायते। अयमेव श्रीपतिः जातकपद्धतिं तथा च रत्नमालाख्यं मुहूर्तग्रन्थमपि ग्रथितवानिति तर्क्यते। श्रीपतेर्विषये इतोऽप्यधिकं नोपलभ्यते ।

त्रयोदशशताब्दे स्थितेन मक्किभट्टेन गणितभूषणाख्येन स्वीयव्याख्यानेन सिद्धान्तशेखरः समलंकृतः। किन्तु व्याख्यानमिदं त्रिप्रश्नाधिकारस्य 75 श्लोकपर्यन्तमेव समुपलभ्यते। सिद्धान्तशेखरोऽयं 1932 तमे क्रिस्ताब्दे कलकत्ताविश्वविद्यालयेन प्रकाशितः यश्च श्रीमद्भिः भावूजीमिश्रामहोदयैः सम्पादितः। मुद्रितग्रन्थस्यावशिष्टभागः सम्पादकमहोदयैः स्वीयविवरणाख्येन व्याख्यानेन संयोजितः। ग्रन्थोऽयं सम्प्रति कुत्रापि नोपलभ्यते। भाग्यवशात् राजमहेन्द्रीपुरनिवासिभिः स्वनामधन्यैः श्रीमधुरकृष्णमूर्तिशास्त्रिपादैः मह्यं मुद्रितपुस्तकस्य प्रतिलिपिः सम्प्रेषिता येनाहं ग्रन्थममुं पठितुं पारितवान्।

ग्रन्थेऽस्मिन् 20 अध्यायाः सन्ति। ब्रह्मगुप्तस्य ब्रह्मस्फुटसिद्धान्तमाधारीकृत्य श्रीपतिना सिद्धान्तशेखरः रचितः इति प्रतिभाति। परन्तु विषयनिरूपणावसरे आकर्षकछन्दांसि प्रयुज्य लल्लस्य शैलीमनुकरोति श्रीपतिः। ब्रह्मगुप्तविरचितं ब्रह्मस्फुटसिद्धान्तं, लल्लविरचितं शिष्यधीवृद्धिदं सम्यक् परिशील्य श्रीपतिना सिद्धान्तशेखरः विरचितः। न केवलमयं त्रिस्कन्धज्योतिषे एव निपुणः अपि तु व्याकरणे छन्दश्शास्त्रे च परिणतः आसीदिति तत्कृतग्रन्थावलोकनेन स्पष्टं

प्रतिभाति। अनन्तरकालिकः प्रसिद्धः भास्करः स्वसिद्धान्तशिरोमणिग्रन्थं श्रीपतेः सिद्धान्तशेखरं बहुधा अवलम्ब्यैव रचितवानिति उच्यते चेत् नातिशयोक्तिः। भास्कराचार्यस्य सिद्धान्तशिरोमणेः मध्यमाधिकारः श्रीपतेः सिद्धान्तशेखरस्य साधनाध्यायेन बहुसाम्यमावहति। प्रायः साधनाध्यायोक्ताः एव विषयाः भास्करेण पदानि छन्दांसि च परिवर्त्य निरूपिताः इति ग्रन्थपर्यालोचनेन स्पष्टं भवति।

सिद्धान्तशेखरस्य मध्यमाधिकारे अहर्गणानयने, ग्रहाणामध्यमानयने च बहवः प्रकाराः निरूपिताः। मक्किभट्टस्य व्याख्यानमपि चमत्कारपूर्णं विद्यते। व्याख्यानस्य वैशिष्ट्यद्योतनार्थमिदमेकमुदाहरणं प्रस्तूयते। साधनाध्याये कुदिनस्य परिभाषामित्थं निरूपयति मक्किभट्टः —

> भूमेः सम्बन्धिनो दिवसा इत्यर्थः। भूमिः प्राङ्मुखी भ्रमति। सा च यावत्तावतो वारान् क्षितिजे रविणा सह सम्बन्ध्यते तावन्ति सावनदिनानि भूदिनानीत्युच्यन्ते। इति

भूमेः दैनन्दिनमक्षभ्रमणं निरूपयति। एतेनेदं स्पष्टं जायते यत् बहवः प्राचीनाः भारतीयज्योतिर्विदः भुवः भ्रमणं जानन्त एव आसन्। किन्तु साम्प्रदायिकानां विशोधभयात् भचक्रभ्रमणमेवाङ्गीचक्रुरिति। कृतयुगादीनां सौरवर्षसङ्ख्यानिरूपणावसरे "कटपयादि"अक्षरसङ्ख्याविधानेन "ज्ञान" पदं प्रयुज्य स्वीयं नैपुण्यं प्रदर्शयति मक्किभट्टः —

ज्ञानो निर्जरैः सेव्यः	—	1,728,000
ज्ञानी नीतिधारकः	—	1,296,000
ज्ञानिनो वित्तदाः	—	8,64,000
ज्ञानेन श्रीलाभः	—	4,32,000

अहर्गणानयनावसरे केवलं कटपयादि अक्षरसङ्ख्याविधिनेनैव स्वकालिकाहर्गणमेकं सोदाहरणं निरूपयति। वारप्रवृत्तिप्रसङ्गे मध्यमाध्याये बहूनां मतान्तराणि प्रदर्शयति —

केचिद्वारं सवितुरुदयादाहुरन्ये दिनार्धात्
भानोरर्धास्तमयसमयादूचिरे केचिदेवम् ।
वारस्यादिं यवननृपतिर्दिङ्मुहूर्ते निशायां
लाटाचार्यः कथयति पुनश्चार्धरात्रे स्वतन्त्रे ।। 10 ।।

स्वीयं मतमधोनिर्धिष्टरीत्या निरूपयति —

सृष्टेर्मुखे ध्वान्तमये हि विश्वे ग्रहेषु सृष्टेष्विनपूर्वकेषु ।
दिनप्रवृत्तिस्तदधीश्वरस्य वारस्य तस्मादुदयात् प्रवृत्तिः ।। 11 ।।

श्रीपतिना अपवर्तनस्य सौकर्यार्थं त्रिज्या 3415 मिता स्वीकृता। चतुर्विंशतिर्ज्याः अपि

ब्रह्मगुप्तादीनामपेक्षया किञ्चित् भिन्नाः स्वीकृताः। पाठपठितज्याभिर्विनैव दोःकोटिजीवे सम्पादयितुं श्रीपतिः नूतनमुपायमाह यच्च इतरसिद्धान्तग्रन्थेषु नोपलभ्यते।

यथा स्पष्टाधिकारे —

दोःकोटिभागरहिताभिहताः स्वनाग चन्द्रास्तदीयचरणोनशरार्कदिग्भिः।
ते व्यासखण्डगुणिता विहताः फले तु ज्याभिर्विनैव भवतो भुजकोटिजीवे ।। 17 ।।

अस्य सूत्रं एवं निरूप्यते —

(180° - इष्टभुजांशाः) = क

क X (180 - क) = ग

10,125 - (ग/4) = द

(ग X त्रिज्या)/ द = इष्टज्या

अस्यैकमुदाहरणं मया निरूप्यते —

इष्टभुजांशाः = 50°

180 - 50 = 130

130 X 50 = 6,500

6,500/4 = 1,625, त्रिज्या = 3,415

10,125 - 1,625 = 8,500

(6,500 X 3,415)/ 8,500 = स्वल्पान्तरेण ज्या 2,611

एवमेव इष्टज्यायां ज्ञातायां चापसाधनक्रमोऽपि पठितज्याभिर्विनैव निरूपितः श्रीपतिना, यच्च विश्तारभयात् न प्रदर्श्यते। प्रायः अमुमेवप्रकारमवलम्ब्य ग्रहलाघवकारः गणेशः पठितज्याभिर्विनैव कर्मसम्पादयतीति विश्वस्यते।

त्रिप्रश्नाध्यायः अत्यन्तं विस्तरेण श्रीपतिना निरुपितः। दिग्ज्ञानोपायसन्दर्भे क्रान्त्यक्षांशान् विहायापि दिक्साधनक्रमः निरूपितः। पलभामानेतुं विशिष्टप्रकारः तेनोक्तः यः श्रीपतेः कुशाग्रमतित्वं द्योतयति —

अजतुलादिगतस्य विवस्वतो दिनदलप्रभयोर्युतिरर्धिता ।
भवति वैषुवती निजदेशजा तदिनवर्गयुतेश्च पदं श्रुतिः ।।

मेषादिगतस्य तुलादिगतस्य च भानोर्ये मध्याह्नच्छाये तयोर्युतिरर्धिता निजदेशजा पलभा भवतीति

श्रीपतिः निरूपयति। अत्र सूक्ष्मातिसूक्ष्मफलसाधनमेव श्रीपतेर्लक्ष्यमिति स्फुटं जायते। यदा छायातः रवेर्भुजांशाः आनीयन्ते तदा पदज्ञानपुरस्सरं राश्यादिकस्य रवेज्ञानार्थं विनूतनोपायः कमलाकरेण गर्वेण प्रतिपादितः सः उपायः वस्तुतस्तु श्रीपत्याविष्कृत एव। यथा त्रिप्रश्नाधिकारे —

आद्ये पदेऽपचयनी पलभाल्पिका स्यात्
छायाल्पिका भवति वृद्धिमती द्वितीये ।
अक्षद्युतेः समधिकोपचिता तृतीये
तुर्ये पुनः क्षयवती तदनल्पिका च ।। 70 ।।

एवं पलभा-दिनार्धच्छाये आश्रित्य सुलभप्रकारेण पदज्ञानपुरस्सरं राश्यादिकस्य रवेः ज्ञानोपादः श्रीपतिना प्रतिपादितः। त्रिप्रश्नाधिकारे यथासम्प्रदायं प्रश्नान् आशंक्य समाधानानि च प्रदर्शयति।

व्यासपरिधिसम्बन्धविषयेऽपि व्यासवर्गाद्दशगुणात् मूलं परिधिरिति स्थूलमपि प्राचीनानां मतमेव स्वीकृतम्। ग्रहयुद्धाध्यायस्य प्रथमश्लोके —

अन्त्यभ्रमेण गुणिता रविबाहुजीवा-भीष्टभ्रमेण विहृता फलकार्मुकेण।
बाहोः कलासु रहितास्ववशेषकं ते यातासवो युगयुजोः पदयोर्धनर्णम् ।।

इति उदयान्तरकर्मणः सूचनां दत्वा अग्रिमश्लोके अन्यं विषयं निरूपयति। सिद्धान्तशिरोमणौ यावत् अस्य उदयान्तकर्मणः वैशद्यं प्रस्तुतं तावदत्र नोपलभ्यते। केचित् विद्वांसः भास्कराचार्यैः श्रीपतेरमुमाशय- मवलम्ब्यैव उदयान्तरं कर्मप्रतिपादितमिति प्रतिपादयन्ति। अस्यैव अध्यायस्य 2-4 श्लोकेषु चन्द्रस्य दृग्गणितसिद्ध्यर्थं संस्कारविशेषं श्रीपतिः प्रतिपादयति यश्चायं संस्कारः आधुनिकानां "ईक्वेशन् वेरियेशन्" (equation variation) इति संस्काराभ्यां स्वल्पान्तरेण साम्यं वहतीति विद्वांस आमनन्ति। श्रीपतिना सिद्धान्तशेखरे व्यक्ताव्यक्तगणिताध्यायौ संयोजितौ विद्येते। भूसंस्थानविषये श्रीपतिना स्वसिद्धान्ते प्रतिपादिता विषयाः सर्वेऽपि भास्कराचार्यैः तेनैव क्रमेण सिद्धान्तशिरोमणौ पदान्तरैः प्रस्तुता इति तु विस्मयं जनयति। भास्कराचार्यैः यश्चापूर्वः भुवः आकर्षणशक्तिसिद्धान्तः समुपस्थापितः स सिद्धान्तः प्रायः सिद्धान्तशेखरस्य प्रेरणया तन्मनसि समुत्पन्न इति प्रतिभाति। यथा गोलाध्याये —

नभस्ययस्कान्तमहामणीनां मध्ये स्थितो लोहगुडो यथास्ते ।
आधारशून्योऽपि तथैव सर्वाधारो धरित्र्या ध्रुवमेव गोलः।। 22 ।।

रविचन्द्रयोरुपरागकारणं राहुरिति पुराणमतं निराकर्तुं राहुनिराकरणाध्यायः इति पृथगध्याय एव श्रीपतिना सिद्धान्तशेखरे संयोजितः इत्यनेन तस्य वास्तवस्थितिनिरूपणविषये महान् आग्रहः

आसीदिति ज्ञातुं शक्यते। यथासम्प्रदायं अस्मिन्नपि ग्रन्थे अन्ते प्रश्नाध्यायमपि संयोज्य जिज्ञासूनां ज्ञानपिपासां संवर्धयति श्रीपतिः।

यद्यपि निजपूर्ववर्तिभ्यः ज्योतिषग्रन्थकर्तृभ्यः विशिष्य लल्लब्रह्मगुप्ताभ्यां च बहून् विषयान् समादाय श्रीपतिना सिद्धान्तशेखरः विरचितस्तथापि बहुत्र स्वबुद्धिबलात् अपूर्वानपि कांचन शास्त्रविषयान् विदुषां छात्राणां च विनोदाय आविष्कृतवानित्यत्र नास्ति संशयलेशोऽपि। भास्कराचार्यैः सिद्धान्तशिरोमणौ बहवः श्रीपतिप्रतिपादिताः विषयाः पदान्तरैः भिन्नच्छन्दोभिः निरूपिताः इति श्रीपतेः सिद्धान्तशेखरस्याध्ययनेन स्पष्टं प्रतिभाति। केवलं स्थालीपुलाकन्यायेन सिद्धान्तशेखरस्य परिचयः दिङ्मात्रेण प्रबन्धेऽस्मिन् प्रस्तुतः।

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अहर्गणानयनम्

केशव मिश्रः

अह्नां दिनानां गणः समूहोऽहर्गणः इति। वस्तुतस्तु त्रिस्कन्धात्मके ज्योतिषशास्त्रे सिद्धान्तज्योतिषशास्त्रस्य मूलभूतप्रयोजनं गणितेन ग्रहानयनमेव। अस्माकं प्राचीनमहर्षिभिः दिव्यचक्षुषा सततावलोकनपद्धत्या (वेधेन) च ग्रहाणामानयनं कृतमस्ति। तद्बलेन तत्र ग्रहाणां युगे कल्पे वा भगणाः अर्थात् (द्वादशराशिसमूहः) पठिताः सन्ति, तेनैवाधारेण युगस्य गणनां कृत्वा वर्तमानदिने ग्रहाणां स्थितिज्ञानार्थं दिनगणमावश्यकं भवति। अतः सर्वप्रथमं ग्रहज्ञानार्थं अहर्गणानयनं सर्वप्रथमं क्रियते। यतो हि ग्रहाणां द्वादशराशिभागो भगणाः कथ्यन्ते। यदि अद्य ग्रहस्थितिं ज्ञानम् अपेक्ष्यते चेत् तदा कल्पारम्भात् अद्य यावत् कियद्दिनं गतमित्येव कल्पारम्भात् वर्तमानदिनं यावत् दिनसमूहः एवाहर्गणः। वस्तुतः ज्योतिषशास्त्रे सिद्धान्त-तन्त्र-करणग्रन्थानुसारेण अहर्गणानयनं क्रियते। प्रसङ्गवशात् अस्य विवेचनमपि क्रियते। तत्र कल्पादेः यत्र ग्रहानयनं स सिद्धान्तः, यत्र युगादेः ग्रहानयनं तत्तन्त्रम्, इष्ट-शकादितः यत्र ग्रहानयनं क्रियते तत् करणमिति अभिधीयते। एवं त्रिष्वपि सिद्धान्तेषु प्रक्रिया पृथक् पृथक् दृश्यन्ते। परन्तु सर्वास्वपि प्रक्रियासु गणितोत्पत्तिः समाना एवोपलभ्यते। सम्प्रति ग्रहानयनस्य प्रक्रिया करण-ग्रन्थाधारेण भवति।

सर्वेष्वपि सिद्धान्तग्रन्थेषु कुदिने ग्रहाणां भगणाः पठिताः सन्ति, तद्वशात् ग्रहाणां दैनिकगतिः अनुपातेन सरलतया ज्ञातुं शक्यते, परन्तु केवलं गतिज्ञानेन वर्तमानस्थितिज्ञानं न कदापि सम्भवति। अतः त्रैराशिकगणितबलेन तृतीयराशिः ज्ञायते। अहर्गणानयनं तु चान्द्रसावननाक्षत्रसौरभेदाच्चतुर्विधमस्ति। तत्र रवेः क्रान्तिवृत्तस्य कांशभोगेन सौरः, रविचन्द्रयोः द्वादशान्तरेण एकतिथिभोगेन चान्द्रः, सूर्योदयादुदयं यावत्सावनम्, भोदयेन भास्तपर्यन्तं नाक्षत्रमिति चतुर्षु मनुजव्यवहार्येषु अन्यसाधनसापेक्षत्वे अपि ग्रहादिसाधनाय सर्वैः प्राचीनार्वाचीनैराचार्यैः सावनात्मक एवाहर्गणः प्रसाधितः।

तत्र सौरचन्द्रयोरन्तरमधिदिनानि चान्द्रसावनयोरन्तरं च क्षयदिनानि कथ्यन्ते। यदि सूर्योदयसमये एव रविचन्द्रौ मेषादिस्थौ गताविति, तदा युगपत् सौरसावननाक्षत्रचान्द्रदिनानां प्रवृत्तिर्जातेति सुविदितमेव। तदानीं रवेः राश्यादिगतत्वात् सौरदिनादिः "उदयादुदयं भानोः सावनं

दिनमुच्यते"[1] अनेन सावनदिनादिः, तत्र यन्नक्षत्रं तदानीम् उदयक्षितिजस्थं तदुदयान्नाक्षत्रदिनादिः, रविचन्द्रयोरेकत्रगतत्वत्तदानीं "दर्शः सूर्येन्दुसङ्गमः"[2] इति परिभाषया अमान्तकाल-घटनेन चान्द्रदिनादिः अपि सञ्जातः ।

ततः प्रवाहगत्या पश्चिमाभिमुखं गच्छन् सूर्यो यदा पुनः उदयक्षितिजे समागतः "तदा इनोदयद्वयान्तरं तदर्कसावनं दिनम्"[3] इति परिभाषया एकसावनदिनस्य पूर्तिर्जाता, नाक्षत्रं दिनं तु इतः पूर्वमेव पूर्णं जातम्, यतो हि तन्नक्षत्रं रवितः पश्चिमगतं वर्तते। अतः तन्नक्षत्रादेकसावनसम्बन्धिगतिकलया पूर्वदिशि अन्तरितो रविः उदयक्षितिजे अस्ति इति ज्ञायते। तदा च रवेः प्राग्भागे गत्यन्तरकलाभिः चन्द्रो वर्तते, तत्र एकसावनदिने रविगतिः 59'/8" चन्द्रगतिः 790'/35" अनयोः अन्तरम् 7317'/27" इदं द्वादशसङ्ख्याभिः विभज्यते = (50 + (11/27))/12।

अस्य षष्टिघट्यधिकदर्शनाद् इतःपूर्वमेव चान्द्रदिनस्य पूर्तिः जाता। तथा च तत्र एकसावनदिनसम्बन्धीया रविगति 59'/8" इयम् एकांशाल्पा, अर्थात् एकांशभोगेन एकं सौरदिनं भवति, तेन सौरदिनस्य पूर्तिः जाता, अतः अनेन ज्ञायते यत् सौरदिनात् अल्पं सावनदिनम्। सावनदिनात् अल्पं चान्द्रदिनम् इति। यदा कस्यापि पदार्थस्य यथा यथा अल्पसङ्ख्यया मापनं क्रियते तथा तथा तन्मापनसङ्ख्याः अधिका जायते इति प्रमाणाधारेण कल्पप्रमितकालस्य पृथक्-पृथक् चान्द्रसावनसौरदिनप्रमाणैः विभक्तसङ्ख्यया उत्तरोत्तरम् अल्पा स्यात्। तथा अत्र कल्पे चान्द्रदिनसङ्ख्या सावनसौरदिनसङ्ख्यातः अधिका। तत्रापि सावनदिनसङ्ख्या सौरदिनसङ्ख्यातःअधिका एव।

अत्र केवलं रविसावनवशेनैव दिनरात्र्योः प्रत्यक्षदर्शनात् रविसावनदिनगणः एव अहर्गणः साधितः। अथ सौरचान्द्रान्तरम् अधिशेषं, चान्द्रसावनयोः अन्तरम् अवमिति परिभाषया त्रैराशिकं क्रियते अत्र सौरचान्द्रसावनेषु तिसृषृ राशिषु साजात्यात् कल्पाधिशेषावमाभ्यामन्यराशिज्ञानं भवति इत्यत्र नैव कोऽपि त्रैराशिकयुक्तिः निवारयितुं शक्यते। साजात्येषु समानसम्बन्धत्वनिश्चयात्। अतः अत्र प्रथमं कल्पादितः अभीष्टदैवसिक अहर्गणानयने तद्विनिगमकाः सौरमासाः साध्यन्ते।

यथोक्तं सूर्यसिद्धान्ते अहर्गणानयनम् –

अत उर्ध्वममी युक्ता गतकालाब्दसङ्ख्यया।
मासीकृता युता मासैर्मधुशुक्लादिभिर्गतैः ।।

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[1] सू०सि०म०अ०, श्लो०सं० 36।

[2] अमरकोशः।

[3] सि०शि०म०अ०का०मा०अ०, श्लो०सं० 20।

पृथकस्थास्तेऽधिमासाघ्नाः सूर्यमासविभाजिताः ।
लब्धाधिमासकैर्युक्ता दिनीकृत्य दिनान्विताः ।।

द्विष्टास्तिथिक्षयाभ्यस्ताश्चान्द्रवासरभाजिताः ।
लब्धोनरात्रिरहिता लंकायामार्धरात्रिकः ।।

सावणो द्युगणः सूर्याद्दिनमासाब्दपास्ततः ।
सप्तभिः क्षयितः शेषः सूर्याद्यो वासरेश्वरः[4] ।।

अत्रोपपत्तिः — कल्पादितो अभीष्टशकान्तं यावत् सौरवर्षम् आनीय द्वादशसङ्ख्ययाभिः गुणितानि सति गतसौरमासाः भवन्ति, पुनः चन्द्रादिगतमासा संयोजनेन इष्टसौरमासा आगच्छन्ति। पुनः अधिमासस्य आनयनं क्रियते, अत्र कल्पादितो गतसौरमासाः चान्द्रमासे परिवर्तनीयं यतो हि दर्शाग्रसंक्रान्तिकालयोः अन्तर्वर्त्तिना अधिमासाः शेषेणाधिकाः भवन्ति।

"दर्शाग्रतः संक्रमकालतः प्राक् सदैव तिष्ठत्यधिमासशेषम्"[5] इति भास्कराचार्यवचनम्। अतः त्रैराशिकगणितबलेन अधिमासमानं साध्यते, यदि कल्पसौरमासैः कल्पाधिमासाः लभ्यन्ते तदा अभीष्टसौरमासैः के इति

(क़०अ०म० x अ०सौ०मा०)/मा० कल्पसौरमासः

अभीष्ट अधिमासाः लभ्यन्ते, पुनः इष्टसौरमासे अधिमासयुते सति इष्टचान्द्रमासाः भवन्ति

इ०सौ०मा०+अधिमासः = चान्द्रमासः + (अ०शे०/यु०सौ०मा०)

अतः अभीष्टगत अमान्तकाले चान्द्रमासाः सावयवाः

इसौ०मा० x इ०अमा० + (अ०शे०/यु०सौ०मा०)

अत्र वर्षान्ते यैः अधिमासाः साध्यन्ते तदा शेषैर्यदि इष्टसौरमासा संयोजनं क्रियते तदा अभीष्ट-संक्रान्तिकालिकाः चान्द्रमासाः भवन्ति। तत्र वर्षान्तकालिकचान्द्रमाससमाने वर्षान्ताधिशेषशोधनेन चैत्रमान्तकाले चान्द्रमासाः सिद्धाः स्युः। अर्थात् अनुपातेन आगता केवलम् अधिमासैः एव ते कल्पगतसौरमासयुक्ताः तदा चैत्रमासा अमान्तकाले गतचान्द्रमासा भवन्ति। अतः अभीष्ट-अमान्तीयचान्द्रमासगणः = इ०सौ०मा० + इ०अ०मा०। ते चान्द्रमासाः भवन्ति, पुनः ते चान्द्रमासाः त्रिशद्गुणिते सति दर्शान्ते चान्द्रदिवसा (तिथयः) भवन्ति। तेषु दर्शान्तात् इष्टदिनादधिका या गततिथयः ताः यदि योज्यन्ते तदा गततिथ्यन्तकाले चान्द्र अहर्गणः स्यात्। चान्द्रदिनेभ्यः सावनदिनम् आनयनार्थम् अनुपातेन चान्द्रसम्बन्धी अवम आनीय अत्र विशोध्यते तदा तिथ्यन्ते

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[4] सू०सि०म०अ०, श्लो०सं० 48-51।

[5] सि०शि०गो०अ०मा०वा०, श्लो०सं०-16।

सावयवाः सावनाहर्गणः स्यात्। यथा — यदि पठितयुगचान्द्रदिनैः पठितयुगावमानि लभ्यन्ते तदा एभिः अभीष्टचान्द्रदिनैः कानीति

(यु०अवम x इ०चा०दि०)/यु०चा०दि० = अवम + (अ०शे०/यु०चा०दि०)

अत्र चान्द्राणां सावनानाञ्चान्तस्यैवावमसंज्ञात्वादेभिः सावमसेषैरिष्टावमैर्यदिचान्द्रदिवसा ऊनाः क्रियन्ते तदा गततिथ्यन्तकाले ते सावनदिवसा भवेयुः। अतः तिथ्यन्ते सावनाहर्गणः सावयवः

इ०चा०-अवम अवम/यु०चा०

परन्तु "उदयादुदयं यावद्भूमिसावनवासराः"[6] इति सावनदिनपरिभाषया सावनाहर्गणोऽर्कोदयकालिकोऽपेक्षितोतः यथोक्तं भास्कराचार्येण —

तिथ्यन्तसूर्योदययोस्तु मध्ये सदैव तिष्ठत्यवमावशेषम्।
त्यक्तेन तेनोदयकालिकः स्यात् तिथ्यन्तकाले द्युगणोऽन्यथातः[7]।।

अत्र तिथ्यन्तकालिकेऽस्मिन्नहर्गणे तिथ्यन्तार्कोदयान्तर्गतोऽवमशेष कालो यदि योज्यन्ते तदा अर्कोदयकालिको अहर्गणो भवेत्। तत्र पूर्वम् अवमशेषो विशोधितम् अधुना योजितश्चेत् तस्य तुल्यधनर्णनाशात्केवलं लब्धितुल्यावमैरेव चान्द्राहर्गणो रहितोऽभीष्टार्कोदयकाले सावनाहर्गणो जायते। अत एकोक्तं भास्कराचार्येण "अधिकमासदिनक्षयशेषतो द्युघटिकादिकमत्र न गृह्यते"[8] इति। अत एव अधिशेष अवमशेषस्य च परित्यागः कृतः वर्तते।

अत्र अहर्गणानयने भास्कराचार्येण-वर्षान्तकाले गतसौरवर्षाणि द्वादशगुणितानि कृत्वा गतसौरमासान् प्रसाध्य तेषु चैत्रादिगतचान्द्रसङ्ख्यकान् सौरमासांश्च संयोज्य अमान्तसमसङ्ख्यकसंक्रान्तिकालिकसौरमासान् संसाध्य त्रिंशद्भिः संगुण्य गततिथिसमसङ्ख्यकान् अंशाश्च संयोज्य गततिथिससङ्ख्यकभागान्तकालिकसौराहर्गणं प्रसाध्य ततश्चान्द्रार्थम् अनुपातेन अधिमासम् आनीय तान्दिनात्मकान् कृत्वा तत्र संयोज्य ततः क्षयदिनान्यानीय अभीष्टदिनोदये मध्यमसावनाहर्गणः साधितः।

अथ अहर्गणस्य वारनियामकत्वात् सप्तभक्तावशेषितेऽहर्गणे शेषांकप्रमितो रव्यादिको वारो भवति। कल्पादौ रविवासरात्वात्। यथोक्तं भास्कराचार्येण —

लंकानगर्यामुदयाच्च भानोस्तस्यैव वारो प्रथमं बभूव ।

[6] सू०सि०म०अ०, श्लो०सं० 36।

[7] सि०शि०गो०अ०मा०वा०, श्लो०सं० 18।

[8] सि०शि०म०अ०ग्र०अ०, श्लो०सं० 3।

मधोः सितादेः दिनमासवर्षयुगादिकानां युगपत्प्रवृत्तिः ।।[9]

अपि च स्पष्टार्कसंक्रान्तिरहितत्रिंशत्तिथ्यात्मकचान्द्रमासाः स्पष्टोऽधिमासाः तथा माध्यमिकगणनायां साधारणतया सार्धद्वात्रिंशद्भिः सौरमासैर्योऽधिमासः प्रचलति स च गणितागतो मध्यमो अधिमासः कथ्यते। मध्यस्फुटार्कयोः अल्पान्तरे सम्भवति एकस्मिन्नैव चान्द्रमासे मध्यस्फुटाधिमासयोः पतनम्। बह्वन्तरे तु अत्र एवं न सम्भवति, अर्थात् स्पष्टाधिमासपाते अपि हरासन्नशेषत्वेन गणिते तत्रागच्छति चेत् तत्र अहर्गणोक्तदिशा साधिताधिमासे निपतिताधिमासस्याग्रहणात् अधिमासग्रहणे सङ्ख्ययैकाल्पत्वग्रहणेन सैकोऽधिमासः कार्यः। यत्र च शेष्यात्यल्पतया गणितेन लब्धेऽप्यधिमासे स्फुटोऽधिमासो न पतति तत्र अहर्गणानयने अधिमासस्य सङ्ख्ययैकाधिकग्रहणान्निरेको अधिमासः कर्तव्यः। अत एवोक्तं भास्कराचार्येण —

स्पष्टोऽधिमासः पतितोऽप्यलब्धो यदा यदा वाऽपतितोऽपिलब्धः ।
सेकैर्निरेकैः क्रमशोऽधिमासैस्तदा दिनौघः सुधिया प्रसाध्यः ।।[10]

एवञ्च चैत्र अमान्ततः अभीष्टतिथ्यन्तावधिं मध्यमतिथिज्ञानाभावात् अहर्गणानयने पञ्चाङ्गता स्पष्टा एव तिथयो गृहीताः। अर्थात् स्फुटतिथिसंख्यासमामेव मध्यमतिथिसङ्ख्याम् अङ्गीकृत्य अहर्गणानयनं कुर्वन्ति आचार्यैः। एवमेव मध्यमस्फुटतिथिभेदेनापि अनेकानुपातागतावमप्यन्तरितं स्यादिति तदानीमहर्गणोऽप्येकान्तरितो भवेत् अतः तथा अहर्गणे वारस्यैव नियामकत्वात् सेकौ निरेकश्च कार्यस्तदा स्ववारे सः कल्पादितः द्युगणः स्यात्। यथोक्तं भास्कराचार्येण—

अभीष्टवारार्थमहर्गणश्चेत् सैको निरेकस्तिथयोऽपि तद्वत्[11] इति।

एवं सृष्ट्यादेः "षण्मनूनां तु सम्पीड्ये"[12]त्यादि महत् अहर्गणवशेन अतिकठिनविधिना अहर्गणमानं बृहत्सङ्ख्यकाः सम्भवन्ति अतः सुलभार्थं सर्वजनव्यवहारोपयुक्तः अभीष्टशकादितः इष्टतो युगात् वा अहर्गणः साध्यते बहुत्र। यथा "शाको नवाद्रीन्दुकृशानुयुक्तः कलेर्भवेदब्दगणो व्यतीतः"[13] इत्यादिः तथा सूर्यसिद्धान्ते —

विस्तरेणैतदुदितं संक्षेपात् व्यवहारिकम् ।
मध्यमानयनं कार्यं ग्रहाणामिष्टतो युगात् ।।[14]

तथा च भास्कराचार्येण —

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[9] सि०शि०म०अ०का०मा०, श्लो०सं० 15।

[10] सि०शि०म०अ०अ०मा०नि०, श्लो०सं० 3।

[11] सि०शि०म०अ०अ०मा०नि०, श्लो०सं० 1।

[12] ब्र०सि०स०अ०, पृ०सं० 24।

[13] सू०सि०म०अ०, श्लो०सं० 56।

[14] सि०शि०म०अ०ग्र०अ०, श्लो०सं० 18।

कलिगतादथ वा दिनसञ्चयो दिनपतिर्भृगुजप्रभृतिस्तदा।
कलिमुखध्रुवकेण समन्वितो भवति तद्द्युगणोद्भवखेचराः।।[15]

तथा च लाघवार्थं कल्पादितो वर्षान्तपर्यन्तं एकोऽहर्गणः साधितः तत् साधितो ग्रहो वर्षान्ते सिद्धः। स ध्रुवसंज्ञः, तथा च वर्षान्तात् इष्टदिनोदयं यावल्लघ्वहर्गणः साधितो लाघवार्थम्। तदुत्पन्नग्रहः वर्षान्तकालिकध्रुवकेण संयुतस्सन् कल्पादितः इष्टदिनोदयं यावदहर्गणः सिद्धः।

अत एव ग्रहाणां साधने गणितादिकार्ये वा लाघवविधिः एव अङ्गीक्रियते । एवमत्र इदानीं प्रसिद्धकरणग्रन्थः ग्रहलाघवः तस्य प्रसारः प्रचारश्च सम्पूर्णेऽपि भारते ज्योतिषलोके प्राप्यते। तत्र सृष्ट्यादितः इष्टदिनोदयावधिककालस्य खण्डत्रयं कृत्वा लाघवार्थं दिनगणः साधितः यथोक्तं अहर्गणानयनम्-

द्वयब्धीन्द्रोनितशक् ईशहतफलं स्याच्चक्राख्यं रविहतशेषकं तु युक्तम्[16]

अत्र सृष्ट्यादितो ग्रन्थारम्भसमयपर्यन्तकालखण्डसम्बन्धीयम् अहर्गणं प्रसाध्य तदुत्पन्नग्रहराश्यादिः क्षेपः कल्पितः।

ग्रन्थारम्भात् इष्टगतासन् वर्षान्तं यावत् वर्षसमूहे एकादशवर्षात्मकं कालखण्डं चक्रसंज्ञकं कल्पितं तत्र एकचक्रसम्बन्धिग्रहराश्यादिलाघवार्थं द्वादशसंख्यया शुद्धं कृत्वा धृवसंज्ञः कल्पितः।

ततश्चक्रोर्वरितवर्षसंबन्ध्यहर्गणं प्रसाध्य तत्सिद्धो ग्रहो चक्रसंबन्धिग्रहेण हीनः क्षेपेण युतस्सन् कल्पादितः इष्टदिनोदयसमयपर्यन्तकालसम्बन्धी ग्रहो जातः यथोक्तं —

दिनगणभवखेटश्चक्रनिघ्नध्रुवोनो दिवसकृदुदये स्वक्षेपयुक् मध्यमः स्यात्[17]। इति।।

प्रसङ्गेऽस्मिन् आचार्यभास्करेण लघ्वहर्गणः साधितः तत्रोक्तं —

चैत्रासितादिगतस्तिथिसङ्घः शोधितशुद्धिरधस्तु समेतः ।
स्वीयकराभ्रतुरङ्गलवेन क्षेपयुतः कृतषट्कविभक्तः ।
लब्धदिनक्षयवर्जितशेषो रव्युदये द्युगणोऽब्दपः स्यात् ।।[18]

अत्र आचार्येण लघ्वहर्गणंकृत्वा तत्र वारस्य गणना तु सदा अब्दपतेः शकाशात् कृता। यत्र वर्षाधिपेन गणना क्रियते। वस्तुतः अहर्गणसाधने महत् कष्टं परिश्रमं च अनुभूयते। अत एवोक्तं "ग्रहास्तु साध्या मनुजैः स्वमानात्" इति। अत एव ग्रहाणां साधने गणितादिकार्ये वा

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15 ग्र०ला०व०म०अ०, श्लो०सं० 4।
16 ग्र०ला०व०म०अ०, श्लो०सं०-9।
17 सि०शि०म०अ०प्र०शु०, श्लो०सं० 12-13।
18 ज्यो०नि०आ०, पृ०सं० 30।

लाघवविधिरेवाङ्गीक्रियते ।

सहायकग्रन्थानां सूची

अमरकोशः, अमरसिंहः।

ग्रहलाघवं करणम्, गणेशदैवज्ञविरचितम्, पं० श्रीः कपिलेश्वरशास्त्रिणा सम्पादितः, चौखम्बा सुरभारती प्रकाशन ।

ज्योतिर्निबन्धादर्शः, डॉ. शत्रुघ्नत्रिपाठी, चौखम्बा सुरभारती प्रकाशन्, वाराणसी।

ब्रह्मस्फुटसिद्धान्तस्य समीक्षात्मकमध्ययनम्, विद्यावाचस्पति डॉ शिवाकान्त झा, नाम पब्लिशर्स्, दिल्ली ।

सूर्यसिद्धान्तः, कपिलेश्वरशास्त्रिटीकाकारः, चौखम्बा विद्याभवन्, वाराणसी।

सूर्यसिद्धान्तः, सुधावर्षिणीटीकासहितः, म०म०पं० सुधाकरद्विवेदी सम्पादितः, चौखम्बा विद्याभवन् वाराणसी।

सिद्धान्तशिरोमणिः भास्कराचार्यविरचितः, पं० श्रीः मुरलीधरठक्कुरेण सम्पादितः, चौखम्बा सुरभारती प्रकाशन।

सिद्धान्तशिरोमणिः मरीचिभाष्यसंवलितः।

23

सिद्धान्तोक्तकालगणनप्रक्रियायां ब्रह्माण्डव्यवस्था

के. सी. नागेश भट्टः

प्रबन्धस्य मुख्यविषयः

1. भारतीयज्योतिषसिद्धान्तोक्तकालमानविषयाणां तथा क्षीरपथस्य च सम्बन्धनिरूपणम्

2. आधुनिकविज्ञानेन अन्वेषणीयाः अन्ये च विषयाः

त्रुट्यादितः प्रलयकालपर्यन्तं भारतीयज्योतिर्विज्ञाने कालगणनपरिभाषा उक्ता वर्तते। तत्र त्रुट्यादयः अमूर्तकाले अन्तर्भवन्ति। प्राणादयः मूर्तकाले अन्तर्भवन्ति। तत्र घटी-दिन-मास-वर्षाणां निर्णयः धरा-तथा-सूर्ययोः परस्परसम्बन्धेन उपजायते। तथैव वर्षमानानन्तरस्य युग-महायुग-मन्वन्तर-कल्प-परार्ध-परा पर्यन्तमपि कालपरिमाणपरिभाषा स्पष्टतया निरूपिता वर्तते भारतीयगणितविज्ञाने। एतेषां युगादिमानानामपि प्राकृतिकरूपो कश्चनसम्बन्धः विद्यते एव इति अत्र तर्कः। यथापूर्वं आवर्षं यावत् कालमानव्यवस्थायां भूमि-सूर्ययोः सम्बन्धः सुनिश्चितः तथैव युगादिव्यवस्थायां अस्य सूर्यस्य तथा क्षीरपथस्य च महान एको सम्बन्धः विद्यते एव।

एवं भारतीयज्योतिषसिद्धान्तोक्तकालमानविषयाणां तथा क्षीरपथस्य च सम्बन्धनिरूपणम् तथा आधुनिकविज्ञाने अन्वेषणीयाः अन्ये च विषयाः अस्मिन् सिद्धान्तोक्तकालगणनप्रक्रियायां ब्रह्माण्डव्यवस्था इति शीर्षिकारूपप्रबन्धे चित्रसहितं व्याख्यातुमिच्छामि।

विष्णोः विष्णोः विष्णोराज्ञया प्रवर्तमानस्य अद्य ब्रह्मणः प्रथमे परार्धे पञ्चाशद्वत्सरेषु अतीतेषु द्वीतीयपरार्धे प्रथमे वर्षे श्रीहरेः श्वेतवराहकल्पे वैवस्वतमन्वन्तरे कलियुगे प्रथमपादे — जम्बूद्वीपे भरतखन्डे भरतवर्षे महामेरोः दक्षिणपार्श्वे – अस्मिन् वर्तमानकालव्यावहारिके — संवत्सरस्य उत्तरायणे शिशिरर्तौ माघमासे शुक्लपक्षे द्वादश्यां शुक्रवासरे —

भोः आदरणीयाः विद्वांसः! किमर्थमेवं संकल्पः क्रियते अनेन? किमधुना धार्मिककार्यः? इति मां तर्जयेयुः प्रायः सर्वे।

परमत्रप्रकृतिप्रपञ्चस्य, निखिलामलसृष्टेः, औचित्यपूर्णप्राकृतिकविज्ञानसन्दोहस्य ज्ञानस्रोतः एव अव्याहतप्रवाहरूपेण प्रवहिता वर्तते भारतीयसंस्कृतिसागरात्। यदत्र भारतीयैः क्रियमाणे संकल्पे जगदुत्पत्तिकालादारभ्य अद्य-अधुना-इदानीन्तनक्षणकालपर्यन्तमपि नैरन्तर्येण प्रपञ्चस्य वा अस्य ब्रह्माण्डस्य कालगणना सुष्ठु निरूपिता वर्तते।

कालगणनार्थमेव प्रवृत्तेऽस्मिन् ज्योतिर्विज्ञाने कालमानास्तु नवधा प्रकीर्तितः। तथाह सू. सि ब्राह्मं दैवं तथा पैत्र्यं प्राजापत्यं गुरोस्तथा। सौरञ्च सावनं चान्द्रं आर्षं मानानि वै नव। इति एतादृशस्य संकल्पस्य, कालमानस्य तथा ब्रह्माण्डस्य च अर्थात् universe इति यद् वदामः तस्य च कश्चन संबन्धः स्यादेव।

अतोऽत्र प्रबन्धे एते विषयाः प्रतिपाद्यन्ते —

1. अस्माभिः प्रतिनित्यं दृश्यमाणः कालसूचकांशाः
2. ब्रह्मान्डकालसूचकाः अंशाः
3. एतयोः उभयोरपि प्राकृतिककालमापकानि
4. पूर्वाचार्याणां ब्रह्माण्डज्ञानम्
5. आधुनिकविज्ञानमतम्
6. आधुनिकविज्ञानेन गवेषणीयाः विषयाः इति एतान् विषयान् यथामति यथासमयावकाशं विद्वत् परिषदि संस्थापयामि। भोः मान्याः, पूर्वोक्तकालमानव्यवस्थायां अंशद्वयम् अवगन्तव्यम् अस्माभिः।
    1. अद्यब्रह्मणः परा, परार्धः कल्पः मन्वन्तरम्, युगमानम् इति। एते ब्रह्माण्डकालसूचकाः भवन्ति।
    2. संवत्सर, अयन, रुतु, मास, पक्ष, तिथि घट्यादयः वर्तमानकालसूचकाः भवन्ति। तत्रभवतां सुविदितोऽयं विषयः यः द्वितीयोक्तानां संवत्सर, अयन, रुतु, मास, पक्ष, तिथ्यादीनां कालमापकाः भवन्ति सूर्यचन्द्रौ एव इति। तत्र नक्षत्रोदयकालात् पुनस्तदेव नक्षत्रोदयकालं यावत् 60 घट्यात्मकं नाक्षत्रं दिनमानं भवति। तथैव सूर्योदयकालात् पुनरुदयकालं यावत् सावनदिनमानं भवति। तदेव भूमेः अक्षपरिभ्रमणं इति कथ्यते। अक्षपरिभ्रमणात्मकानां त्रिंशद्दिनानां एको मासः।

भूमेः अथवा सूर्यस्य उत्तर-दीक्षणदिग्गमनमेव अयनकालमानम्। तथा सूर्यस्य भचक्रे भ्रमणकालः एव वर्षशब्देन व्यपदिश्यते। अर्थात् भूमिः येन कालेन परिभ्रमति सः कालः वर्षमिति कथ्यते। यथोक्तं च भास्करीये "रवेश्चक्रभोगोऽत्र वर्षं प्रदिष्टम्" इति।

एवञ्च व्यवहारयोग्यानां घटी-तिथ्यादीनां निर्णयः रवि-धरण्योः परस्परपरिभ्रमणवशात्

भवतीति अर्थः। एवमेव संवत्सरानन्तरस्य महायुग-मन्वन्तर-कल्प-पराणां तथा अस्माकं सौरमण्डलस्य च कश्चन संबन्धः पूर्वजैः गृहीतः इति मम तर्कः।

तत्र प्रथमतः पर-परार्धानां मानविचारः, युगादीनां मानानां सङ्ख्याः दिव्यमानेन प्रोक्ताः। मानवानां यद्वर्षं तद्देवानां दिनम्। सुरासुराणामन्योऽन्यं अहोरात्रं विपर्ययादिति वचनेन भूमौ एव ध्रुवस्थानस्थितानां सूर्यस्य दर्शन-अदर्शनकालमनुसृत्य एव दिनप्रमाणं कथितम्। अतः मानववर्षैः 360 देवानां एकं वर्षं भवति। एतेषां दिव्यवर्षाणां द्वादशसहस्राणां एको महायुगः भवति।

(12,000 X 360 = 4,320,000 मानववर्षाणि)

एतादृशानां महायुगानां एकसप्तत्या एकं मन्वन्तरं भवति।

युगानां सप्ततिःसैका मन्वन्तरमिहोच्यते इत्युक्तं च सिद्धान्ते।

12,000 X 71 = 8,52,000 दिव्यवर्षाणि।

मानववर्षैः तावत् 30,672,000 भवन्ति।

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सिद्धान्तग्रन्थानां यन्त्रालयैस्सह सम्बन्धः

कृष्णेश्वर झा

वादीप्रतिवादिभ्यां निर्णीतोऽर्थः सिद्धान्तः। प्रयोगपरम्परानुरोधने प्राप्तसिद्धनिष्कर्षः सिद्धोऽन्तो निर्णयो यस्यासौ सिद्धान्त इति सामान्यपरिभाषा। ज्यौतिषस्य मुख्यभागः मुख्यस्कन्धो वा गणितसिद्धान्त इति। ज्यौतिषस्य वेदाङ्गत्वं निरुपयन् भास्करः वक्ष्यति —

वेदास्तावद्यज्ञकर्मप्रवृताः कालानुपूर्वा विहिताश्च यज्ञाः।
यस्मादिदं कालाविधानशास्त्रं यो ज्यौतिषं वेत्ति स वेद यज्ञान्।।

इत्यनेन वेदाः यज्ञकर्मप्रवृताः निरूपिताः। सर्वविधप्राकृतिकाः सृष्टि स्थिति विकास संहाररूपविश्वगतयज्ञाः कालाश्रिताः। मानवीययज्ञाश्चापि कालोऽनुपूर्वाः निहिताः। यस्मादिदं कालविधानशास्त्रमतः यो ज्यौतिषं वेत्ति स वेदयज्ञानपि वेत्ति।

तर्हि कोऽयं कालः? ज्यौतिषस्य कालविधायकत्वं कथम्? कथं ज्यौतिषज्ञानेन वैदिकयज्ञानां ज्ञानमिति प्रश्नानां समाधानरूपेण त्रिस्कन्ध-ज्यौतिषं प्रवर्तते।

कालः पचति भूतानि सर्वाण्यैव सहात्मना।
कान्ते सपक्वस्तेनैव सहाव्यक्ते लयं व्रजेत्।।

इत्यनेन कालस्य भूतानां पाचकत्वं कालसापेक्षत्वेन ब्रह्मादिनादौ सृष्टिस्तद्दिनान्ते लयश्च सूच्यते। परं कथमिति प्रश्नस्योत्तरे सर्वाः भौतिकाध्यात्मिकाविद्यास्तदन्तर्भुक्ताः जायन्ते।

कलयति लोकानिति कालस्य सामान्यपरिभाषा।
कालस्य कलनकर्त्तृत्वादस्य कलनशास्त्रमित्यपरनाम।।

ज्यौतिषां ग्रहर्क्षतारादीनां प्रबोधकं कालज्ञानविधायकं यज्ञकालनिरूपकत्वेन वेदाङ्गभूतं नेत्ररुपञ्चेदं शास्त्रम्। इदं त्रिस्कन्धात्मकं केचनमते पञ्चस्कन्धात्मकञ्च विद्यते। विश्वस्य समस्तप्रयोगात्मकविज्ञानानि ज्यौतिषेन ज्यौतिषं गणितेन युक्तमिति। यथा कथितं भास्करेण —

अस्ति त्रैराशिकं पाटीबीजञ्च बिमला मतिः।
किमज्ञातं सुबुद्धीनामतो मन्दार्थमुच्यते।

द्विविधगणितमुक्तं व्यक्तमव्यक्तयुक्तम्।
तदवगमननिष्ठ शब्दशास्त्रै पटिष्ठः।।

यदि भवति तदेदं ज्यौतिषं भूरिभेदम्।
प्रपठितुमधिकारी सोऽन्यथा नामधारी।।

इति श्लोकद्वयेन पाटीगणितस्य त्रैराशिकं मूलं बीजंगणितस्य विमला मतिश्च। तयोर्ज्ञानेन सुबुद्धीनां किमज्ञातमर्थात् किमपि च।

व्यक्तमव्यक्तञ्च विविधगणितं शब्दशास्त्रे च सम्यक् ज्ञात्वा भूरिभेदं ज्यौतिषं पठितुं शक्यतेऽन्यथा नामधारिमात्रं भवति। अधुना नामधारी परम्परा गणितगोलादिभिर्विना सर्वत्र परम्परागतशिक्षणे वर्धते। सिद्धान्त-ज्यौतिषस्य स्वरूपं यन्त्रालयैः सिद्धान्तग्रन्थानां सम्बन्धश्चेति विषयमलं किञ्चित् विचारयामि। भास्करात्पूर्वसिद्धान्तग्रन्थेषु प्रयोगानुरोधेन गणितगोलः संस्थानमानसंचारादयः गोलीयगणितं गोलीयोपपत्तिश्च तथा ग्रहर्क्षसंस्थानं सोदाहरणप्रश्नोत्तरविधानं यन्त्रविधानं वेदविधानञ्च प्राप्यते। तत्र भास्करीयसिद्धान्तलक्षणम् —

त्रुट्यादिप्रलयान्तकालकलनामानप्रभेदः क्रमा-
च्चारश्च द्युसदां द्विधा च गणितं प्रश्नास्तथा सोत्तराः।
भूधिष्ण्यग्रहसंस्थितेश्च कथनं यन्त्रादि यत्रोच्यते
सिद्धान्तः स उदाहृतोऽत्र गणितस्कन्धप्रबन्धे बुधैः।।

जानन् जातकसंहिताः सगणितस्कन्धैकदेशा अपि ज्यौतिः
शास्त्रविचारसारचतुरप्रश्नेष्वकिञ्चितकरः।
यः सिद्धान्तमनन्तयुक्तिविततं नो वेति भितौ
यथा राजा चित्रमयोऽथवा सुघटितः काष्ठस्य कण्ठीरवः।।

गर्जत्कुञ्जरवर्जिता नृपचमूरप्यूर्जिताऽश्वादिकै-
रूद्यानं च्युतचूतवृक्षमथवा पाथोविहीनं सरः।
योषित्प्रोषितनूतनप्रियतमा यद्वन्न भात्युच्चकै-
र्ज्योतिः शास्त्रमिदं तथैव विबुधाः सिद्धान्तहीनं जगुः।।

एभिः — सिद्धान्तस्य स्वरूपं विस्तारः सर्वविश्वाभिप्रायिकमहत्वञ्च प्रस्फुटत्वमेति यथा —

1. कालकलनम् — त्रुटिकालात्प्रलयान्तम्।
2. मानप्रभेदाः — अनन्तकाले नवविधकालभेदाः तैः सम्बद्धाः क्षेत्रभेदाश्च।
3. धुसदां ग्रहर्क्षकेत्वादीनां चारस्तत्र — गणित्तीयप्रतीतिः चाक्षुषवेधोपलब्ध-दृग्गणितैक्यं यान्त्रिकवेद्योपलब्धदृग्गणितैक्यञ्च। गोलीयगणितं गोलीय-यन्त्रवेधश्च प्रयुज्यन्ते।
4. द्विविधगणितम् — व्यक्तमव्यक्तंनाम पाटीगणितं बीजगणितञ्च। गणितीय विस्तारस्त्वनन्तं यावदस्ति नान्तोऽस्ति यस्मात् गणितार्णवस्येति भास्करः।
5. सोत्तराः प्रश्नाः भूग्रहोपग्रहनक्षत्रादीनां संस्थानं दूरत्वं स्थितिश्च संस्थानमित्यस्याप्यनेके प्रभेदाः सत्तात्मकाः विश्वस्यानन्त्यात् भवन्ति।
6. यन्त्रविधानं यन्त्राध्यायः यन्त्रनिर्माणां विविधप्रयोगाः खगोलीयवेधोपयुक्तयन्त्राणां निर्माणं प्रयोगः गोलीयरहस्योद्घाटकत्वेन निष्कर्षावगमनं दृग्गणितैक्यविधानञ्च यन्त्रं विना न सम्भवत्यतः त्रिस्कन्धज्यौतिषं गणितमूलेन गोलेन यन्त्रेण, विमलबुद्ध्या च गम्यं नान्यथेति। एवं यन्त्रविज्ञानस्य स्वतन्त्रपरम्परा, महत्वं सर्वविधाभिप्रायिकत्वञ्च सिद्ध्यति। यतःषडङ्गो वेदोऽध्येयो ज्ञेयश्चेति परम्परा स्वतन्त्रतादनन्तरमपि न सञ्चालितातः भारते अशिक्षा अभावस्तथापराधश्च सर्वत्र वर्धन्ते। पूर्वैः विश्वविद्यालयानुदानायोगाध्यक्षप्रवरजां प्रो०. हरिगौतममहोदयानां प्रो० मुरलीमनोहर जोशीनाञ्च दिव्यदृष्ट्या समस्तप्रयोगात्मकविज्ञानानां मूलरूपज्यौतिर्विज्ञानस्य प्रवेशद्वारः सर्वाभिप्रायिकत्वेनोद्घाटितः। फलतः ज्यौतिषाद्भिन्नान्यविज्ञानस्य छात्राः साभारेण ज्यौतिषमूलेन युक्ताः सन्तः कालविद्यया ब्रह्माण्डस्योत्पत्तिस्थितिविनाशानामनन्तक्रमे स्वकीयक्षमतां ज्ञात्वा वर्धयित्वा च पुरुषार्थचतुष्टयेषु निष्णाताः भवितुमर्हन्ति नान्यथेति। यतः सत्तात्मकं द्वैतविश्वं त्रिगुणात्मकं पाञ्चभौतिकमस्त्यतः भौतिकादिनां विज्ञानान्यपि गणितेन गोलेन विमलबुद्ध्या यन्त्रेण च युक्तानि वेदाङ्गज्यौतिषस्यैव वाक्रुपाणीति। वराहस्य संहितोक्तप्रमाणैः नरपतिजयचर्यादिभिः प्रदर्शितयथार्थैः तथा भास्करीयप्रमाणैरपि यन्त्रस्य यन्त्राध्यायस्य महत्वं (त्रिस्कन्धज्यौतिषस्य परमावश्यकाध्यायरूपेण) निरूपितं स्वकीय यन्त्राध्याये यथा —

दिनगतकालावयवा ज्ञातुमशक्या यतो विना यन्त्रैः।
वक्ष्ये यन्त्राणि ततः स्फुटानि सङ्क्षेपतः कतिचित्।।

गोलो नाडीवलयं यष्टिः शङ्कुर्घटी चक्रम्।
चापं तुर्य फलकं धीरेकं पारमार्थिकं यन्त्रम्।।

अतः विभिन्नयन्त्राणि दिनगतकालावयवान्निरुपयितुं भास्करेण निरुपितानि तत्र धीयन्त्रस्य सर्वोत्कृष्ट

त्वं पारमार्थिकत्वञ्च प्रदर्शितमिदं तथ्यं सार्वकालिकमेव।

यतः सर्वविधमानानि, संस्थानसञ्चारादयः यन्त्रः वेधोपलब्धत्वात् विभिन्नकालिकप्रत्येकसिद्धान्ते तदयुगीयसैद्धान्तिकसामर्थ्यस्य यान्त्रिकसामर्थ्येन बौद्धिकविकासस्यैव सीमां दर्शयति। परवर्तीकाले भस्करीयमूलस्यैव समग्रविश्वे विकासो जातः। यन्त्रवेधेन दृग्गणितैक्यसम्पादनं सूक्ष्मकालज्ञानार्थं कालप्रभावकलनार्थञ्च परमावश्यकमेवेति यथा भास्करः —

यात्राविवाहोत्सवजातकादौ खेटैः स्फुटैरेव फलस्फुटत्वम्
स्यात् प्रोच्यते तेन नभश्चरणं स्फुटक्रिया दृग्गणितैक्यकृद्या।।

अतः कालज्ञानं भगणज्ञानं गतिसंस्थानादीनां ज्ञानं कालान्तरप्रभावनिष्पत्या गत्या तापांशशीतांशाभ्यां त्रिगुणात्मकनिष्पत्या पाञ्चभौतिकप्रपञ्चे च चराचरात्मके विश्वेद्युनाभसभौमानां त्रिगोलीयनिष्पत्या सौरादारभ्य प्रसरति। कालपरिवर्तनेन सत्तापरिवर्तनं गतिः सञ्चारादिभिस्तथावस्थाभेदाश्च सम्पद्यन्ते। अतः ज्यौतिषं भूपृष्ठादारभ्य मानावादनन्तं यावत् सम्बद्धमिति प्रतीयते। अन्यथा किं वास्य मूलं को वा कथयितुं समर्थः न कोऽपि। ईश्वरांशभूतादेवास्य प्रकटीकरणादनन्तरं सर्वैः विश्वेतिहासाः खगोलीयचित्रैस्तत्सम्बद्धभूपृष्ठीयचित्रैश्च गम्याः सन्तीति विद्यावाचस्पति मधुसूदन ओझा तथा पं० दीनानाथ शास्त्रीचुलैट प्रभृतिभिः (कथं सम्बद्धमिति) सम्यक् निरुपितम्।

भास्करेण सर्वमूलत्वात् तीक्ष्णबुद्धिगम्यत्वादेव गणितज्ञानेन गणितीयप्रायुक्तया बुद्धिगम्यगणितस्यैव सर्वोत्कृष्टत्वं निरुपितम्।

यथा भास्करः —

ज्योतिः शास्त्रफलं पुराणगणकैरादेश इत्युच्यते
नूनं लग्नबलाश्रितः पुनरयं तत् स्पष्टखेटाश्रयम्।
ते गोलाश्रयिणोऽन्तरेण गणितं गोलोऽपि न ज्ञायते
तस्माद्यो गणितं न वेत्ति स कथं गोलादिकं ज्ञास्यति।।

भास्करेण ब्रह्मगुप्तागमः स्वीकृतः बल्लालसेनेन वराहस्य तथा पुराणानामागम स्वीकृतम्। जयसिंहात्पूर्वं सौरपक्षः ब्राह्मपक्षः आर्यपक्षश्चासन्। इति।

25

कालस्वरूपम्

पि. पवन कुमार

ज्योतिषं कालविधायकशास्त्रमिति सर्वे जानन्त्येव। अतः तादृशस्य कालविधानशास्त्रस्य स्वरूपं बहवो ज्येतिषशास्त्राचार्याः अकथयन्। ते ऋषयः ज्योतिषशास्त्रप्रवक्तारः। एते एव ज्योतिषशास्त्रस्य आधारभूतऋषयः। ते सर्वे ज्योतिषशास्त्रस्य प्रत्यङ्गं सुष्टु अकथयन्।

वेदचतुष्टयस्यापि प्रतिवेदं भिन्नं ज्योतिश्शास्त्रमुपलभ्यते, ऋग्ज्यौतिषं, यजुर्ज्यौतिषं, सामज्यौतिषं, अथर्वज्यौतिषञ्चेति। कालक्रमेण शास्त्रस्यास्य बहुविकासः समजनि। गच्छति काले इदञ्च शास्त्रं सिद्धान्त-संहिता-होरेति स्कन्धत्रयेण विभक्तम्। उक्तं च नारदेन —

सिद्धान्तसंहिताहोरारूपं स्कन्धत्रयात्मकम्।
वेदस्य निर्मलं चक्षुर्ज्योतिश्शास्त्रमनुत्तमम्।। इति।

एवञ्च प्रश्नमार्गे —

जातकगोलनिमित्तप्रश्नमुहूर्ताख्यगणितनामानि।
अभिदधतीह षडङ्गान्याचार्या ज्योतिषे महाशास्त्रे।।

इति च ज्यौतिषस्य षडङ्गत्वं एषु जातकादिषु आमनन्ति विद्वांसः। इदञ्च शास्त्रं इतोऽपि विराट्स्वरूपं सम्प्राप्य मनोविज्ञानचिकित्साशास्त्रादिभिरपि समृद्धमभूत्। सूक्ष्मेक्षिकया परिशील्यमाने स्कन्धत्रये एव सर्वेऽपि विचाराः विलीयन्ते।

सिद्धान्तः

सिद्धान्तस्कन्धेऽस्मिन् आकाशस्थग्रहनक्षत्रादीनां स्थितिः, ग्रहाणां गतिविशेषः, ग्रहकक्षाः, अहर्गणानयनक्रमः, ग्रहस्पष्टीकरणप्रकारः,सूर्यचन्द्रयोर्ग्रहणमित्यादिविचारा उपवर्ण्यन्ते। एवमेव दिग्देशकालनिर्णयः सौरसावनादि नव मानभेदाः, ज्या साधनम्, चर-देशान्तरसंस्काराः इत्यादि-विषया अपि स्कन्धस्यास्य विचाराः।

कल्पादितः अहर्गणं संसाध्य यत्र ग्रहस्पष्टीकरणं क्रियते स सिद्धान्तः, यत्र च युगादितः अहर्गणमानीयते तत्तन्त्रमिति, तथा च कल्पितेष्टवर्षमारभ्य यस्मिन् अहर्गणमानीय ग्रहकर्म क्रियते तच्च करणमित्युदीर्यते। गणित-बीजगणित-रेखागणितमिति त्रिधा भिद्यते। बहुप्राचीनकाले एव भारतीयगणितज्ञाः गणितविषये महता प्रयत्नेन अनुसन्धानं कृत्वा बहूनंशान् प्रतिपादितवन्तः।

प्राचीनभारतीयज्यौतिषिकैराविष्कृतदशमलवपद्धतिः अधुनातनाधुनिकविज्ञानिभिरुपस्थापितः स सिद्धान्तः भास्कराचार्यैः सिद्धान्तशिरोमणिग्रन्थे स्पष्टं प्रतिपादितो दृश्यते। यथा —

आकृष्टिशक्तिष्टा मही तया यत्खस्थं गुरु स्वाभिमुखं स्वशक्त्या।
आकृष्यते तत्पततीव भाति समे समन्तात् क्व पतत्वियं खे।। इति।

नारदत्रिस्कन्धे एवमुक्तमस्ति।

गणिते परिकर्माणि खगमध्यस्फुटक्रिये।
अनुयोगष्टान्द्रसूर्यग्रहणं चोजयास्तकम्।।3।।

छाया श्रृङ्गोन्नतियुती पातसाधनमीरितम्।
— नारद त्रिस्कन्ध ज्योतिषे

आर्यभट्टस्य आर्यभटीयं, लल्लस्य धीवृद्धिदम्, ब्रह्मगुप्तस्य ब्रह्मस्फुटसिद्धान्तः, भास्कराचार्याणां सिद्धान्तशिरोमणिः, सूर्यसिद्धान्तः इत्यादयः प्रसिद्ध सिद्धान्तग्रन्थाः।

सिद्धान्तभागे अत्यन्तप्राचीनः प्रामाणिकग्रन्थः वर्तते सूर्यसिद्धान्तः। सूर्यसिद्धान्तस्य कर्तृविषये ज्योतिश्शास्त्राचार्येषु मतभेदाः दृश्यन्ते। परन्तु सूर्यांशपुरुषमयासुरयोः संवादरूपः ग्रन्थः अयमिति सूर्यसिद्धान्ते एव दृश्यते। तस्मिन्ग्रन्थे उक्तः कालस्वरुपविषयः मया अत्र प्रस्तूयते।

ग्रन्थोक्तरीत्या कालस्तु द्विविधः। सकलभुवनभूतानां संहारकारकः एकः कालः। सः तु अखण्डकालः। द्वितीयः कलनात्मकः कालः। कलनात्मके कालेऽपि वर्गद्वयम् वर्तते। स्थूलकालः सूक्ष्मकालष्टोति। व्यवहारे योग्यः स्थूलकालस्तु मूर्तकालः अपि च सूक्ष्मस्तु अमूर्तकालः इति उच्यते। तदेव अत्र

लोकानामन्तकृत् कालः कालोऽन्यः कलनात्मकः।
स द्विधा स्थूलसूक्ष्मत्वान्मूर्तष्टामूर्त उच्यते। इति

तत्र मूर्तकालः प्राणादयः, अमूर्तकालः त्रुट्यादयष्टा इति कथयन्त्याचार्याः।

प्राणादिः कथितो मूर्तस्त्रुष्ट्याद्योऽमूर्तसंज्ञकः। इति

अत्रापि मूर्तकालः पुनः उक्तः

षड्भिः प्राणैर्विनाडी स्यात् तत्षष्ठ्या नाडिका स्मृता।
नाडीषष्ट्या तु नाक्षत्रमहोरात्रं प्रकीर्तितम्।
तत् त्रिंशता भवेन्मासः सावनोऽर्कादयैस्तथा।। इति।

इत्युक्ते षड्प्राणाः एका विनाडिका। तादृश षष्टि विनाडिकाः एका नाडिका इत्युच्यते। षष्टि नाडिकास्तु एकं नक्षत्रमुच्यते। तन्नक्षत्रप्रमाणमेव अहोरात्रस्यापि कथयन्ति। एतादृशाहोरात्राणि त्रिंशत् एकः मासः भवति। सूर्योदयद्वयान्तर्गतः कालः एकं सावनदिनमित्युच्यते।

ऐन्दवस्तिथिभिस्तद्वत् सङ्क्रान्त्या सौर उच्यते।
मासैर्द्वादशभिर्वर्षं दिव्यं तदह उच्यते।।

तिथयः चान्द्रदिनानि भवन्ति। अतः अमान्तादमान्तं त्रिंशत्तिथयः एकः चान्द्रमासः। तथैव सङ्क्रान्तेः सङ्क्रान्तिं यावत् सूर्यस्य त्रिंशदंश-भोगकालः सौरमासः। एते सौरसावनचान्द्रमासाः द्वादश, एकं वर्षं भवति। तदस्माकं मानवानां एकं वर्षं देवानां एकं अहोरात्रं च भवति। तद्दिव्यदिनमिति कथ्यते।

एतत् दिव्यदिनमेव देवदैत्यानाम् अहोरात्रम् भवति। इत्युक्ते यत् देवानाम् दिनम् तत् असुराणाम् रात्रिः। यत् देवानाम् रात्रिः तदसुराणां दिनं भवति। तदैवात्र उक्तः

सुरासुराणामन्योऽन्यमहोरात्रं विपर्ययात्।
तत्षष्टिः षड्गुणा दिव्यं वर्षमासुरमेव च।। इति

दिव्यदिनानि यदि षष्ट्यधिकत्रिशतं भवन्ति चेत् तत् एकं दिव्यवर्षं भवति। तत् द्वादशसहस्राणि तु चतुर्युगं भवति। इत्युक्ते द्वादशसहस्राणि दिव्यवर्षाणि चतुर्युगाः भवन्ति। चतुर्युगा नाम कृत-त्रेता-द्वापर-कलियुगाः। एतानि चतुर्युगानि यदि सौरवर्षेषु वक्तव्यानि चेत् —

12,000 दिव्यवर्षाणि X 360 सौरवर्षाणि = 4,320,000 सौरवर्षाणि।

तद्द्वादशसहस्राणि चतुर्युगमुदाहृतम्।
सूर्याब्दसङ्ख्यया द्वित्रिसागरैरयुताहतैः।।

एतच्चतुर्युगमानं तु युगसन्धिसहितं भवति। यथा प्रतिदिनं दिनषष्ठांशमितं सन्ध्यामानं भवति तथैव कृत-त्रेता-द्वापर-कलिसंज्ञकयुग-चरणानामपि आद्यन्तयोः सन्ध्यासन्ध्यांशौ भवन्ति। कृतादीनां युगानामियं व्यवस्था युगीयधर्मचरणानुसारिणी इति ज्ञेया। यथा कृतयुगे धर्मस्य चत्वारः पादाः, त्रेतायुगे त्रयः भागाः, द्वापरे द्विभागौ, कलौ तु एकः एव धर्मपादः भवति। तदनुसृत्य युगानां मानं भवति। तदित्थं वदति

सन्ध्यासन्ध्यांशसहितं विज्ञेयं तच्चतुर्युगम्।
कृतादीनां व्यवस्थेयं धर्मपादव्यवस्थया।। इति

युगस्य दशमो भागः पृथक् पृथक् चतुर्भिः, त्रिभिः, द्वाभ्याम्, एकेन च गुण्यते चेत् क्रमेण कृत-त्रेत-द्वापर-कलियुगानां मानं भवति। तम्मानं स्वस्वसन्ध्यासन्ध्यांशसहितमिति ज्ञेयः। तत् कथं नाम

युगप्रमाणं तु 12,000 दिव्यवर्षाणि x 10/4

= 4,800 दिव्यवर्षाणि कृतयुगम्।

युगप्रमाणं तु 12,000 दिव्यवर्षाणि x 10/3

= 3,600 दिव्यवर्षाणि त्रेतायुगम्।

युगप्रमाणं तु 12,000 दिव्यवर्षाणि x 10/2

= 2,400 दिव्यवर्षाणि द्वापरयुगम्।

युगप्रमाणं तु 12,000 दिव्यवर्षाणि x 10/1

= 1,200 दिव्यवर्षाणि कलियुगम्।

अधुना सन्धिमानगणना तु कृतयुगमानं 4,800/6 = 800 दिव्यवर्षाणि कृतयुगसन्धिभागः। तदपि 400 दिव्यवर्षाणि तु कृतादौ, 400 दिव्यवर्षाणि कृतान्ते च सन्धिर्भवति।

त्रेतायुगमानं 3,600/6 = 600 दिव्यवर्षाणि त्रेतायुगसन्धिभागः। तत्रापि 300 त्रेतायुगादौ, 300 त्रेतायुगान्ते च सन्धिभागः भवति।

द्वापरयुगमानं 2,400/6 = 400 दिव्यवर्षाणि द्वापरयुगसन्धिभागः। अत्र 200 द्वापरयुगादौ, अन्ते 200 दिव्यवर्षाणि च सन्धिः भवति।

कलियुगमानं 1,200/6 = 200 दिव्यवर्षाणि कलियुगसन्धिभागः। अत्रापि 100 कलियुगादौ, एवञ्च 100 कलियुगान्ते च सन्धिभागः भवति। एतदेव उक्तम् अत्र —

युगस्य दशमो भागष्टातुस्त्रिद्व्येकसङ्गुणः।
क्रमात् कृतयुगादीनां षष्ठांशः सन्ध्ययोः स्वकः।। इति

पूर्वोक्तमहायुगानां (द्वादशसहस्रदिव्यवर्षात्मकम्) एकसप्ततिः एकं मन्वन्तरं इति उच्यते। एकसप्ततिमहायुगमेको मनुस्तिष्ठतीत्यर्थः। एकैकस्य मनोरन्ते सन्धिकालः कृताब्दसंख्याकालः विद्यते। सन्धिकालेऽस्मिन् महीजलेन पूर्णा भवति। तदैवोक्तः —

युगानां सप्ततिः सैका मन्वन्तरमिहोच्यते।
कृताब्दसङ्ख्यस्तस्यान्ते सन्धिः प्रोक्तो जलप्लवः।। इति ।

एकस्मिन् कल्पे स्वस्वसन्धिसहिताः मनवः चतुर्दश भवन्ति। ते के नाम स्वयंभुव, स्वारोचिष, उत्तम, तामस, रैवत, चाक्षुष, वैवस्वत, सावर्णि, दक्षसावर्णि, ब्रह्मसावर्णि, धर्मसावर्णि, रुद्रपुत्र, रौच्यष्टा, भौत्यकः इति चतुर्दशमनूनां नामानि।

कल्पादौ कृतयुगप्रमाणकालः सन्धिकालः स्मृतः। इत्युक्ते कल्पादौ कृतयुगकालानन्तरं प्रथमो मनुराविरभूदित्यर्थः। तेन कल्पे चतुर्दश-मनवस्तेषां पञ्चदश सन्ध्यष्टाभवन्ति तथैवोक्तः —

ससन्धयस्ते मनवः कल्पे ज्ञेयाष्टाचतुर्दश।
कृतप्रमाणः कल्पादौ सन्धिः पञ्चदशः स्मृतः।। इति ।।

तदेवं वदति —

इत्थं युगसहस्रेण भूतसंहारकारकः
कल्पो ब्राह्ममहः प्रोक्तं शर्वरी तस्य तावती।।

ब्रह्मणः आयुः तावत् शतमहोरात्रं भवति। अर्थात् द्विशतकल्पाः ब्रह्मणः आयुः। अधुना ब्रह्मणः पञ्चाशत् अहोरात्राण्यतीतानि। एकपञ्चाशत्तमं दिनं प्रचलति।

परमायुः शतं तस्य त्वहोरात्रसङ्ख्यया।
आयुषोऽर्धमितं तस्य शेषकल्पोऽयमादिमः।।

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परमेश्वराचार्यविरचितायाः विवरणाख्यसूर्यसिद्धान्तव्याख्यायाः वैशिष्ट्यम्

चित्तरञ्जननायकः

सूर्यसिद्धान्तः

भारतीयगणितज्योतिषशास्त्रस्य मूलग्रन्थोऽस्ति सूर्यसिद्धान्तः।

अल्पाविशिष्टेतु कृते मयो नाम महासुरः।
रहस्यं परमं पुण्यं जिज्ञासुर्ज्ञानमुत्तमम्।
वेदाङ्गमग्र्यमखिलं ज्योतिषं गतिकारणम्।
आराधयन् विवश्वन्तं तपस्तेपरे सुदुश्चरम्।

आभ्यां श्लोकाभ्यामवगम्यते-कृतयुगस्यान्तिमभागे मयनामकः कश्चन असुरः अस्य ग्रहनक्षत्रादि ज्योतिष्पिण्डानां गतिविषयकस्य रहस्यमवगमनाय सूर्यदेवं तपश्चचार। सूर्यदेवः मयस्य सुदुश्चरतपसा प्रीतः जातः। अनेन तपोबलेन मयासुरः सूर्यांशपुरुषविशेषात् शास्त्रमिदमलभत। अतो एनं ग्रन्थं केनापि पार्थिवपुरुषेण न रचितः। इदं भारतीयगणित-ज्योतिषस्य आर्षग्रन्थेति लोके सुप्रसिद्धः, सर्वमान्यश्च। "अल्पावशिष्टे तु कृते" इति पङ्क्तौ अनुमन्यते। अस्य ग्रन्थस्याविर्भावकालः 21,65,111 सौरवर्षेभ्यः पूर्वं नाम 21,600,000 BCE पूर्वमिति। अस्य ग्रन्थस्य मातृकाः (manuscripts) न केवलं भारतीयमातृकालयेषु अपितु विदेशे स्थितानां मातृकासङ्ग्रहालयेषु च संगृहिताः सन्ति। अयं पञ्चशतश्लोकविशिष्ट, चतुर्दशाधिकारैः विभक्तोऽस्ति। ग्रन्थस्यास्य पञ्चविंशत्यधिकानि व्याख्यानानि समुपलभ्यन्ते। तासु व्याख्यासु परमेश्वराचार्यस्य विवरणाख्या व्याख्या भिन्नास्ति।

आचार्यपरमेश्वरः

आचार्यपरमेश्वरः स्वीयकृतिषु कुत्रापि स्वस्य परिचयः न दत्तः। तेन विरचितदृग्गणितपुस्तके

स्वस्य रचनाकालः 1353 शकवर्षेनाम CE 1431 इति अवगम्यते। सूर्यसिद्धान्तस्य व्याख्यानादौ अस्य महात्मनः सामान्यपरिचयः परिलक्ष्यते। यथा —

व्याख्यातं भास्करीयं लघु तदनु महाभास्करीयं सभाष्यम्
पश्चाल्लीलावती च ग्रहगतिविषयं किञ्चिदन्यञ्च येन।
सोऽयं श्रीरूद्रशिष्यो वदनजशिशवे सूर्यसिद्धान्तसंस्थम्
वक्ष्यत्यस्पष्टमर्थगणितविषयकं कर्म तत्रैव हि स्यात्।।

श्लोकादस्मादवगम्यते परमेश्वरस्य लघुभास्करीय, महाभास्करीय लीलावत्यादि, गणितविषयानां व्याख्यानानि एवमन्यत् गणितविषयानां विरचनञ्च दृश्यते। अस्य महात्मनः गुरोर्नाम रुद्रदेवः। अयं वदनजशिशवे नाम ब्राह्मणपुत्रः इति ज्ञायते। एतद्भिन्नमपि आचारसङ्ग्रहः गोलदीपिका, ग्रहणान्यदीपिका, ग्रहणमण्डन ग्रहणाष्टक, चन्द्रच्छायागणितः, चातकपद्धति, दृग्गणित, वाक्यकरण, वाक्यदीपिका, विवाहानुकूल्यम्, षडवर्गफलादि परमेश्वरस्य स्वीयकृतयः, एवञ्च आर्यभटीय, जातककरण, मुहूर्तरत्न, लघुमानस, व्यतिपाताष्टक, षट्पञ्चाशिका, सूर्यसिद्धान्तादि-ग्रन्थानां व्याख्यानानि परमेश्वराचार्यस्य कृतयः विद्यन्ते। परमेश्वरस्य शिष्य नीलकण्ठस्य आर्यभट्टीयव्याख्याने अस्य महात्मनः परिचयः समुपलभ्यते। परमेश्वरोऽयं दक्षिणभारतस्य मालावरप्रदेशो नाम केरलप्रदेश-नीलनद्याः उत्तरभागेदशकलोनेकादशांशोत्तराक्षांशे (10'-50') — अष्टदशव्यङ्गुलाधिक द्वेऽङ्गुले विषुवद्भ्यां मध्यरेखातः पश्चिमभागे अष्टादशयोजनानि दूरे अश्वत्थग्रामे अस्य ग्रामस्याधुनिकनाम अलत्तुरग्रामे भार्गवगोत्रीय ब्राह्मणः आसीत्।

व्याख्यानमिदं त्रयोदशाध्यायैः अतीव सरलः, संक्षिप्तः, सुबोधगम्यश्चास्ति। ग्रहभगणाः, भूदिनस्वरुपम्, युगाधिमासादिविषयेषु भास्करीयप्रमाणस्य तोलनं दृश्यते। अतोऽनुमन्यते आचार्यपरमेश्वरः भास्कराचार्यस्य मतमङ्गीकृतवन्तः इति। सूर्यसिद्धान्तानुसारे कलियुगारम्भिक-ग्रहसंस्थितेः संशोधनमेव व्याख्यानस्यास्यातीव वैशिष्ट्यमस्ति।

ग्रहाणां गतिभेदवशात् कालान्तरे तेषां दृग्भेदो जायते। अतः कालतो मन्दफल-शीघ्रफलसंस्कारेणैव क्रमात् खेटानां सिद्धान्ताः सदैव परिवर्त्तनीयाः। तदर्थं आचार्यपरमेश्वरः सूर्यसिद्धान्तस्य व्याख्यानावसरे सूर्यसिद्धान्तोक्तकलियुगारम्भिको ग्रहाणां संशोधनं कृतं विद्यते। यथा —

कल्यादौ जातसंस्कारो ध्रुवरुपेण कथ्यते
अत्रैषामनुपातेन तैः कल्प्यश्चोर्ध्वकालतः।।

एवं कल्यादौ ग्रहसंस्कारः अग्रीमकाले तदनुपातिकः संस्कारः करणीयः। अत्र कल्यादौ ग्रहसंशोध्यांशाः प्रोक्ताः। यथा —

भानौ योज्या बाणकला विकलाश्चेषु बह्नयः।
लिप्ताद्वयं विधौ शोध्यं विलिप्ताश्च नागाग्नयः।।

तुङ्गे शोध्याश्चतुर्भागाः सप्तचन्द्रकला अपि।
विकला विश्वतुल्याश्च विकालान्तास्त्रयस्वामी।।

पञ्चलिप्ताः कुजे शोध्या बुधे वेदांशकस्तथा।
शोध्याश्शराब्धिलिप्ताश्च गुरौ भागत्रयं तथा।।

शोध्यं भृगौ वेदभागाश्शोध्या लिप्ताजिनैर्मिताः।
शनौ योज्या वेदभागास्सप्तलिप्तास्तथैव च।।

अत्र कलियुगारम्भिक ग्रहसंस्थितौ यथाक्रमम्
सूर्ये पञ्चकलाः पञ्चत्रिंशत् विकलाः योज्याः। (+5'37")
चन्द्रमसि द्वे कले सप्तत्रिंशत् विकलाः शोध्याः (-2'-37")
चन्द्रोच्चे चतुर्भागाः सप्तदशकलाः त्रयोदशविकलाश्च शोध्याः। (-4"/17'/13')
चन्द्रनीचे द्वौ भागौ पञ्चत्रिंशत्कलाः योज्याः। (+2°/3'5)
अङ्गारके पञ्चलिप्ताः शोध्याः। (-5')
वुधे चत्वारांशाः पञ्चचत्वारिंशत् कलाः विशोधनीयाः। (4°/45')
गुरौ त्रयांशाः शोध्याः। (-3°)
शुक्रे चत्वारांशाः चतुर्विंशतिकलाः शोध्याः (-4°/24')
शनौ चत्वारांशाः सप्तकलाः योज्याः (4°7')
योज्यं भागद्वयं पातमध्ये लिप्ताश्शराग्नयः।
दृक्साम्यसिद्धये कुर्यात् कल्यादौ ध्रुवका इति।।

अत्र कल्यादौ पातस्य संशोधनार्थमपि पञ्चत्रिंशत्कलाः अधिकाः अंशद्वयं (2° - 35') योजनीयमस्ति आचार्यस्य प्रमाणम्। अनेन संशोधनेन कल्यादौ ग्रहाणां पातस्य च ध्रुवकाः प्राप्यन्ते। एवमत्रास्य व्याख्यानस्य वैशिष्ट्यमुपलक्षते।

ग्रहाः	सूर्यसिद्धान्तोक्त कलियुगारम्भिक राश्यादि ग्रहाः				ग्रहाशोध्यांशाः			ग्रहाणां संशोधित भागाः			
	राशि	अंश	कला	विकला				रा	अ	क	वि
रविः	00	00°	00'	00"	+5		35"	0	0°	5'	35"
चन्द्रः	00	00°	00'	00"	−2'		37"	11	29°	57'	23"
चन्द्रोच्चः	03	00°	00'	00"	−4°	17'	13"	02	25°	42'	47"
चन्द्रनीचः	06	00°	00'	00"	+2°	35'	00"	06	02°	35'	00"
कुजः	00	00°	00'	00"	−00°	05'	00"	11	29°	55'	00"
बुधः	00	00°	00'	00"	−04°	45'	00"	11	25°	15'	00"
गुरुः	00	00°	00'	00"	−03°	00'	00"	11	27°	00'	00"
शुक्रः	00	00°	00'	00"	−04°	24'	00"	11	25°	36'	00"
शनिः	00	00°	00'	00"	+04°	07'	00"	0	04°	7'	00"

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अहर्गणानयनम्

गोविन्द प्रसाद शर्मा

अह्नानां दिनानां गणः समूहोऽहर्गणः इत्युच्यते। अतः इदानीं सर्वेषां मनसि जिज्ञासा जायते अहर्गणस्य प्रयोजनं किम्? अतः उक्तं सूर्यादिग्रहाणां स्पष्टीकरणार्थं, तिथ्यादिपञ्चाङ्गसाधनार्थं ग्रहणादिस्पष्टीकरणार्थं सृष्ट्यारम्भकालज्ञानार्थं पृथिव्याः उत्पत्तिकालदर्शनार्थम् आवश्यकता भवति यथा — जीवस्याधारेण जीन्स्परीक्षाधारेण च वैज्ञानिकास्तस्यायुषो निर्धारणं कुर्वन्ति। तथैव दैवज्ञैः अहर्गणविधिना ग्रहोदयास्ताः स्पष्टीकरणार्थं आचार्यैः निर्दिष्टाः।

अहर्गणः चान्द्रसावननाक्षत्रसौरभेदाश्चतुर्विधोऽस्ति, तत्र चान्द्रसौरनाक्षत्रादीनां कदा आदि-प्रारम्भः कदा पूर्तिरिति युक्तिमन्तरा प्रत्यक्षाभावात् सावनदिनस्य सूर्योदयसमये प्रारम्भविरामयोः प्रत्यक्षावलोकनात् ग्रहादि-साधनाय सर्वैः प्राचीनैराचार्यैः सावनात्मकः अहर्गणः साधितः। तत्र सौरचान्द्रमसोरन्तरमधिदिनानि चान्द्रसावनयोरन्तरं क्षयदिनानि उच्यन्ते। अर्थात् सूर्योदयसमये एव रविचन्द्रौ मेषादिस्थो जाताविति तावत् कल्प्यते। तदा युगपत् सौरसावनचान्द्रनाक्षत्रादीनां प्रवृत्तिर्जायतेति सुविदितं सर्वेषां तदानीं रविः राश्यादिगतत्वात् सौरदिनादि। उदयायुदयं भानोः भूमिसावनवासर इति उक्तं सूर्यसिद्धान्ते। अयमेव सावनदिनादिः यन्नक्षत्रं तदानीमुदयतिथिजात्य-तदुदयान्नक्षत्रदिनादिः रविचन्द्रयोरेकत्र गतत्वात् तदानीं दर्शः सूर्येन्दुसङ्गमः इति लक्षणेन अमान्तकालघटनाच्चान्द्रदिनादिः जातः।

तत्र द्वादशसौरमासानां वर्षसंज्ञात्वात् कल्पादितः गतवर्षसंख्यया द्वादशगुणिताः अभीष्टवर्षादौ सौरमासा भवन्ति। तेषु चैत्रादिगत-चान्द्रमासतुल्याः सौरमासाः योज्यन्ते। सौरमासाः तदा ते अभीष्ट-संक्रान्त्यवधिकाः सौरमासाः भवन्ति। परन्तु ते दर्शसंक्रान्तिकालयोरन्तर्वर्तिनाधिमासाशेषेणाधिका भवन्ति। अतः दर्शाग्रतः संक्रमकालतः प्राक् सदैव तिष्ठत्याधिमासाशेषमिति उक्तमावश्यकम्। इत्युक्तेः तेषां सौरमासानां चान्द्रमासकरणार्थमधिमासानयनं प्रतिपादितम्। यदि पठितयुगसौरमासैः पठितकल्पादिमासस्तैरिष्टसौरमासैः कः इति।

कल्पाधिमासाः X इष्टसौरमासाः　　　　　　　　अधिशेष
कल्पसौरमासाः　　　　　　　　　　　　　　क.सौ.मा.

तत्राभ्यामधिमासाऽधिशेषाभ्यां युताः क्रियन्ते तदा गतसौरमासाः गतसौरवर्षान्ते चान्द्रमासाः भवन्ति। अर्थात् अभीष्टास्त्वमान्तकालिकाः अतोऽमान्त संक्रान्ति कालयोर्मध्ये अधिशेषं तिष्ठन्ति, उतोऽधिशेषेण हीनाश्चान्द्रमासाः अमान्तकालिकाः सिद्ध्यन्ति। यथा —

गतसौरमासाः गताधिमासाः अधिशेषम् - अधिशेषम्

चैत्रामान्ते चान्द्रमासाः अत्र अधिशेषस्येकत्र योजनम् अपरत्र शोधनं क्रियते। अतः तत्त्याग एव वरम्। पुनश्च चान्द्रमासस्त्रिंशद्गुणिता दर्शान्ते चान्द्रः दिवसाः (तिथयः) भवन्ति। तेषु दर्शान्तादिष्ट-दिनावधिका या गततिथयः ताः यदि योज्यन्ते तदा गततिथ्यन्तकालिक-चान्द्रदिनानि भवेयुः। अतः तेषां चान्द्रदिनानां सावनदिनकरणार्थमवमानयनं क्रियते। अत्र अवमः अर्थात् क्षयदिवसाः यदि पठितकल्पचान्द्रदिनैः कल्पक्षयदिनानि लभ्यन्ते तदा अभीष्टकान् इति।

कल्पक्षयदिनानि　　इष्टचान्द्रदिनानि　　क्ष. शे.
कल्पचान्द्रदिनानि　　　　　　　　　　　का.चा.दि.

तत्राऽऽभ्यां विशोधिताभीष्टचान्द्रदिनानि तिथ्यन्ते सावनदिनानि भवन्ति। किन्त्वपेक्षितास्तु सूर्योदयकालिकेऽतः "तिथ्यन्तसूर्योदययोऽस्तु मध्ये सदैव तिष्ठत्यवमावशेषम् " उक्तं च भास्कराचार्येण इत्युक्ते लक्षणात् तिथ्यन्तकालिक-सावनोऽहर्गणे क्षयशेषस्य योजनेन सूर्योदयकालिक-सावनाहर्गणो भवति। अर्थात् अभीष्टचान्द्रदिनानि-प्राप्तक्षयदिनानि-क्षयशेषं क्षयशेषम्।

अभीष्टचान्द्रदिनानि-प्राप्तक्षयदिनानि सूर्योदयकालिक-मध्यमसावनाहर्गणः अतः भास्कराचार्येण उक्तं "अधिमासा दिनक्षयशेषोऽतोऽद्यघटिकादिकमत्र न गृह्यते" क्षयशेषस्य त्यागकरणार्थं निर्देशः प्रदत्तः। तत्राहर्गणानयने मध्यमतिथीनामज्ञानवशात् तिथयः स्पष्टाःगृहीताः। तेन मध्यमस्पष्ट- तिथ्यन्तरवशादहर्गणस्याप्यन्तरितत्वात् अभीष्टवारस्य अनुपलभ्यमानत्वाच्च तिथ्यादिषु सैकैर्निरेकत्वं करणीयम्। अथ च चैत्रामान्तादभीष्टदिनपर्यन्तं स्पष्टमानेन यद्यधिमासाः पतितो मध्यममानेन तद्यदि नोपलभ्यते, तथा स्पष्टमानेन यदि नोपलब्धो मध्यममानेन चोपलभ्यते। तदाप्यधिमासस्य सैकैर्निरेककरणेनाऽभीष्टवारेऽहर्गणः सिद्ध्यति। सूर्यसिद्धान्ते एवं प्रकारेण प्रतिपाद्यते। यथा —

अत ऊर्ध्वममीयुक्ता गतकालाब्दसङ्ख्यया।
मासीकृता युता मासैर्मधुशुकलादिभिर्गतैः।।

पृथक्स्थास्तेऽधिमासघ्नाः सूर्यमास-विभाजिताः।
लब्धाधिमासकैर्युक्तादिनीकृत्य दिनान्विताः।।

द्विष्ठास्तिथिक्षयाभ्यस्ताश्चान्द्रवासर-भाजिताः।
लब्धोनरात्रिरहिता लङ्कायामार्धरात्रिकः।।

सावनो द्युगणः सूर्याद्दिनामासाब्दपास्ततः।
सप्तभिः क्षयितः शेषः सूर्याद्यो वासरेश्वरः।। — 48-51

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ग्रहणस्वरूपविमर्शः

टि. मुरली कृष्ण

गृह्यते अनेनेति ग्रहणमिति व्युत्पत्त्या ग्राहको ग्राह्यं वस्तु यदा गृह्णाति तदा ग्रहणमिति। ग्रहणञ्च चन्द्रग्रहणं सूर्यग्रहणमिति द्विविधम्। ग्रहणस्य सम्भवः कदा कथं स्यात् कारणञ्च किमिति जिज्ञासा भवत्येव।

पुराणेष्वपि ग्रहणस्य विचारः कथारूपेण संवर्णितः वर्तते। किन्तु ज्योतिश्शास्त्रस्य प्रमुखेषु सिद्धान्तग्रन्थेषु आर्यभटीय-सिद्धान्तशिरोमणि-सूर्यसिद्धान्तेषु अथवा संहिताग्रन्थेष्वन्यतमायां बृहत्संहितायां वा भवतु ग्रहणसम्भवः कदा स्यात् तत्र किं कारणमित्यादि स्पष्टमेवाभिहितं आचार्यप्रवरैः।

पुराणेषु सूर्यचन्द्रयोर्ग्रहणं राहुकृतमिति प्रतिपादितम्। उक्तञ्च यथा बृहत्संहितायां राहुचाराध्याये —

अमृतास्वादविशेषाच्छिन्नमपि शिरः किलासुरस्येदम्।
प्राणैरपरित्यक्तं ग्रहतां यातं वदन्त्येके।।

पुरा समुद्रमथनावसरे अमृतं पिबतः असुरस्य शिरः मोहिनीरूपधारिणा भगवता हरिणा सुदर्शनाख्येन चक्रेण खण्डितम्। किन्तु अमृतास्वादकारणात् प्राणसहितः सोऽत्रावतिष्ठत्। सैव राहुः ग्रहणाकर्ता इति पौरणिकानां मतम्।

अन्ये च केचन रविचन्द्रयोर्यादृश्याकृतिर्वर्तते तादृगेव राहुमण्डलस्यापि परन्तु तस्य कृष्णवर्णत्वमस्तीत्यतः गगने नैव दृश्यते अन्यच्च ब्रह्मणः वरप्रदानात् पर्वकालादन्यस्मिन्दिवसे राहुः दृष्टिपथे नायाति इति।

अन्ये च केचन आचार्याः मुखपुच्छविभक्ताङ्गान्वितः आकारः इति, सर्पाकृतिरिति, मूर्तिरहितः अन्धकारस्वरूपः राहुरिति इत्येतादृशमतानि वराहमिहिरस्य कालादर्वाग्पुराणप्रसिद्धमासीत्। अतस्तदेव मतानि उपस्थाप्य अस्य साध्वसाधुत्वं निरूपयति यथा —

राहुः मूर्तिमान् सन् यथान्ये ग्रहाः राशिषु नक्षत्रेषु वा विचरन्ति तथा यदि विचरति तर्हि राहुः गणितस्कन्धोक्तदिशा निश्चितगतिर्भूत्वा कथं वा राशिषट्केनैव व्यवहितौ सन्तौ सूर्यचन्द्रमसौ सः गृह्णाति। अतः राहुर्मूर्तिमान्नित्येतन्मतं निरस्तम्।

राहुर्यदि अनिश्चितगतियुक्तः इति कथ्यते तर्हि गणितप्रकारेण तस्य स्थित्युपलब्धिर्न भवेत्। किन्तु गणितस्कन्धे तद्भवतीति निरूपितं किल। मुखपुच्छविभक्ताङ्ग राहु इति स्वीकृते सति सूर्यचन्द्रमसोः षड्राश्यन्तरमेव किमर्थं राशिद्वयेन, त्रयेण, चतुष्केण वा अन्तरमेव कस्मान्न भवति? अतः एतदपि मतं दोषपूर्णं सञ्जातम्।

सर्पाकारस्सन् षड्राश्यन्तरितावर्कचन्द्रौ लाङ्गूलेन वदनेन वा गृह्णाति चेत् मुखपुच्छ-मध्यवर्तिभगणार्धमपि आच्छादयेत्। एतन्नदृश्यते गगने किमिदं समीचीनम्? नैव भवति। एवं सर्वाण्यपि मतानि निराकृत्य वास्तविकं वैज्ञानिकं तत्त्वं किमस्त्यत्र इति स्पष्टीकरोति यथा —

भूच्छायां स्वग्रहणे भास्करमर्कग्रहे प्रविशतीन्दुः।
प्रग्रहणं पश्चान्नेन्दोर्भानोश्च पूर्वार्धात्।। इति

चन्द्रग्रहणे चन्द्रः भूच्छायां प्रविशति। अर्थात् महाबिम्बात् स्वगतप्रकाशाच्च क्रान्तिवृत्तस्थस्सूर्यात् षड्राश्यन्तरे विद्यमानस्य सूर्यबिम्बापेक्षया स्वल्पभूतभूमिगोलस्य ऐक्यकाले सूर्यकिरणावरोधात् क्रमशः अपक्षीयमाणा सूचीरूपा छाया समुत्पद्यते। स एव तमोरूपः राहुसंज्ञकः इति। एवं रविमण्डले भ्रममाणश्चन्द्र भूभासूचीं प्रविश्य कान्तिविहीनः यदा भवति तदा चन्द्रग्रहणं सञ्जायते। अतः चन्द्रग्रहणे ग्राह्यश्चन्द्रः ग्राहिका भूच्छाया। शीघ्रचन्द्रस्य भूच्छाया प्रवेशो रवेराभिमुख्ये षड्राश्यन्तरितप्रमाणेनैव सिद्ध्यति इत्यनेन चन्द्रग्रहणं सर्वदा पूर्णिमायां एव सम्भवति।

सूर्यग्रहणे चन्द्रबिम्बं सूर्यमाच्छादयति। चन्द्रः स्वकक्ष्यायां भूरव्योस्साक्षान्मध्ये सञ्चरन् मेघवत् सूर्यबिम्बमाच्छादयति। तेन सूर्यग्रहणं सञ्जायते। अतः सूर्यग्रहणे सूर्यो ग्राह्यः ग्राहकश्चन्द्रमा। ग्रहणेऽस्मिन् सूर्यचन्द्रावेकराशिस्थौ भवतः अर्थात् अमावास्यायामेव सूर्यग्रहणम् सम्भवति। यथोक्तं सूर्यसिद्धान्ते —

तुल्यौ राश्यादिभिः स्याताममावास्यान्तकालिकौ।
सूर्येन्दू पौर्णमास्यन्ते भार्धे भागादिभिः समौ।।

चन्द्रग्रहणे पूर्वाभिमुखस्सन् भूच्छायां प्रविशति। अतः एतेनेदं सिद्ध्यति कदापि अस्मिन्ग्रहणे पश्चाद्भागे स्पर्शः न भवति। सूर्यग्रहणे चन्द्रः पश्चादागत्य अमावास्यान्ते अर्कतलं प्रविशति इत्यनेन कदापि पूर्वार्धात् सूर्यग्रहणं न भवति।

एवञ्चेत् प्रतिमासं पूर्णिमायां अमायां वा किन्निमित्तं ग्रहणं न भवति इति प्रश्नः

समुदेति। उक्तञ्च यथा —

सूर्यात् सप्तमराशौ यदि चोदग्दक्षिणेन नातिगतः।
चन्द्रःपूर्वाभिमुखश्छायामौर्वीं तदा विशति।।

एतेनेदं गम्यते यदि चन्द्रः सूर्यात् सप्तमे राशौ स्थित्वा भूच्छायातः उत्तरेण दक्षिणेन वा स्वल्पेन शरेण विक्षिप्तस्सन् पूर्वाभिमुखो गच्छन् भूच्छायां प्रविशति। भूच्छायायाः स्वरूपं तावत् मूलाद् बृहद् भवति अग्रादल्पञ्च। सा छाया चन्द्रकक्ष्यामुल्लङ्घ्य ऊर्ध्वं याति। तत्रस्थश्चन्द्रमा अत्यल्पविक्षिप्तो यदा भवति तदा सर्वग्रासः तन्न्यूनाधिक्ये चतुर्भाग-अर्धपादोनमथवा ग्रासाभावः इत्येवं चिन्तनीयम्।

चन्द्रग्रहणं सर्वत्रैकरूपं, सूर्यग्रहणं प्रतिदेशमन्यादृशञ्च भवतीति यथा —

चन्द्रोऽधःस्थः स्थगयति रविमम्बुदवत् समागतः पश्चात्।
प्रतिदेशमतश्चित्रं दृष्टिवशात् भास्करग्रहणम्।।

आदित्याधस्थश्चन्द्रमा पश्चाद्भागात् समागत्य मेघवच्छादयतीति पूर्वमेवाभिहितम्। इदमेव कारणं वर्तते यत्सूर्यग्रहणं दर्शकस्य प्रदेशवशात् नानाप्रकारेण अवलोक्यते। अर्थात् क्वचित्सर्वग्रहणं क्वचित्खण्डग्रहणं क्वचिच्च ग्रहणाभावः इति।

ग्रहणस्पर्शकाले मध्यकाले उन्मीलनकाले वा चन्द्रमायाः वर्णः कथं स्यादिति गोलपादे आर्यभटः —

प्रग्रहणान्ते धूम्रः खण्डग्रहणे शशी भवति कृष्णः।
सर्वग्रासे कपिलः सकृष्णताम्रस्तमोमध्ये।।

इत्थं ग्रहणस्य केवलं स्थूलं परिचयं मयास्मिन् प्रबन्धे निरूपितम्। एतदतिरिच्य गणितस्कन्धान्तर्गतेषु ग्रन्थेषु गणितप्रक्रियाः विशेषतया प्रदर्शिताः वर्तन्ते। विस्तरभयात्तन्न प्रतिपाद्यते।

अन्ते तु कानिचन वाक्यानि — सम्प्रति इस्रो-नासासंस्थाभिः यादृक्कर्मकृतं, क्रियमाणं वर्तते तादृक्कर्म अस्माकं पूर्वजैः आचार्यैः वेधप्रक्रियया, प्रत्यक्षदर्शनेन, योगबलेन च साक्षात्कृतम्। तानि च तैः तालपत्रेषु मातृकासु वा लिखित्वा संस्थापितम्। बहवः गणितस्कन्धग्रन्थाः अप्रकाशिताः वर्तन्ते। अतस्तेषां सम्पादनमध्ययनं वा नूतनदिशि अस्मन्नयेदिति भावये।

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पञ्चाङ्गपरिचयः

एन्. डि. जयकृष्णन् नम्पूतिरि

अपौरुषेयाणां वेदानां षडङ्गेषु शिक्षाकल्पव्याकरणनिरुक्तच्छन्दज्योतिषेषु अन्यतमं भवति वेदस्य चक्षुरूपं ज्योतिश्शास्त्रम्।

छन्दः पादौ शब्दशास्त्रञ्च वक्त्रं कल्पः पाणी ज्योतिषं चक्षुषी च।
शिक्षा घ्राणं श्रोत्रमुक्तं निरुक्तं वेदस्याङ्गान्येवमाहुर्मुनीन्द्राः।।

एवं वेदाङ्गानि आचार्यैः विव्रियन्ते। एवं वेदस्य चक्षुरूपम् अन्यतमं ज्योतिश्शास्त्रं सिद्धान्तः संहिता होरा इति त्रिस्कन्धात्मकम्, जातकं गोळः निमित्तं प्रश्नः मुहूर्त्तः गणितम् इति षडङ्गभूतं च वर्तते। अस्य शास्त्रस्य कालविधानशास्त्रम् इत्यपरं नाम। वेदकालादारभ्य अभीष्टफलप्राप्तये क्रियमाणकर्मणां कालनिर्धारणम् अनेन क्रियते इत्यतः अस्य कालविधानशास्त्रमिति नामान्तरम्। अस्य कालस्य बोधनाय पञ्चाङ्गान्यपि स्वीक्रियन्ते। पञ्चावयवैः संवलितत्वेन पञ्चाङ्गमित्यस्य ख्यातिः। अत्र सम्पूर्णप्रपञ्चे प्रसिद्धः विषयोऽयं प्राधान्येन विव्रियते।

पञ्चानामङ्गानां समाहारः पञ्चाङ्गम्। तिथिवारनक्षत्रयोगकरणानि पञ्चाङ्गानि। एषामज्ञानेन मुहूर्तज्ञानं वा जातकनिर्माणं वा न सिद्ध्यति। अतः अस्य पञ्चाङ्गस्य प्रत्येकम् अङ्गस्य विवरणमत्र दीयते।

तिथिः

सूर्यचन्द्रयोरन्तरं तिथिः। सूर्याच्चन्द्रमसः द्वादशभागात्मकमन्तरं तिथिः। शुक्ळप्रतिपदारभ्य पौर्णमीपर्यन्तं प्रतिपदादि तिथयः पञ्चदशशुक्ळपक्षे, कृष्णप्रतिपदारभ्य अमावास्यापर्यन्तं प्रतिपदादि तिथयः पञ्चदश कृष्णपक्षे च। आहत्य त्रिंशत्तिथयः। अतः एका तिथिः द्वादशांशात्मिका। सूर्यचन्द्रौ एकत्रैव वर्तेते तर्हि तिथिः अमावास्या। अर्थात् सूर्यचन्द्रस्फुटौ समानौ भवतः इति। तयोः षड्राश्यन्तरेण पौर्णमी जायते।

अर्कोन चन्द्रलिप्तास्तु तिथयो भोगभाजिताः।
गता गम्याश्च षष्टिघ्न्यो नाड्यो भुक्त्यन्तरोद्धृताः।।

तिथ्यानयनक्रमः

चन्द्रस्फुटात् सूर्यस्फुटं विशोध्य द्वादशसंख्यया विभजनीयम्। यत्फलं प्राप्यते सा गततिथिः। शिष्टः (वर्तमानतिथेः भुक्तांशः) द्वादशभागात् विशोध्यते चेत् वर्तमानतिथेः भोग्यांशादयः भवन्ति। ते षष्ट्या सङ्गुण्य रविचन्द्रगत्यन्तरेण विभजनीयाः। लब्धितिथेः अवशिष्टकालः भवति।

वर्तमानतिथिः = चन्द्रस्फुटम्-सूर्यस्फुटम् / 12 +1

तिथेः अवशिष्टकालः = (12 अंशः - तिथेः भूक्तांशः) X 60/रविचन्द्रगत्यन्तरम्

एवं प्रवृत्तमानतिथिः का, इतोऽपि कियत्कालः सा तिथिः प्रवर्तते इति ज्ञायते।

वासरः

ग्रहकक्षामनुसृत्य वारक्रमः प्रवर्तते। सप्तग्रहाः सप्तवासराः। ग्रहाणां कक्षाक्रमः तावत् शनिः गुरुः कुजः रविः शुक्रः बुधः चन्द्रः इत्येवं वर्तते। एकस्मिन् दिने चतुर्विंशतिहोराः भवन्ति। दिनस्य प्रथमहोराधिपः तत्तत्वासराधिपः द्वितीयहोराधिपः कक्षाक्रमानुसारमग्रिमः भवति। एवं पञ्चविंशतितमहोरा अग्रिमदिनस्य प्रथमहोरा भवति। तस्याधिपः वासराधिपः।

उदा-रविवासरे सूर्योदयात् प्रथमहोराधिपः सूर्यः, द्वितीयहोराधिपः ग्रहकक्षाक्रमानुसारं शुक्रः च भवति। ततः क्रमेण बुध-चन्द्र-शनि-गुरु-कुजानां होराः प्रवृत्तन्ते। पुनः एतेषां आवृत्तिः भवति। एवं पञ्चविंशतितमहोरा चन्द्रस्य आयाति। तदग्रिमदिनस्य प्रथमहोरा भवति। अतः तत्सोमवासरः।

नक्षत्रम्

अश्विन्यादि सप्तविंशति-नक्षत्राणि द्वादशराशिषु वर्तन्ते। तेषु यस्मिन्नक्षत्रे चन्द्रः तिष्ठति, तत् तदानीन्तननक्षत्रम्। एकस्य नक्षत्रस्य मानं त्रयोदशांशाः विंशतिकलाष्टा (800 कलाः) भवन्ति।

भभोगोऽष्टशतीलिप्ताः खाश्विशैलास्तथा तिथेः।
ग्रहलिप्ता भभोगाप्ता भानि भुक्त्या दिनादिकम्।।

नक्षत्रानयनक्रमः

अभीष्टकालचन्द्रस्फुटम् अष्टशतसंख्यया विभज्यते चेत् फलं गतनक्षत्रम्। शिष्टम् अभीष्टकालनक्षत्रस्य भुक्तकलाः। ताः अष्टशतसंख्यायाः विशोध्यन्ते तर्हि नक्षत्रस्य भोग्यकलाः प्राप्यन्ते। ताः भोग्यकलाः षष्ट्या सङ्गुण्य चन्द्रगत्या विभज्यन्ते चेत् नक्षत्रस्य एषः कालः प्राप्यते।

वर्तमाननक्षत्रम् = (चन्द्रस्फुटम् / 800 कलाः) +1

नक्षत्रस्यावशिष्टकालः = (800 कलाः - नक्षत्रस्य भुक्ताकलाः) X 60/चन्द्रगतिः

योगः

रविचन्द्रयोर्योगः योगः। ते च योगाः विष्कम्भप्रीत्यादयः सप्तविंशतिः। एकस्य योगस्य मानम् अष्ट-शतकलाः (13 अंशः 20 कलाः)।

रवीन्दुयोगलिप्ताश्च योगा भभोगभाजिताः।
गतगम्याश्च षष्टिघ्न्यो भुक्तियोगाप्तनाडिकाः।।

योगानयनक्रमः

सूर्यचन्द्रस्फुटयोः योगं कृत्वा अष्टशतसंख्यया विभज्यते तर्हि गतयोगसंख्या प्राप्यते। शिष्टाः (वर्तमानयोगस्य भुक्तकलाः) अष्टशतात् विशोध्यते चेत् वर्तमानयोगस्य भोग्यकलादयः भवन्ति। ताः कलाः षष्ट्या सङ्गुण्य रविचन्द्रगत्योर्योगेन विभजनीयाः। लब्धिः वर्तमानयोगस्य एष्यकालः भवति।

वर्तमानयोगः = ((चन्द्रस्फुटम् + सूर्यस्फुटम्)/800 कलाः) + 1
योगस्य भोग्यकालः = (800 कलाः - योगस्य भुक्तकलाः) X 60/रविचन्द्रगत्योर्योगः

करणम्

तिथ्यर्धं करणम्। तिथेरर्धभागः करणमित्यभिधीयते। सप्तचरकरणानि चत्वारिस्थिरकरणानि च मिळित्वा एकादशकरणानि। कृष्णपक्षचतुर्दश्युत्तरार्धे शकुनि, अमावास्यायाः पूर्वार्धे चतुष्पात्, उत्तरार्धे नागः शुक्लपक्षप्रतिपद्पूर्वार्धे किंस्तुघ्नम्, एवं स्थिरकरणानि। बवादि चरकरणानि शुक्लप्रतिपदुत्तरार्धमारभ्य कृष्णचतुर्दशीपूर्वार्धं यावत् पुनःपुनरायान्ति।

करणानयनक्रमः

ध्रुवाणि शकुनिर्नागं तृतीयं तु चतुष्पदम्।
किंस्तुघ्नं तु चतुर्दश्याः कृष्णायाश्चापरार्धतः।।

बवादीनि ततः सप्तचराख्यकरणानि च।
मासेऽष्टकृत्वम् एकैकं करणानां प्रवर्तते।।

तिथ्यर्धभोगं सर्वेषां करणानां प्रकल्पयेत्।
एषा स्फुटगतिः प्रोक्ता सूर्यादीनां खचारिणाम्।।

कृष्णपक्षे — गततिथिः द्वाभ्यां सङ्गुण्य सप्तसंख्यया विभज्यते चेत् यत् शिष्टमायाति, तस्मिन् एका संख्या योज्यते चेत् वर्तमानकरणं प्राप्यते। शुक्लपक्षे — गततिथिः द्वाभ्यां सङ्गुण्य सप्तसंख्यया विभज्यते चेत् यत् शिष्टमायाति तद्वर्तमानकरणं भवति।

कृष्णपक्षे करणम् = गततिथिः X 2/7 = शिष्टम् + 1

शुक्लपक्षे करणम् = गततिथिः X 2/7 = शिष्टम्

गर्भाधानादि षोडशकर्मणाम् अन्येषां शुभाशुभकर्मणाञ्च अभीष्टफलप्राप्तये विहिताः मुहूर्ताः स्वीकर्त्तव्याः भवन्ति। तथैव जातकफलकथनावसरेऽपि पञ्चाङ्गानां फलानि स्वीकर्त्तव्यानि भवन्ति। अतः जातकमुहूर्तादीनां चिन्तनकाले पञ्चाङ्गानि नितरां अपेक्षन्ते। तत् पञ्चाङ्गानयनाय रविचन्द्रयोः स्फुटे अपेक्षेते। ते च पञ्चाङ्गाद्वा स्वीकर्तव्ये। एवं लघुरीत्या पञ्चाङ्गानयनप्रकारः उपस्थाप्यते।

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खगोळमे साहित्यानिकि मूलं

सागि कमलाकर शर्म

हितमुतो कूडुकुन्नदि साहित्यं. आलोचनामृतं साहित्यं. अन्नि भाषल्लोनु साहित्यं उंटुंदि. आलोचनापरुल मनोविश्लेषण प्रकृति विश्लेषण समाज विश्लेषणे साहित्यं. तमपै प्रभावान्नि चूपिंचे वेरु वेरु अंशालनु अनेक दृक्कोणाल्लो गमनिंचि लोकानिकि तनदैन शैलिलो अंदिंचेवारु रचयितलु, कवुलु. ई दृक्कोणालकु मूलं ऐन्नो विधालुगा उन्नप्पटिकि लौकिकमैन, तनचुट्टू उंडे उदाहरणल द्वारा विषयान्नि तॆलियजेसे प्रयत्नान्नि रचयित चेस्तू उंटाडु. आया अंशालनु मनं सूक्ष्मंगा गमनिस्ते रचयित दर्शिंचिन मौलिकांशं स्पष्टमौतुंदि. दानिकि अवसरमैन अध्ययनं विमर्शकुनिकि अवसरं अवुतुंदि. तनकु तॆलियनंत मात्रान रचयितनु तप्पुपट्टडं विमर्शकु, अविवेकानिकि कारणमवुतुंदि. ऐन्नो शास्त्राल परिज्ञानान्नि सुलुवैन रीतिलो कथलरूपंलो अंदिंचिन विधानं मनकु साहित्यंलो कनिपिस्तुंदि. वानिनि अध्ययनं चेस्ते साहित्यानिकि मूलमैन वेरु वेरु अंशालु, वानिलोनि वैज्ञानिक, शास्त्रीय परिशीलनांशालु मनकु दर्शनमिस्तायि. ई मार्गंलो जोतिश्शास्त्रं साहित्यंपै चूपिंचिन प्रभावं, प्रतीकात्मक विधानान्नि ई व्यासंलो मनं स्थूलंगा गमनिंचे प्रयत्नं चेद्दां.

वेदांगालल्लो प्रमुखमैनदि ज्योतिषं. ज्योतिषं प्रकाशानिकि संबंधिंचिन शास्त्रं. ई प्रकाश स्थानमे आकाशं. ज्योतिषवेदांगाल लोनि भाषा विषयालल्लो दिशादर्शनं चेस्तू यज्ञयागादुल निर्वहण समयालकु तन विशेषमैन विवरणनु अंदिस्तुंदि. समयासमय निर्देशं चेस्तुंदि. काल स्वरूपान्नि चूपि अनुकूल प्रतिकूल कालालनु तॆलियजेस्तुंदि. वेदंलोनि ऐन्नो विज्ञानात्मक, जिज्ञासात्मक विषया लनु विवरिस्तू वेदार्थान्नि तॆलियजेस्तुंदि. मार्गनिर्देशं चेस्तुंदि.

शिक्ष, व्याकरणं, छंदस्सु निरुक्तादुलु वेदान्नि उच्चरिंच डानिकि, वेदगतिनि अर्थं चेसुकोवडानिकि, वेदभाषयॊक्क अवगाहनकु उपयोगपडेवे शास्त्रालु. कल्पं, यज्ञयागादि कर्मलल्लो उन्न वैज्ञानिक रहस्यालनु, जीवनविधानालनु वॆल्लडिचेस्तुंदि. ज्योतिषं खगोळ संबंधमैन विज्ञानान्नि भूगोळंपैनुन्न जीवराशुलपै, प्रकृतिपै खगोळ प्रभावालनु तॆलुपुतू जीवनविधान गमनानिकि मार्गदर्शकमै करदीपिकगा निलुस्तुंदि. अंदुके वेदपुरुषुनिकि चक्षुस्थानंलो निलिचिंदने

आलंकारिकमैन माट सत्यमैंदि. ई समयं लेकुंडा चेसे वेद व्याख्यानं संपूर्णं कादु.

भाषकन्ना पूर्वं ज्योतिषसंबंधमैन आलोचनलुन्नट्लु अर्थमौतुंदि. ऒक क्रमपद्धतिलो सूर्युडु उदयिंचडं, आ समयंलो प्रकृतिलोनि पशुपक्ष्यादुलन्नी मेल्कॊवडं, आहार समुपार्जनकै तिरगडं, रात्रि कागाने वाटि गूळ्ळकु चेरि निद्रिंचडं, सूर्योदय कालंलोनि सृष्टि चैतन्यं, सूर्यास्तमय कालानिकि निद्राणस्थिति इवन्नी मुंदुगा आदिम मानवुनिपै प्रभावं कलुगु जेशायि. पौर्णमिनाटि चंद्रुनि वॆन्नॆल आनंदान्नि आह्लादान्नि कलिगिंचिंदि. ऒकेवैपुन उदयिंचे सूर्युडु ऒके क्रमंलो एर्पडे ऋतुवुलु उत्कंठनु कलिगिंचायि. ई रकमैन जिज्ञास ज्योतिष शास्त्रान्वेषणकु, विश्लेषणकु दारितीसिंदि.

कांति ऐक्कड उंटुंदो ज्योतिषं अक्कड व्यापिंचिंदि. व्यक्तिकि आलोचना हेतुवैन ज्योतिषं साहित्यंलोनि अन्नि भागाललो चेरि तन प्रतिपत्तिनि प्रत्येकंगा चूपिंचिंदि. मॊदटिरोजुल्लो केवलं सिद्धांत ज्योतिषमे ऐक्कुव व्याप्तिलो उंडडंवल्ल दानिकि संबंधिंचिन प्रचारमे ऐक्कुवगा कॊनसागडंवल्ल वेरु वेरु साहित्य संबंध गाथलकु आकाशंलोनि नक्षत्र मंडलालु, कालमानालु मूलमैनायि. तरुवाति कालंलो फलितज्योतिषांशालु कूडा वीनिलो भागमैनायि.

ऒक नक्षत्रमंडलानिकि संबंधिंचिन गाथकु आ नक्षत्रानिकि संबंधिंचिन पेरु, दानि आकृति, दानि अधिदैवं, दानि प्रक्कने उन्न इतर नक्षत्रमंडलालु, दानि ऎदुरुगा उंडे 180° लो उंडे नक्षत्र मंडलालु मॊदलैनवन्नी कथानिर्माणंलो प्राधान्यं वहिंचायि. अटुवंटि गाथलन्नी परिशीलिस्ते साहित्यानिकि ज्योतिषमे मूलमनि अर्धमौतुंदि.

वैदिकवाङ्मयं, आर्षवाङ्मयं वानि व्याख्यानालुगा एर्पडिन पुराण साहित्यं, संस्कृत साहित्यं....... वीटि यॊक्क अनुवादालैन तॆलुगु साहित्यांशालु, ई क्रमंलो मनकु साहित्यविषयंलो मूलालुगा कनिपिस्तुन्नायि. इवन्नी जाग्रत्तगा गमनिस्ते कथाक्रमंलो कूडा ऒक स्पष्टमैन रीति कनिपिस्तू उंटुंदि.

प्रपंचंलोनि अन्नि प्रांताललोनु आकाशपरिशीलन उंदि. ग्रहगतुल निर्णयं उंदि. नक्षत्रमंडलाल आकृतुल आधारंगा वानिपै कथलु अल्लडं उंदि. आया प्रांताललोनि सामाजिकादि परिस्थितुल आधारंगा ई निर्णयं जरुगुतू उंटुंदि. ऒक नक्षत्रमंडलानिकि संबंधिंचिन कथ दादापुगा कॊद्दिकॊद्दि भेदालतो प्रपंचसाहित्यंलो ऒके विधंगा उंटुंदि. ई विधमैन परिशीलनवल्ल साहित्यानिकि ज्योतिषमे मूलमने सिद्धांतं तॆलुस्तुंदि.

ज्योतिषविज्ञानं साहित्यंलो व्यक्तमैन रीतिनि परिशीलिंचडानिकि मुंदुगा वैदिक साहित्यान्नि परिशीलिंचालि. वैदिक साहित्यंलो व्यक्तियॊक्क आलोचनलकु हेतुवैन ई ज्ञानंयॊक्क मूलरूपं स्पष्टंगा कनिपिस्तुंदि. आकाशंलो कनिपिंचे नक्षत्र ग्रह तारागणालु, सूर्यचंद्रादुलु तमपै चूपे प्रभावालु सूर्य चंद्र नक्षत्राल द्वारा चेसे कालगणनलु. कालान्नि विभजिंचुकॊनि वेरु वेरु कालांशाललो

तीसुकोवलसिन जाग्रत्तलु, वेरु वेरु नक्षत्रालु तूर्पु आकाशंलोनू, पश्चिमाकाशंलोनू उदयिंचि, अस्तमिस्तुन्नप्पुडु प्रकृतिलो जरिगे मार्पुलु मॊदलैन विवरालतो कूडिन वैदिक साहित्यं ई ज्योतिर्विज्ञानंयॊक्क मॊट्टमॊदटि प्रचार वेदिक. ई वैदिकवाङ्मयंलो केवलं ज्योतिष विषयालने चॆप्पे मंत्रभागालु कॊन्नि मात्रमे. इतर विषयालनु चॆपुतुन्नप्पुडु प्रासंगिकंगानो, उदाहरणात्मकंगानो, कथनात्मकंगानो, ज्योतिस्सुलने तीसुकॊनि विश्लेषण चेयडं ई साहित्यंलो कनिपिस्तुन्न विषयं. ऎप्पुडैना बागा तॆलिसिन अंशान्नि मात्रमे मनं उदाहरणगा तीसुकॊंटां. ज्योतिस्सुलु आविधंगा साहित्यंलो व्यक्तमय्यायंटे अप्पटिके व्यक्तिपै वीटि प्रभावं ऎंत अधिकंगा उंडेदो मनं अर्थं चेसुकोवच्चु.

वैदिकसाहित्यंलोनि ऒक चिन्नमंत्रं पुराणसाहित्यंलो ऒक कथगामारि विषयपरिज्ञाना न्नंदिस्तुंदि. पुराणंलोनि चिन्नकथ काव्याललो मरिंत पॆरिगि कॊन्नि नूतनांशालनु कलुपुकॊनि रम्यंगा चॆप्पडानिकि प्रयत्नंचेस्तू विषयविश्लेषण चेस्तुंदि. काव्याललोनि ई कथ प्रबंधाललो अत्यंत विस्तृतंगा ऎदिगि अनेकरकाल वर्णनांशालनु कलुपुकॊंटू पॆद्दकथगा मारिपोतुंदि. ई पॆद्दकथलोनू मूलमैन कथयॊक्क विशेषाले उंटायि. कानी केवलं आ विशेषाले काकुंडा इतरमैन ऎन्नो अंशालनु संदर्भानुसारंगा चेर्चडंवल्ल अदि सुदीर्घमौतुंदि. ई रकमैन पॆंपु साहितीवेत्तलंदरिकी सुपरिचितमे.

साहित्यंलोनि ज्योतिर्विशेषालनु गमनिंचडानिकि स्पष्टमैन ज्योतिषपरिज्ञानं प्रस्तुत समाजानिकि अवसरं. नित्यं ज्योतिस्सुल्नि गमनिंचगलिगे वातावरणंलो लेनिवारिकि तामु विने कथनालकु मूलं ज्योतिषंलो उंदने भावं अर्धकाकुंडा पोतुंदि. ज्योतिष परिज्ञानानिकि संबंधिंचिन अंशालनु स्पष्टंगा तॆलुसुकोवडंद्वारा ग्रह, नक्षत्र, तारासमुदायाल विशेषालनु, कालज्ञानान्नि परिपूर्णंगा अर्ध चेसुकोवच्चु.

साहित्यपरंगा ऒक कथ एर्पडटानिकि ज्योतिषविज्ञानंलोनि — ऒक नक्षत्रमंडलं अदि उन्न राशिपेर्लु, आकृतुलु, अधिदैवालु, प्रक्कने उन्न नक्षत्रालु, राशुलु, वाटि आकृतुलु पेर्लु, अधिदैवालु-ऎदुरुगा उन्न नक्षत्रराशि, पेरु आकृति, अधिदैवं आया नक्षत्रालु सूर्योदयंकन्नामुंदु, सूर्यास्तमयकालंलो तूर्पु टाकाशंलो उदयिंचडं, रात्रिपूट नडिनॆत्तिमीद कनिपिंचडं, प्रकृतिपै तीव्रमैन प्रभावान्नि कलुगजेयडं, कालसंबंधमैन मार्पुलनु सूचिंचडं मॊदलैन प्रकृतिलो जरिगे मंचि, चॆडु मार्पुलु कारणालवुतुन्नायि.

ई विषयालु वैदिकसाहित्यंलोने मॊट्टमॊदटगा व्यक्तीकृत मैनायि. कालस्वरूपं, नक्षत्र स्वरूपालु, चंद्रमार्गंलोनि नक्षत्र मंडलाले काक, इतर मंडलाललोनि नक्षत्रालु, वाटिकि संबंधिंचिन विशेषालु, वेदालु, ब्राह्मणालु, आरण्यकालु, संहितलु, उपनिषत्तुलु, स्मृतुल्लो कनिपिस्तू उन्नायि.

उदाहरणकु कॊन्नि कथनालनु परिशीलिद्दां. देवतलकु वाहनालुगा साहित्यंलो कॊन्नि

कच्चितमैन प्रतीकलनु चूपिस्तुंटारु. शिवुनिकि नंदि, विष्णुवुकु गरुडुडु, ब्रह्मकु हंस, अम्मवारिकि सिंहं, अग्निकि मेषं मॊदलैनवि ई प्रतीकललो कॊन्नि. इवि इदेविधंगा ऐंदुकुंडालि अने प्रश्नकु एदो धार्मिकमैन अन्वयं तप्प निजमैन हेतुवुलु कनिपिंचवु. ज्योतिश्शास्त्ररीत्या मात्रमे वीटिकि सरियैन विवरण लभिस्तुंदि.

आकाशंलोनि द्वादशराशुल्लो मिथुनं मूडवदि. मिथुनराशिकि भारतीय पुराणप्रतीकललो पार्वतीपरमेश्वर मैथुनंगा वर्णिचडं संप्रदायं. दीनिलो रॆंडु नक्षत्रालुन्नायि. पाश्चात्य ज्योतिषंलो वीनिनि कवलपिल्ललुगा अभिवर्णिस्ते, भारतीय ज्योतिषंलो अर्थनारीश्वर तत्त्वंगा तॆलियपरचारु. ई राशिलोनि आर्द्रानक्षत्रानिकि रुद्रुडु अधिपति. "अर्धयारुद्रः प्रथमा न एति" अनि "नक्षत्रेष्टि" तॆलियजेस्तुंदि. आकाशंलो मिथुनराशिकन्ना मुंदुन्न राशिपेरु वृषभराशि. तूर्पु आकाशंलो मुंदुगा वृषभं तरुवात मिथुनराशि उदयिस्तुन्नप्पुडु वृषभं लांछनंगा कनिपिस्तुंदि. दीन्ने वृषभध्वजं अनि अंटां. शिवालयंलो उंडे ध्वजं वृषभध्वजमे. अस्तमिंचे समयंलो पश्चिमाकाशंलो क्रिंदुगा वृषभं पैभागंलो मिथुनं कनिपिस्तायि. ई संदर्भंलो वृषभवाहनुडुगा शिवुडु दर्शनमिस्ताडु. ई भावमे पुराणाललोनू, अन्नि चित्राललोनू साहित्यमंतटा विस्तरिंचिंदि. मौलिकमैन अंशं ज्योतिष संबंधमैनप्पटिकि अन्वयालु मात्रं अनेक रीतुल्लो कनिपिस्तुंटायि.

पुराणाललो अम्मवारु, पार्वति, दुर्गगा चॆप्पबडेराशि कन्याराशि. कन्यलो सूर्युडु संचरिस्तुन्न समयंलोने शरन्नवरात्रि उत्सवालु जरुपुकोवडं संप्रदायं. अयिते कन्य कन्ना मुंदुगा उन्न राशि सिंहराशि. उदयंलो सिंहं मुंदुगा पैवैपु, कन्य क्रिंदुगा कनिपिंचडंवल्ल अम्मवारु सिंहलांछनगा कनिसिस्तुंदि. अस्तमयसमयंलो सिंहं क्रिंदुगा कन्य पैवैपुन कनिपिंचडं वल्ल सिंहवाहनगा कनिपिस्तुंदि.

श्रवणानक्षत्रानिकि अधिदैवं विष्णुवु. श्रवणं प्रक्कगा वुन्न नक्षत्रमंडलं गरुडमंडलं. अंदुवल्ल विष्णुवु गरुडवाहनुडु. अभिजित् नक्षत्रं (वेगा) प्रक्कन्ने वीणा (लैरा) मंडलं उंटुंदि. दानि क्रिंदुगा वुन्न मंडलं हंस (सॆग्नस्) मंडलं. ई विषयान्नि आधारंगा चेसुकॊनि श्रवणंप्रक्कगा अभिजिन्नक्षत्रं उंडडंवल्ल विष्णुवुकु ब्रह्म कुमारुडुगा चॆप्पबडिनाडु. वीणा मंडलानिकि सरस्वति प्रतीक. वीरिद्दरिकि वाहनंगा हंस पुराणसाहित्यंलो मनकु कनिपिस्तुंदि. कृत्तिकानक्षत्रानिकि अधिदैवं अग्नि. कृत्तिकलो 1व पादं मेषराशिलोनू, 2 ,3, 4 पादालु वृषभराशिलो उंटायि. अंदुके उदयास्तमयाल्लो वच्चे तेडालवल्ल अग्निकि मेषं वाहनंगा कनिपिस्तुंटुंदि. इवि पुराणप्रतीकले कानि अग्नि मेषंपैन कूर्चोवड मेमिटि अनि आलोचिंचे अंशं कादु. मनकु इप्पटिवरकु कनिपिंचे वेरु वेरु अंशालकु ई विधंगा वेरु वेरु शास्त्रालकु संबंधिंचिन प्रतीकलु कनिपिस्तूने उंटायि. वॆतुक्कुने वारिकि ऎन्नो रूपाल्लो विवरणलु कनिपिस्तुंटायि.

ध्रुवुनिकथ साहित्यंलो सुप्रसिद्धमैनदे. संस्कृत तॆलुगु भागवताललो ई कथकु मंचि प्राचुर्यं उंदि. ध्रुवुडु ज्योतिष रीत्या पोल्स्टार्. ध्रुवमंटे स्थिरं अनि अर्थं. कानि ई स्थानंकूडा कदुलुतुंदि. इक्कड कदिलेस्थानं केवलं भूमियॊक्क वंगि तिरिगे कोणं मार्पु पॊंदडमे. ई मार्पुवल्ल विषुवत्तुललो मार्पुलु एर्पडतायि. उत्तर दक्षिण अयनालु विषुवत्तुललो मार्पुलु वस्तायि. वीनिमार्पु चाला सूक्ष्मंगा उंटुंदि. साधारणंगा गमनिंचेंतगा उंडदु. 26 वेल संवत्सराललो ई वंगि तिरिगे कोणं ऒक चुट्टु पूर्ति अवुतुंदि. अप्पुडु मरो नक्षत्रं ध्रुव नक्षत्रंगा कनिपिस्तुंदि.

पोतन भागवतंलो पेर्कॊन्नप्रकारं श्री महाविष्णुवु ध्रुवुनि तपस्सुकु मॆच्चि वरालनु इस्ताडु. अदि यॆट्टिदनिन

> . . . . नॆंदेनि मेधियंदु परिभ्राम्यमाण गोचक्रंबुनुंबोलॆ ग्रह नक्षत्र तारागण ज्योतिश्चक्रंबुलु नक्षत्ररूपंबुलैन धर्माग्नि कश्यप शुक्रुलुनु, सप्तऋषुलुनु दारकासमेतुलै प्रदक्षिणंबु तिरुगुचुंडुदु रट्टि दुरापंबुनु ननन्याधिष्ठितंबुनु लोकत्रय प्रळय कालंबुनंदु नश्वरंबुगाक प्रकाशमानंबुनु नैन ध्रुवक्षितिपदंबु मुंदट निरुवदियारुवेलेंड्लु सन ब्रापिंतुवु.

ध्रुवुनिकथ पुराणंगा चॆप्पुकुंटे 26वेल संवत्सरालु चाला पॆद्दसंख्य कावच्चु गानि, ज्योतिषपरंगा विषुवत्तुल मार्पु परंगा चॆप्पुकुंटुन्नप्पुडु वैज्ञानिक प्राधान्यान्नि पॊंदुतुंदि. वैज्ञानिकमैन अंशान्नि साध्यमैनंत सुलुवुचेसि चॆप्पिन पुराण कथाकथनं ऎंत गॊप्पदो मनं ऊहिंचलें. अयिते ध्रुवनक्षत्रान्नि गूर्चि ऎंतो अवगाहन अतिसूक्ष्ममैन विषयालु अवगतमैते तप्प ई कथनु पुराणकर्त इंत गॊप्पगा निर्वहिंचलेडु. संस्कृत भागवतं वच्चि ऎंतो कालमैंदि. पुराणकथललो ई अंशालु एर्पडि इंकॆंतो कालं अयिंदि. इटीवल पाश्चात्य ज्योतिष्कुडु हिपार्कस् अनेवाडु ई विषुचलनानिकि 25,800 संवत्सरालु पडुतुंदनि चॆप्पिनप्पटि विषयमु प्रमाणमै कूर्चुंदि. ई रकमैन सांस्कृतिकमैन दाडि जरगडंवल्ल मनं सांकेतिक, वैज्ञानिक परिज्ञानं लेनिवारंगा निरूपिंच बड्डां. अंदुके प्रस्तुतं मळ्ळी ई अंशालवैपु दृष्टिपॆट्टि भारतीय वैज्ञानिक, सांस्कृतिक मूल्याल वैपु नूतन पद्धतिलो दृष्टि पॆट्टाल्सिन अवसरं एर्पडिंदि.

अयनांश अने कीलकांशं ऎंतो श्रमचेस्तेकानि अर्धमय्येदि कादु. ए परिकरालु लेकुंडा मनवारु ई अंशालनु अति सुलुवुगा अध्ययनं चेयगलिगारु. दक्षयज्ञ ध्वंसं कथलोनू, नरकासुरवध कथललोनू कनिपिंचेदि ई अयनांश संबंधांशमे. मनवारु पुराणकथगा मार्चि अध्ययनंचेस्तुन्न अंशं वॆनुक उन्न शास्त्रीयांशान्नि दृष्टिलो पॆट्टुकोकपोते, पुराणकथ पुक्किटि पुराणमे अवुतुंदि. दानि वॆनुकनुन्न विज्ञानं मनकु अंददु. अंतेगाक ग्रहणालविषयान्नि चॆप्पडानिकि पाल समुद्रान्नि मथिंचि, अमृतं पंचे गाथनु तॆलियजेसारु मन पुराण रचयितलु. त्रिपुरासुर संहारं, कार्तिकेय जन्मवृत्तांतं, नौकाकथ, शिबि चक्रवर्ति वृत्तांतं वंटि ऎन्नोकथलु मनकु कनिपिस्तुन्नायि. अग्निपुराणाललोनि

अंशालु इटुवंटि प्रत्येक विषयालने चेपुतायि. अध्ययनं चेसेवाडि शक्तिनि बट्टि पूर्वांशाल आविष्करणं जरुगुतुंदि.

प्रस्तुतं साहित्यान्नि ई दृष्टिकोणंलो अध्ययनं चेस्ते ऐन्नो नूतनांशाल आविष्करण जरुगुतुंदि. ऐन्नो शास्त्रालकु संबंधिंचिन मूलालु कनिपिस्तायि. प्रपंचसाहित्यंलोनू इटुवंटि अध्ययनं अवसरमे. वैज्ञानिक दृक्कोणंलो एर्पडिन साहित्यं पिच्चापाटि साहित्यान्नि वेरुचेसि चूस्ते मनघनत मनकु तेलुस्तुंदि.

इटुवंटि ऐन्नो कथलु उंडडंवल्लने साहित्यानिकि मूलं ज्योतिषमनि तेलुस्तुंदि. अंदुके मन पूर्वीकुलु ज्योतिर्मयं वाङ्मयं अनडंलो औचित्यं कनपडुतुंदि.

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दृग्गणित पंचांग रचनमे सर्वसिद्धान्त सम्मतमु

मधुर कृष्णमूर्तिशास्त्रि

1

सौरादि सर्वसिद्धांतमुलु रव्यादि समस्त ग्रहमुलयोक्क गणितमुलनु दृक्तुल्यमुलुग नुंडुनट्लु गणितविधानमुनु तॆलिपि युन्नवि. ई सिद्धांतमुलन्नियु निरयन गणितमुनु चॆप्पियुन्नवि.

सूर्यसिद्धांतमु-स्पष्टाधिकारमु - 14व श्लोकमुलो.

तत्तद्गतिवशान्नित्यं यधा दृक्तुल्यतां ग्रहाः।
प्रयान्ति तत्प्रवक्ष्यामि स्फुटीकरणमादरात् ।।

आया गतुलवलन ग्रहमुलु येविधमैन गणितमुचेत (प्रतिदिनमु दृक्तुल्यतनु प्रत्यक्षवेधोपलब्ध ग्रहमुलतो साम्यमुनु) पॊंदुनो अट्टि स्पष्टीकरण गणितमुनु प्रेमपूर्वकमुग चॆप्पुचुंटिनि.

वसिष्ठ वचनमु —

यस्मिन् पक्षे यत्र काले येन दृग्गणितैक्यकम् ।
दृश्यते तेन पक्षेण कुर्या त्तिथ्यादि निर्णयम् ।। इति ।।

ये कालमंदु ये पद्धति ननुसरिंचि ग्रहमुल गणितमु दृक्तुल्यतनु पॊंदुनो आ पक्षमुननुसरिंचि तिथ्यादि निर्णयमुनु चेयवलयुनु.

2

ई विधमुलैन प्रमाणमुलनु दृष्टियंदुंचुकॊनि श्री केरो लक्ष्मणछत्रेगारु (बॊंबायि) मॊदट रैवतपक्ष अयनांशमुलनु साधिंचि, ग्रहसाधनकोष्ठकमनु ग्रंथमुनु दृग्गणितसाधनकै रचिंचिरि. महाराष्ट्रभाषलो अच्चुवेयबडिनदि.

3

अनंतरमु वीरिवद्द गणितशास्त्रमु नभ्यसिंचिन वीरि शिष्युलु वेंकटेशबाबू केत्कारुगारु मराट ीभाषलोनुन्न ग्रहसाधन कोष्ठक ग्रंथमुनु संस्कृतभाषलोनिकि अनुवदिंचि, रैवतपक्षाय नांशमुलनु मात्रमे स्वीकरिंचि "ज्योतिर्गणित" मनु ग्रंथमुनु (दृग्गणित साधन कुपयुक्तमगुनट्लु) रचिंचिरि. श्री केत्कारुगारु "केतकीग्रह लाघवमु मध्यमाधिकारमु 2व श्लोकमुलो निट्लु व्रासिरि.

श्री मद्गणेशरचितं ग्रहलाघवाख्यं भूमंडले विजयते करणं तथापि ।
दृक्र्पत्ययेति शिथिलं समभूदिदानीं सद्वेधसिद्ध गणितं रचयामि सम्यक् ।।

गणेश दैवज्ञुनिचे व्रायबडिन ग्रहलाघवग्रंथमु बहुळ प्रचारमुलोनुन्नदि. अयिननु दृक्तुल्यतनु पोंदुटलो मात्रमु शिथिलमैनदि. अंदुचे नेनु दृग्गणितमुनु (वेधसिद्धगणितमुनु) व्रायु चुंटिनि. अनि तॆलिपिरि.

तरुवात —

सौरोक्तंशरदः प्रमाणमधुनासार्धैः पलैरष्टभिः ।
सत्याद्दीर्घतरंच वेधनिपुणैः प्रत्यक्षतो दृश्यते ।
चक्रुः प्राक्किलवर्तमान घटनां दृष्ट्वा मुहुस्सूरयः ।
शुद्धिं तद्वदिहापि वेधजशरद्दैर्घ्यंमया स्वीकृतम् ।।

वेधनिपुणुलगु पाश्चात्युलु सौरसंवत्सर प्रमाणमुनु वेध चेसि परीक्षिंचगा सूर्यसिद्धांतोक्त सौरसंवत्सरप्रमाणमु 8½ विघटिकलु अधिकमुग नुन्नदनि प्रत्यक्षमुगचूचि चॆप्पुचुन्नारु. प्राचीन कालमुलोनु, प्राचीनमुनकु वर्तमानमुनकु तेडा कलिगिते प्राचीनमुनु विडिचि वर्तमानघटननु ग्रहिंचियुन्नट्लु अंदरिकिनि तॆलिसिन विषयमे कनुक नेनुकूड प्रत्यक्ष वेध सिद्धमैन सौरसंवत्सर प्रमाणमुनु ग्रहिंचितिनि.

तरुवात —

शाके षड्गोब्धि तुल्यांशरदि समभवत्सौरवर्ष प्रवृत्ती
रेवत्यां सौरवर्षे सदलवसुविनाड्युन्मिताधिक्यभावात् ।
मंदं मंदं पुरस्सा प्रचलति सततं रेवतीतश्चतुर्भि-
र्भागैरग्रेषुना भवति पुनरितो प्रग्रतस्संभवेच्च ।।

तस्माद्वर्ष प्रवृत्तिःपुनरपिच यधा रेवतीतारकायां ।
स्यात्तादृत्सुव्यवस्था करण इह मयारैवतः पक्ष उक्तः।।

इच्छेयुर्ये न हातुं सुदृढ परिचयाद्वर्तमानां प्रवृत्तिं ।
तेभ्यश्चैत्राख्यपक्षः प्रचलनरहितस्संगृहीतः किलात्र।।

शालिवाहन शकमु 496व संवत्सरमुलो सौरवर्ष प्रवृत्ति रेवती नक्षत्रमुदग्गर अयिनदि. सूर्यसिद्धांतोक्त सौरवर्ष प्रमाणमु दृक्सिद्ध सौरवर्ष प्रमाणमुकंटे 8½ विघ।।लु. अधिकमुगनुंडुट वलन रेवती नक्षत्रमुलो नैन आ वर्ष प्रवृत्ति रेवतिदाटि मुंदुनकु मॆल्लिमॆल्लिग जरुगुचुन्नदि. इप्पटिकि रेवतिनिदाटि मुंदुनकु ४ भागमुलु (डिग्रीलु) जरिगिनदि. अग्रिम (राबोवु) कालमुलो यिंकनु मुंदुनकु वॆळ्ळवच्चुनु. आ कारणमुचेत वर्षप्रवृत्ति ऎल्लप्पुडु रेवतीनक्षत्रमुलोने अय्येटट्टु सरियैन व्यवस्थनु चेयुटकु नाचे रैवतपक्षमु चॆप्पबडिनदि.

श्री केत्कारुगारु "सुव्यवस्थाकरण इहमयारैवतः पक्षउक्तः।।" अनि तनयॊक्क अभिप्रायमुलो रैवतपक्षमे सरियैनदि, शास्त्रीय मैनदनि कंठोक्तिग तॆलिपियुन्नारु.

वीरे, चैत्र पक्षमुनु संग्रहिंचि चॆप्पुटकु गल कारणमुलु रैवतपक्षमे दृग्गणितमुनु चेयुटकु सरियैनदनि पंडित सभललो चॆप्पगा आ सभलंदुन्न पंडितुलु यी विधमुग तॆलिपि युन्नारनि वीरि जीवित संग्रहचरित्रलो "संमेळनानि" अनु शीर्षिक क्रिंद

सौरोक्तं शरदोमानं पलैः सार्धाष्टभिर्महत्।
इति वेधप्रवीणानां मतं विन्यस्य पार्श्वतः।।

संमेलने ज्यौतिषाख्ये प्रथमे बुधमंडिते ।
धृत्वादीर्घतरंमानं विधेयं करणं नवम् ।।

इति निर्णीत मासीत्तेः पंडितैश्च दुराग्रहात् ।
तत् श्रुत्वा ललिकु स्ताता एवं शब्दैस्तु संस्फुटैः।।

मार्जालस्य गले घंटाबंधनात्मक निर्णयैः।
यथा वृथा मूषकाणां सभा तद्वदियं सभा।।

द्वितीयं मेळनंचासीत्पुण्य शाठ्यविमिश्रितम् ।
तृतीयं स्वार्ध संमिश्रं वीक्ष्यतातैर्विगर्हितम्।।

पंडितुलसभललो पंडितुलु वेधप्रवीणुलु चॆप्पिन मतमुनु प्रक्ककु पॆट्टि, दीर्घतरमानमुने ग्रहिंचि नूतनग्रंथमुनु व्रायमनि तॆलिपिरि. वीनि नवीन मतमगु रैवतपक्षमुनु ऎवरुन्नु अंगीकरिंचनि कारणमुचेत "चैत्रपक्षमु"नु ग्रहिंचिति ननि व्रासिनारु.

ऎवरैते वर्तमान प्रवृत्तिनि वदलुकॊनुटकु इष्टपडक तन मतमुनु (तनचे निर्णयिंचिन दृग्गणितपद्धतिकि सरिपडु रैवत पक्षमुनु) ग्रहिंचुटकु अंगीकरिंचलेदो अट्टिवारिकि मात्रमे चैत्रपक्षमु नाचे संग्रहिंचबडिनदनि विवरिंचिरि.

दीनिवलन तेलिन सारांशमेमनगा वेंकटेशबाबूजीकेत्कारु गारु रैवतपक्षमे तनचे निर्णयिंपबडिन दृग्गणित पद्धतियनियु, चैत्र पक्षमु दृग्गणितपद्धति कादनियु निश्चयमुग तेलिनदि.

4

श्री केत्कारुगारे मरॊक विषयमुनु "द्वितीयमुद्रित ज्योतिर्गणित" मंदु पूरणिक 21व पेजीलो शके 1807 पक्षे पंचांगत्रयमासीत् 22 अयनांश घटितं सर्वजन-स्वीकृतमेकं, अपरं नवीनं पट वर्धनीयपंचांगं 18 अयनांश घटितं, तृतीयं आंग्लतुल्यं सायनं श्री दीक्षित प्रवर्तितमिति।। मया ग्रथ्यमानस्य ग्रंथस्य पंचांगत्रयोपयोगि त्व संपादनाय तदुचित क्षेपकान् संयोज्य हस्तलिखितो ग्रंथः समापितः।। प्रकारत्रय स्थापनस्य हेतुरपि तत्रैव श्लोकैर्निर्दिष्टः ।।

शालिवाहन शकमु 1807लो 22 अयनांशमुलतो चेयबडिन सर्वजन स्वीकृतमैन पंचांगमु, 18 अयनांशमुलतो नवीनमुग चेयबडुचुन्न पटवर्धनीय पंचांगमु, शंकर बाल कृष्णदीक्षितुल आंग्लतुल्यमैन सायन पंचांगमु अनि 3 विधमुल पंचांगमुलु कलवु. ई 3 पंचांगमुलकु उपयोगपडुनट्लु वानि वानिकि तगिन क्षेपकमुलतो कूडिन हस्तलिखित पुस्तकमुकूड पूर्तिचेयबडिनदि.

अंदुः

22 अयनांश पुरस्कारार्धं श्लोको यथा ।
पारंपर्येण सर्वोह्यनुसरति जन श्चैत्रकं सौरपक्षं ।
तस्मात्तत्पक्षतुल्या नयनगतिलवांश्चाधिमासान् विधातुम्
चित्रानक्षत्र भोगस्तदभिमत इहांगीकृतो राशिषट्कः।
चित्राधः क्रांति पातान्तर मयनलवाः स्वीकृतास्तन्मयात्र ।।

समस्त जनुलु परंपरग अनुसरिंचुचुन्न पद्धतिकि अनुकूल मुग नुंडुनट्लु चैत्र पक्षायनांशमुलनु अंगीकरिंचि, चित्रा नक्षत्र भोगमु 180 भागालनि वारिकिष्टमैनदानिके अंगीकरिंचडमैनदि.

पैन व्रासिन दानिनि बट्टि श्री वेंकटेश बापूजि केत्कारुगारिनि पंडितुलेगाक तनकुमारुडैन दत्तात्रेय केत्कारु, शंकर बालकृष्ण दीक्षितादुलु ऎंत ऊदरकॊट्टि, ऒत्तिडिचेसि चैत्रपक्षायनांशलननुसरिंचि ग्रंथमुनु व्रायिंचिरो बोधपडुचुन्नदि. मरियु वीरिचे "केतकीग्रह लाघव" मनु ग्रंथमुनु कूड व्रायिंचि वीरि कुमारुलगु दत्तात्रेय केत्कारुगारु आ ग्रंथमुनकु भाष्यमुनु व्रासि, चैत्र पक्षमुनु समर्धिंचुटकै विश्वप्रयत्नमुलनु चेसि अयधार्थ विषयमुल ननेकमुल नंदु प्रवेशपॆट्टिरि.

श्री केत्कारुगारु मात्रमु संपूर्ण दृग्गणितवादि यगुटचेत वारु निर्णयिंचिनदि "रैवतपक्षमे".

5

भारत प्रभुत्व पंचांग संस्करण संघमुवारु कूड चैत्रपक्षायनांशमुलने ग्रहिंचि पंचांगमुनु प्रकटिंचुचु चैत्र पक्षमुनु ग्रहिंचुटकु कारणमु नी क्रिंद विधमुग व्रासिरि.

Dr. Gorakh Prasad thereafter submitted a note containing his definite proposals in this respect which was also circulated amongst the members. He proposed that "23-15" be taken as the *ayanāṁśa* on the vernal Equinox day (21 March) 1956, because this will reconcile most of the *pañcāṅgas* in India based on modern constants.

ई व्रासिन दानिनिबट्टि देशमंदुगल अनेक पंचांगमुलनु समाधान परचुटकु 21-3-1956कि चैत्रपक्षरीत्या वच्चिन 23°-15° अयनांशमुलनु ग्रहिंचडमैनदनु भावमुनु स्पष्टपरचुचुन्नदि.

6

अयनांशमुल प्रामुख्यमुनु गुरिंचि शास्त्रचर्चललो श्री श्रीपाद वेंकटरमण दैवज्ञशर्मगारु बहुपरिशोधनलनु जरिपि सूर्य सिद्धांतोक्त छायार्क "करणार्कांतरमे" अयनांशमुलनि निर्णयिंचि, करणार्कुनिलो (गणितागसूर्युनिलो) गल कालकृतांतरमुनु संस्करिंचि "छायार्क-संस्कृत करणार्कांतरमे" शुद्धमुलैन अयनांशमुलनि, रैवत पक्षमुकंटे कूड यी पक्षमे शास्त्रीयमनि निर्णयिंचि 21-3-1956नकु "20°-2"" अयनांशमुलु ग्रहिंचवलेननि निर्णयिंचिरि. वीरुचेसिन निर्णयमुनु अनेक विद्वांसुलु इदिये सरियैनदनि तेलियचेसिरि.

रायल् ऐस्ट्रनामिकल् सोसैटि (लंडनु) यंदु मुख्य सभ्युलु, गोप्प विद्यावेत्त यगु श्री शक्तिधरशर्मगारु 19-1-1983 तेदीन नाकु उत्तरमुनु व्रासि दानिलो "संशोधित करणागतसूर्यछ ायासूर्ययो-रंतरमेव शुद्धायनांशमान साधनाय प्रभु" रिति सत्यं अत्र न मे लेशतोऽपि विमतिः।। नात्रसंदेहः भवदुक्त विधिसाधिता अयनांशा चित्रापक्षीयायनांशा-पेक्षया शुद्धतराः।।

संशोधित करणागतसूर्य, छाया सूर्यांतरमे शुद्धमैन अयनांशमुलनु साधिंचुटकु प्रभुवु इदि सत्यमु. चैत्रपक्षाय नांशमुलकंटे मीरु निर्णयिंचिन "अयनांशमुले शुद्धतरमुलु" अनि तेलिपिरि. इटुवंटि उत्तरमुलु देशमंदुगल विद्वांसुलु तेलिपियुन्नारु.

सारांशमु

7

रेवतपक्षमुकंटे, चैत्रपक्षमुकंटे, इतरमुलैन ये पक्षमुलकंटेकूड श्रीश्रीपाद वेंकटरमण दैवज्ञशर्मगारिचे

निर्णयिंच बडिन "छायार्क-संस्कृत करणागतार्कांतर" रूपमुलैन अयनां शमुले शास्त्रीयमुलु परिग्राह्यमुलु. 4-4-2011 तेदि नाटिकि 21-1-2009 अयनांशमुलु अगुनु.

मुगिंपुः

ज्योतिश्शास्त्रमु कालनिर्णयमु चेयुनदि. सकालमंदु वेदोक्तकर्मलनु अनुष्ठिंचुटचे मानवाळि सत्फलितमुलनु पॊंदगलदु. कावुन शास्त्रीयमुग काल निर्णयमु अत्यंत आवश्यकमगुचुन्नदि. पंचांग गणितप्रकारमु कालनिर्णयमुलो "सूर्यसिद्धांतमु", वसिष्ठ सिद्धांतमु मॊदलयिन ग्रंथमुल प्रामाणिक वचनमुलनुबट्टि आया गतुलवलन ग्रहमुलु ए विधमैन गतुलचेत प्रतिदिनमु दृक्तुल्यतनु पॊंदुनो अट्टिपद्धतिने अनुसरिंचवलॆनु.

पंचांग निर्णय पद्धतुललो 1. रैवत पक्षमु 2. चैत्रपक्षमु 3. सायन पक्षमु 4. छायार्क संस्कृत करणार्क अंतरमु अनु 4. पद्धतुलु कलवु.

शास्त्रीयदृष्टि रागद्वेषमुलकु तावीयक, वत्तिडुलकु तलॊग्गक निष्पक्षपातमुगा विचारिंचिनचो ई 4व पक्षमैन (श्री श्रीपाद वेंकट रमण दैवज्ञशर्मगारु चूपिन) पद्धतिये शुद्धमैयुन्नदि. दीनिनि प्रतिवादुलु कूडा सत्यमनि व्रातपूर्वकमुग तॆलिपियुन्नारु.

ऐननु बहुळजनुलचे अंगीकरिंपबडि असत्यमैननु "भारत प्रभुत्व पंचांग संस्करण संघमु" वारिचे अंगीकरिंपबडिन चैत्रपक्ष अयनांश पद्धतिने पलुवुरु अनुसरिंचुचुन्नारु.

9-5-1955व तेदीन राजमंड्रि, श्री गौतमी विद्यापीठमुद्वारा आ संस्थ सॆक्रटरी गारैन "श्री कांड्रेगुल जगन्नाथरावु गोपालरावु" गारि आध्वर्यमुलो श्री श्रीपाद वेंकटरमण दैवज्ञशर्मगारु पैन तॆलिपिन 4व पक्षमुपै वारि अभिप्रायमुलनु प्रभुत्व पंचांगकमिटी वार्कि तॆलियचेयडमैनदि. कानि वारु पक्षपात वैखरितो दीनिनि स्वीकरिंचलेदु. कनीसं मतांतरमुग कूडा चूपॆट्ट लेदु. यिदि वारि पक्षपातवैखरिकि तार्काणमु. पंचांगनिर्णय संघमुवारु आमोदिंचिन पद्धति असत्यमनि, अशास्त्रीयमनि तॆलिसिनप्पटिकि, बहुळजन आमोदमु कॊरकु अनुसरिंपबडुचुन्नट्लु अंगीकरिंचुचुन्नारु. वारिलोकूडा भेदाभिप्रायमुलकु, पंचांग वैविध्यमुलकु कारणमुनु वारे विवरिंचवलसियुन्नदि. जनांगीकारमु शास्त्रीयतकु कॊलबद्दकागलदा?

कावुन प्रभुत्वमु, पीठाधिपतुलु कल्पिंचुकॊनि सुव्यवस्थ कॊरकु शास्त्रीय पंचांग विधानमुनु निर्दुष्टमुग प्रकटिंचुट ऎंतयु लोकोपकारकमु. महर्षुल वचनमुल ननुसरिंचि दृक्तुल्यतनु साधिंचुटलो नेनु चूपिन 4व पद्धति वेधशालललो परीक्षलकु निलबडुननि सुदृढविश्वासमुतो शास्त्रीयमगु ई पद्धतिनि अनुसरिंचुचुन्नानु.

प्रस्तुत निर्णायक संघमु विचारिंचि वेधशालललो परीक्षिंचि दृक्तुल्यमैन रीतिनि निर्दुष्टमुग,

शास्त्रीयमुग चूपिनचो आ पद्धतिनि अनुसरिंचुटलो ऎट्टि अभ्यंतरमु लेदनि मनवि चेयुचुन्नानु. तामु चॆप्पुनदि असत्यमनि अंगीकरिंचुचु "दानिने" अनुसरिंचि प्रजलनु तप्पुमार्गमुनु पट्टिंचुट शास्त्रमुनकु द्रोहमु, मनस्सुनकु क्लेशकारकमु अनु आवेदनतो, सत्यदृष्टितो शास्त्र प्रामाण्यमुनु पूर्तिग निलुपुटकै नेनी पद्धतिनि (छायार्क संस्कृत करणार्क पद्धतिनि) स्वीकरिंचितिननि सविनयमुग तॆलियजेयडमैनदि.

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भारतीय खगोळ ज्योतिषमु
नेटि स्थितिगतुलु

काशीभोट्ल नाग वेंकट पार्वतीश्वर शर्म

अचिन्त्याव्यक्तरूपाय निर्गुणाय गुणात्मने
समस्तजगदाधार मूर्तये ब्रह्मणे नमः

अचिन्त्यं अप्रमेयं अव्यक्तम्
अप्रकटितरूपं स्वरूपं यस्य तस्मै यतो वाचो
निवर्तंते अप्राप्य मनसासह सत्यं ज्ञानमनंतं
ब्रह्मारूपं यत्तत्प्राहुरव्यक्तमेव इत्यादि श्रुतेः

सिद्धान्तं संहिता होरा रूपस्कंद त्रयात्मकं।
वेदस्य निर्मलं चक्षुर्ज्योतिश्शास्त्रमनुत्तमम्।।

वेदास्तावद्यज्ञकर्मप्रवृत्ता यज्ञा प्रोक्तास्तेतु कालाश्रयेण
शास्त्रा दस्मात्काल बोधोयतस्स्याद्वेदांगत्वं ज्योतिषस्योक्तमस्मात्

ई ज्योतिश्शास्त्रमु वेद पुरुषुनकु तेजोवंतमैन नेत्रमु वंटिदि. इदि वेदमुनंदलि कर्मभागमुनु, उपासनाभागमुनु विवरिं चुनु. ए समयमुन एमिचेयवलयुनु, ए विषयमुलु तमकु अनुकूलमुलु अनुनवि अन्नियू निर्णयिंचुटकु दोहदपडुनु.

भारतदेशमु कर्मभूमि मरियु वेदभूमिगा अनादिकालमु नुंडि भासिल्लुचुन्नदि. कर्मफलमुवलन इहपरसाधन मोक्षमार्ग मुलु कल्गुननि मनमु विश्वसिंचुचुन्नामु. इहपर साधन कर्मलकु दृष्टा दृष्ट भेदंबुन फलमु द्विविधंबु. दृष्टंब लोकसिद्धंबु, अदृष्टंबु विधिसिद्धंबु अनु आर्योक्ति कलदु. कनुक अंदुकुतगिन कारणमुलु चूपुटचे शास्त्रमुनकुकूडा फलंबु द्विविधंबु. ऎट्लनिन विशेषसंस्कारसाधित ग्रहणग्रह समागमादि फलमु दृष्टमगु टचेत दृष्टफलकत्वंबुनु, पितृप्रीणन स्वर्गादुल नदृष्टमगुटचेत नदृष्ट फलकत्वंबुगानु शास्त्रमंदु निर्देशिंचबडिनदि. अंतियेकाक पाश्चात्यदेशमुललो वारिकि दृष्ट

फलकत्वंबुमात्रमे आचरणलोगलदु. कावुन वारियोक्क गणनमुलु वार्कि मात्रमे अनु सरणीयमु. भारतदेश संस्कृतिकि वाटिनि अनुसरिंच तगदु.

मन पूर्वीकुलयोक्क साधनवलन सूर्यभगवानुडिनुंडि ऋषुलकु मरियु साधकुलकु अष्टादश सिद्धांतमुलेर्पडिनवि. आया विषयमुलनु वारु ताळपत्रमुलो निक्षिप्तमोनर्चिरि. क्रममुगा ग्रंथरूपमुलै मनयोक्क गणितमुलकु आधारभूतमुलै युन्नवि. कालमु अतिसुदीर्घमैनदि. कालनिर्णयमुनकु ज्योतिश्शास्त्रमु मुख्य भूमिकनु पोषिंचुचुन्नदि.

प्राचीन वेदकालमुनुंडि महर्षुलु खगोळज्योतिषमु परिशीलिंचि सूत्रीकरिंचियुन्नारु. अंदुननु 18 मंदि पेरुन सिद्धांतमुलु एर्पडिनवि.

सूर्यः पितामहो व्यासो वसिष्ठात्रि पराशरा
कश्यपो नारदो गार्ग्यो मरीचिर्मनुरंगीराः।
रोमशः पौलशश्चैव च्यवनो यवनो भृगुः
शौनकाष्टादशह्येते ज्योतिश्शास्त्र विशारदाः।।

इंदुलकु साक्षीभूतुडैन सूर्यभगवानुड्डु मयुनकुप देशिंचिन सूर्यसिद्धान्तमु मोट्टमोदटिदनि अनादिनुंडि प्रपंच व्याप्तमुगा प्राचुर्यमु पोंदियुन्नदि.

अटुलने वराहमिहिरुडु. भास्कराचार्युलु, आर्यभट्टु, गणेशदैवज्ञुडु, बालादित्युनि पुत्रुडैन सूर्युडु मोदलगु महनीयुलु सनातनकालमुलो ऐटुवंटि यंत्रवेध सहायमु लेकुंडा कल्पन मरियु स्वीयपरिश्रम द्वारा गणिंचि प्रत्यक्षमुगा परीक्षिंचि निरूपिंचि सूत्रीकरिंचिनारु. आधुनिककालमुलो आंध्र देशमु, तमिळनाडु, केरळ राष्ट्रमुललो मरियु उत्तरहिंदूस्थानमुललो प्राचीन ताळपत्रमुलनु आधारमुगा चेसुकोनि अनेक सिद्धांत ग्रंथमुलु, तंत्रग्रंथमुलु मरियु करणग्रंथमुलु एर्पडिनवि. आया ग्रंथमुलनु आधारमु चेसुकोनि सांप्रदायकमुगा पंचांग गणनमु चेयुचुन्नारु.

भगवंतुड्डु लोकमुलन्निंटिनी सृष्टिंचुटकु पूर्वमु जलमुनु मरियु ब्रह्मांडमुनु सृष्टिंचेनु. अंदु अंधकारमुनु तोलगिंचुटकै सूर्युनि सृजियिंचेनु. अंदुवलनने आदित्युडनु नामधेयमु सूर्युनकु कल्गेनु. पिम्मट ई लोकमुलनु सृष्टिकोरकु ब्रह्मदेवुनि सृजिंचि चतुर्वेदमुल नोसंगि लोकसृष्टिकि अधिकार मोसंगेनु. ब्रह्म सृष्टिप्रारंभमुनकु मनस्सुन संकल्पिंचगा चंद्रुडुद्भविंचेनु. अंदुवलनने "चंद्रमा मनसोजातः" अनुशृति कलदु. अटुपिम्मट भूमि-जलमु-अग्नि-वायुवु-आकाशमु अनु पंचभूतमुलनु एर्परचेनु. आकाशमुवलन शब्दमु, वायुवु वलन स्पर्शमु, अग्निवलन रूपमु, जलमुवलन रसमु, भूमिवलन गंधमु मरियु अग्निवलन सूर्युडु, जलमुवलन चंद्रुडु, तेजस्सुवलन अंगारकुडु, भूमिवलन बुधुडु, आकाशमुवलन गुरुडु, उदकमुवलन शुक्रुडु, वायुवु वलन शनियु कल्गिरि. ब्रह्म मनो ध्यानमुचेत मेषादि द्वादश राशुलु, अश्विन्यादि नक्षत्रमुलु सृजिंप बडिनवि.

प्रकृतिननुसरिंचि ऊर्ध्वभागमंदु देवतलनु-गंधर्वुलनु, मध्यभागमंदु पक्ष्यादुलनु, अधोभागमंदु मनुष्यादुलनु, पर्वत वृक्षादुलनु, कर्मानुसारमुनुबट्टि देवता प्रदेशमुलनु-मानुष प्रदेशमुलनु विभजिंचि सृजिंचॆनु. चतुर्दश भुवन भांडमुलनु सृजिंचॆनु.

ब्रह्मांड मध्ययंदु आकाशकक्ष्य, आकाश मध्यममुन नक्षत्रमुलुनु, नक्षत्रमंडलमु मध्य नक्षत्रकक्ष्य, दानि कधोभाग मुन शनिकक्ष्य, दानिकधोभागमुन गुरुकक्ष्य, दानिकधोभागमुन कुजकक्ष्य मरियु दानि कधोभागमुन रविकक्ष्य, दीनिकधोभागमुन शुक्रकक्ष्य, दानिकधोभागमुन बुधकक्ष्य, दानिकधोभागमुन चंद्रकक्ष्य दानिकि क्रिंदवरुसलो सिद्ध विद्याधर मेघ वायुमंडलमुलुनु वीटिकधो भागमुनंदु समस्त ओषधुलतो निंडियुंडि भूमंडलमु कलदु. दीनि दिगुवन पाताळादि लोकमुलुनु कल्गि युन्नदि.

मंदामरेद्य भूपुत्र सूर्य शुक्रेंदुजेंदवः।
मंदादधः क्रमेणस्युः चतुर्धादिवसाधिपाः।।

पै कक्ष्यलननुसरिंचि शनि मॊदलु नाल्गवग्रहमु रविगान शनिवारमु तरुवात आदिवारमु तदुपरि नाल्गवग्रहमु चंद्रुडगुटचे सोमवारमु, चंद्रुनकु नाल्गवग्रहमु कुजुडगुटचे मंगळवारमु इटुलने मिगिलिन वारमुलु संभविंचॆनु.

पाश्चात्युलु मरियु प्रपंचदेशमुलयंदु इदे वारक्रम मुनु भाषाभेदमुन अनुसरिंचुचुंडगा मनमुमात्रमु भारतीय मूलशकाब्दमुलैन सृष्ट्यादि, कल्यादि, विक्रमार्क, शालिशकादि संवत्सर मुलकनुगुणमुगा मन खगोळग्रंथमुलेर्पडिनट्लु प्रमाणमुलुंडगा भारतदेशमुलो ए खगोळ प्रमाणमु आधारमुलेनि क्रीस्तु शकमु (इंग्लीषु शकमुनु) बहुळ प्राचुर्यपरचि मनदेश शकाब्दमुलनु विस्मरिंचुट ऎंतवरकुसमंजसमो विज्ञुलैनवारुग्रहिंचि संस्कृतिनि प्रतिबिंबिंचुविधमुगा विषयनिर्धारण चेयगलरनि आशिंचॆदमु.

वर्तमानकालमुलो पंचांगमुलो भिन्नरीतुलुगा गुणिंचुटचे व्यत्यासमुलु एर्पडि मुख्यपंडुगलु, व्रतादुलु मरियु पितृ तिथ्यादुलु आचरिंचुटलो अगम्यगोचर परिस्थिति तटस्थिंचुचुन्नदि.

कानी मनपूर्वुलु वैदिकक्रियलकु ऎवरिकि ऎप्पुडु ऎट्लु आया समयमुललो निर्णयिंचडंलो, एवि ऎप्पुडु आचरिंचकूडदो अनेक धर्मशास्त्रग्रंथमुललो सृष्टीकरिंचिनारु. अट्ले अन्नि विषयमु ललो ऒके विधानमु चॆप्पबडलेदु. अटुलने पंचांग गणनमुनकु कूडा एए विषयमुललो एए संस्कारमुलु ऎटुलचेयवलनो निर्देशिंचबडिनवि.

इंदुलकु कॊन्नि उदाहरणलनु ई क्रिंद उदहरिंचु चुन्नामु.

सूर्यसिद्धान्ते स्फुटाधिकारे।

मंदादि साधारण संस्कार संस्कृतार्केंदुभ्यां तिथ्यादि साधन क्रममुपदिश्य। अनन्तराधिरेषु तत्संस्कृद्ग्र हात्क्रांतिछाया चरदळादिकं स्पुटं दृक्तुल्यतां गच्छेदयने विषुवद्वये। नक्षत्र ग्रहयोगेषु ग्रहस्तोदयसाधने शृंगोन्नतौतु चंद्रस्य दृक्कर्मादौ विदं स्मृतम्।

रव्यादि नवग्रहमुललो रवि चंद्रुलकु तिथ्यादुलु साधिंचु नपुडु बीजसंस्कारमु चेयनवसरमुलेदनि केवलमु मंदादि साधारण संस्कारमु चेयवलॆननि स्पष्टीकरिंचबडिनदि. ग्रहग्रहण समागमादि विषयमुललोनु मरियु चंद्रशृंगोन्नति निर्णयिं चुटकु मॊदलगु विषयमुलो दृक्संस्कारमुलु चेयवलॆननि चॆप्पबडिनवि.

स्वदेशोचित निर्बीजग्रहैः पञ्चाङ्गसाधनं सबीजै ग्रहणादीनां पुण्यकर्मणि शस्यते ।।

— तिथिकौस्तुभे

स्वदेश संस्कृतसाधित ग्रहमुलु (बीज संस्कारमु चेयनिवि) उपयोगिंचि पंचांगसाधनचेयुट मरियु ग्रहणादुल यंदु बीजयुक्तमुलैन ग्रहमुलतो साधिंचुटयू पुण्यकर्मलकु प्रशस्तमै युन्नदि.

चंद्रार्कशशि तुंगानां बीजं तिथ्यादिसाधने न कर्तव्यंतु कर्तव्यं चंद्रार्कग्रहणादिषु।।

— ज्योतिस्सिद्धान्त संग्रहे

मांदैक कर्म संशुद्ध व्यर्केदुत्पादिता तिथिः श्राद्धादिषु परिग्राह्या ग्रहणादौ तु बीजयुक् ।।

— कालार्के

मन्दं कर्मैकमार्केंदोर्भौमादीनामधोच्यते।
शैघ्रयं मंदं पुनर्मंदं शैघ्र्यं चत्वार्यनुक्रमात्।।

मध्येशीघ्रफलस्यार्धं मन्दमर्धफलंतधा।
मध्यग्रहे मंदफलं सफलं शीघ्रयमेवच।।

— सूर्यसिद्धान्तमु 43 श्लो

दृक्सिद्ध सूर्यचंद्रुलचेत साधिंपबडिन तिथ्यादुलु वैदिक कर्मार्हमैनवि कावु अनिचॆप्पबडुचुन्नवि. बीजकर्म चेयवलसिन संदर्भमुनु विवरिंचुचुन्नामु.

शाकल्यसंहितायां — "ग्रहणे ग्रहयोगेच कालभा लग्नसाधने शृंगोन्नत्युदया स्तेषु ग्रहेबीजं विधीयते" दृष्टकर्मोपयोगियगु सूर्यचंद्रग्रहणादुलयंदुनु मरियु ग्रहसमागम शृंगोन्नत्युदयास्तमयादि विषयमुलकु क्रांतिच्छाया साधनमुनकु बीजसंस्कारमु चेयवलसियुन्नदि.

भचक्र चलनमुवलन ग्रहमुलयंदु गतिव्यत्यासमुलु कनबडुचुन्नवि. अंदुवलन बीजमनगा मध्यगतिव्यत्यासमुलनु चक्कबरचुनट्टिकर्म. इदि तिथ्यादि पंचांगनयनमुलकु चेयनव सरमुलेदु.

ग्रहणादुलैनटुवंटि दृष्टकर्मलयंदु बीजसंस्कारमु तप्पक चेयवलॆनु. इंकनू वीटिकि अनेक प्रमाणमुलु कलवु.

तिथेस्तु पंचघटिकापर्यन्तं वृद्धिसंज्ञिकाम्।
तत्तिथेस्तर्कघटिकापर्यंतं क्षयसंज्ञिकाम्।
एतवृद्धि क्षये किंचिद्वैषम्यमविवेक्षितम्।।
— सिद्धान्त नरकंठीरवमु

पै प्रमाणरीत्या तिथिवृद्धि 5 घटिकलु क्षयमु 6 घटिकलु मात्रमु उंडुननी, कानी दीन्कि कॊद्दिपाटि व्यत्यासमु वृद्धिक्षयमु लुंडुननि शास्त्रवचनमु. कानी नेटि दृग्गणित पंचांगमुललो दादापु 8 घटिकलु वृद्धि, 10 घटिकलु क्षयमु कन्पडुचुन्नवि. रानु रानु ई व्यत्यासमु पॆरुगुचुन्नदि. इदि शास्त्रीयमुकादु. ई तेडालवलन पंडुगलु व्रतादुल निर्णयमुललो भिन्नमुगा वच्चुट प्रजलकु तीव्र अयोमयस्थिति नॆलकॊनि उन्नदि.

कावुन मन भारतीय संस्कृतिलो ज्योतिषमु-खगोळ विज्ञानमु अंतर्भागमुगानुन्नदि. प्राचीनग्रंथमुलनु उद्धरिंचि अंदुगल विषय विज्ञानमुलनु विश्वविद्यालयमुलद्वारा बुध जनुलकु अंदुबाटुलोनुंचिन मन संस्कृतिनि मनमु गौरविंचिनट्ल गुनु.

स्वस्ति सर्वेषां समस्तसन्मंगळानि भवस्तु।
सर्वे जनाः सुखिनो भवन्तु।।

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प्राचीन भारतीय खगोळ शास्त्रं — आर्यभट

टि. वेंकटेश्वर्लु

पौर्णमिरात्रिवेळ आकाशंलोकि चूस्तुंटे रकरकाल विंत अनु भूतुलु कलुगुतायि. उन्नट्लुंडि नक्षत्रं ऒकटि रालिपोतुंटुंदि. मरोनक्षत्रं वेगंगा दूसुकुपोतुंटुंदि. कॊन्नि मिणुकुमिणुकुमनि मॆरुस्तुंटायि. कॊन्नॆमो धगधगा वॆलुगुलु विरजिम्मुतुंटायि. इवन्नी ऒक ऎत्तयिते इक चंद्रुडु मब्बुलचाटुकु चेरि ऎन्नॆन्नो दोबूचुलाडु तुंटाडु. ई वितलु विशेषालन्निंटिकी वेल संवत्स रालुगा परिशीलिस्तुन्न मनिषिकि असलु आकाशंलो एमुंदो तॆलुसु कोवालन्न तपन पुट्टिंदि. ई नक्षत्रालु एमिटि? चंद्रुडु ऎंदुवलन कांतिवंतंगा उंटुन्नाडु? आकाशंलो मरिंक एमेमि उन्नायि. मॊदलैन अनेक प्रश्नलु आलोचनापरुलैन वारि मस्तिष्कालनु स्थिरंगा उंडनिव्वलेदु. तत्फलितमे खगोळशास्त्र आविर्भावं.

प्राधमिक परिशोधनलकु प्राधान्यं इव्वकुंडा ए देशमू शास्त्र विज्ञानरंगंलो पुरोगमिंचलेदु. कॊत्तविषयालनु शोधिंचडं, परिकरालनु यंत्रालनु कनिपॆट्टडं वंटि विनूत्न आविष्करणलकु कूडा प्राधमिक परिशोधनले मूलं. मौलिकांशाललो प्राधमिक परिशोधनलु चेयडानिके ईनाटि मनदेशंलो सजावैन केंद्र बिंदुवुलु कानरावडंलेदु. ई वातावरणंलो प्राचीन भारतीय शास्त्रवेत्तल कृषिफलालनु मननं चेसुकोलेक पोतुन्नां. मनदेशं प्रप्रथमंगा प्रयोगिंचिन अंतरिक्ष परिशोधन उपग्रहानिकि आर्यभटअनि नामकरणं चेयडंलो भारतीय खगोळशास्त्रवेत्तललो अग्रगामिगा भासिल्लिन आर्यभट तिरिगि स्मरणीयुडु कागलिगाडु.

भूमि गुंड्रंगाउंदि. सूर्युनिचुट्टू भूमि तिरुगुचुन्नदि. भूभ्रमणंवलन रात्रिंबवळ्ळु, ऋतुवुलु एर्पडुतुन्नायि. सूर्य चंद्रग्रहणालु राहुकेतुवुल कारणंगा कादु, भूमि चंद्रग्रहमुल नीडलवलन एर्पडुतुन्नायि मॊदलैन ज्ञान गुळिकलनु विश्वमान वाळिकि अंदिंचिन तॊलि शास्त्रवेत्त "आर्यभट". राहुवु, केतुवुलने राक्षसुलु सूर्युडिनि, चंद्रुडिनि मिंगेस्तुन्न संदर्भालल्लो ग्रहणालु एर्पडु तुन्नायन्न मूढ विश्वासालनु, मूर्खत्वान्नि मॊदलंटू नरिकिवेसि विज्ञान उषस्सुनु कल्पिंचिन तॊलिशास्त्रज्ञुडु आर्यभट.

आर्यभट की.श 476व सं.लो केरळलोनि तिरुवान्कूरुलो जन्मिंचारु. मगधसाम्राज्यंलोनि पाटलीपुत्रं (ईनाटि पाट्ना) समीप कुसुमपुरंलोनि नलंद विश्वविद्यालयंलो विद्यार्जन चेशारु. खगोळ शास्त्र अध्ययनं चेशारु. स्वयंगा अनेक परिशोधनलु चेशारु. 23व एटने आर्यभटीय ग्रंथरचन की.श. 499 न, प्रारंभिंचारु. खगोळ गणितशास्त्रमुललो अनेक नूतन परिशोधनांशमुलनु वॆल्लडिंचिन महाद्भुत ग्रंथंगा कीर्तिगडिंचिन पैतामह, सौर, वाशिष्ट, रोमक, पौलिश मॊदलैन प्राचीन शास्त्रज्ञुल सिद्दांतालु कालभ्रष्टतचॆंदि कनुमरुगैपोतुन्न तरुणंलो आर्यभट भारतीय खगोळशास्त्रमुनकु कॊत्त वूपिरुलु पोसि जवसत्वालनु एर्परचि नूतन चैतन्यान्नि कलिगिंचारु. भारतीय खगोळशास्त्रानिकि अद्युडुगा कीर्तिगडिंचारु.

खगोळशास्त्र अध्ययनंलो परिशोधनललो की.पू. चारित्रक घटनलनु अंचनावेसिन घनापाठीगा आर्यभट प्रसिद्धिचॆंदारु. महाराष्ट्रनु पालिंचिन चाळुक्यवंशानिकि चॆंदिन राजा 2व पुलकेशि क्री.श 609-55 नाटि शिलाशासनमुल प्रकारं कुरुक्षेत्र महासंग्रामं क्री.पू. 3101लो जरिगि उंटुंदनि आर्यभटतॆलिपारु. 3102, फ्रिब्रवरि 18न कलियुगं प्रवेशिंचडंलो 3101लोने महाभारतयुद्धं जरिगिंदनि विवरिंचारु.

आर्यभट अमोघ मेधा संपत्तिकि अब्बुरपडिन गुप्तसाम्राज्य अधिपति बुद्धगुप्तुडु नलंद विश्वविद्यालयानिकि प्रधान आचार्युलुगा नियमिंचाडु. खगोळग्रंथ रचन आर्यसिद्धांत (महा सिद्धांत) क्री.पू. वॆलुवडिन संकलनशास्त्रग्रंथालनु परिष्करिंचारनि मनुस्मृतिपेरुतो उन्न ग्रंथान्नि सरिचेशारु. ऒक मन्वंतरानिकि 71 युगालनि मनुस्मृति चॆप्पगा आर्यभट 72 अनि सरिचेशारु. क्री.श. 522 लो पूर्ति चेसिन ग्रंथरचन, आर्यभटीयं, खगोळशास्त्र परिशोधकुलके ऒक प्रामाणिक ग्रंथं.

आर्यभटीयंलो मॊत्तं 4 अध्यायाललो 121 श्लोकालु वुन्नायि. मॊदटि अध्यायंलो खगोळं, ग्रहगतुलु, भूमंडलं मॊ. अंशालनु कवितारूपंलो नूतन सिद्धांतालुगा आविष्करिंचारु. 3व अध्यायं रोदसिलोनि अभ्यंतर (इन् फैर्) अंतर्गत (इन् टॆरिर्) बाह्य (सुपीरियर्) ग्रहमुल गूर्चिन विवरमुलु उन्नायि. चिवरि अध्यायंलो कालगमनं ग्रहचलनालनु गूर्चि विवरण उंदि.

कालान्नि लॆक्किंचे पद्धतिनिगूर्चि पाश्चात्य देशालवारिकन्ना भारतदेशंलोने मुंदुगा तॆलियवच्चिंदि. अयिनप्पटिकी लॆक्किंपु पद्धतिलो वुन्न गुणदोषालनु तॊलिसारिगा आर्यभट परिष्करिंचारु. ऒक सॆकनुकालान्नि 33,750 समान भागलुगा चेशारु. तैत्तिरीयसंहित प्रकारं ऒक संवत्सरंलो 27 नॆललु, अथर्वणवेदं प्रकारं 28 नॆललु अमावास्य पुन्नमल आधारंगा कालान्नि ए विधंगा कॊलवालने अंशान्नि आर्यभट चर्चिंचारु. पातसिद्धांताललोनि लोपालनु सवरिंचारु.

अनुलोम गतिणिर्नौस्तः पश्चत्यचलं विलोमगम्
यद्वत् अचलानि भानि तद्वत् सम पश्चिमगानि लङ्कायाम्

भूमि तन अक्षंमीदने तिरुगुतुंदनि, ग्रहालु, नक्षत्रालु चलिंचवनि (अचलमुलु) स्पष्टं चेशारु.

छादयति शशीः सूर्यं शशिनं महातीच भूच्छाया

भूमंडलं नीड चंद्रग्रहंमीद पडिनपुडु चंद्रग्रहणं एर्पडुतुंदनि इदेविधंगा भूमि चंद्रग्रहालु, सूर्यग्रहं मध्यकु वच्चिनपुडु सूर्यग्रहणं एर्पडुतुंदनि विवरिंचि आनाटि मतस्तुलकु कंटगिंपुगा तयारय्यारु.

आर्यभटीयंलो सूर्यग्रहंनुंचि विविधग्रहाल नडुमगल दूरान्नि गणनचेसि तॆलिपारु. ई कॊलतलु आधुनिक विज्ञानशास्त्र कॊलतलकु सरिसमानंगा उन्नायि. उदाहरणकु सूर्यग्रहंनुंचि शुक्रग्रहं 0.725 खगोळशास्त्र यूनिट्लदूरं वुंदनि आर्यभट पेर्कॊनगा आधुनिक विज्ञानशास्त्रं 0.723 अस्ट्रानमिकल् यूनिट्ल दूरं वुंदनि कनुगॊन्नदि.

सूर्यग्रहं उपरितलंमीद कॊन्नि प्रांताललो निर्देशिंचिन समयाललो नल्लमच्चलु एर्पडतायनि, इवि अयस्कांत आकर्षणशक्ति रूपु दालुस्तायनि पेर्कॊन्न आर्यभटसिद्धांतं इटीवलिकालंलोकूडा ऋजुवैंदि. मनदेशंलो सूर्यग्रहंमीद परिशोधनलु जरिपे एकैक खगोळकेंद्रं कॊडैकॆनाल्लो 1896लो स्थापितमैंदि. 2003 सं. अक्टोबर्लो ई केंद्रंलोनि परिशोधकुलु सूर्यग्रहंलो 3,82,680 कि.मी. विस्तीर्णानिकि नल्लमच्च एर्पडिंदनि, वरुसगा 4 रोजुलपाटु चूडवच्चनि (अक्टोबर् 26 नुंडि 29 वरकु) प्रकटिंचारु. 11 एळ्ळकु ऒकसारि सूर्युनिलो नल्लमच्चलु अधिकंगा एर्पडतायनि, प्रस्तुतं सूर्युडि मध्यभागंलो ईशान्यदिशलो रॆंडुमच्चलु कनबडुतुन्नायनि पेर्कॊन्नारु. वीटिलो मध्यभागंलो एर्पडिन मच्च 3,82,680 कि.मी विस्तीर्णंलो वुंदनि वॆल्लडिंचारु. इदि भूमिविस्तीर्णंकन्ना 30 शातं अधिकमनि अन्नारु. भूमिविस्तीर्णं 12,756 किलोमीटर्लु कागा, सूर्युडि विस्तीर्णं 14 लक्षल कि.मी.

आर्यभट सकलनंचेसिन खगोळशास्त्रान्नि कूडा कॊंतमंदि ज्योतिषशास्त्रंगा मार्चिवेशारु. प्रजल विज्ञानराहित्यान्नि आसरागा तीसुकॊनि गंदरगोळं सृष्टिंचारु. आर्यभट तन ग्रंथरचनलो स्पष्टंगा विवरिंचारु — निजानिकि सूर्यग्रहं कदलदनी, भूमिमात्रमे तन चुट्टू तानु तिरुगुतू उंडटंवलन सूर्युडु, नक्षत्रालु, चंद्रुडु आकाशंलो पैकिलेस्तुन्नट्टु, गिरगिर तिरुगुतुन्नट्टू, किंदकि दिगिपोतु न्नट्टू कनिपिस्तायनि ज्ञानबोध चेशारु. सूर्यचंद्रुलु हरिंचुकोलेनि राहुकेतुवुलनु आर्यभट तम ज्ञाननेत्रंलो हरिंचुकॊनि मिंगेशारु. मनकु ज्ञानोदयं चेशारु. राहुकेतुवुलु अन्नवि केवलं ऊहा बिंदुवुलु, छायाग्रहालु. काल्पनिक साहित्यतरहालोने ई राहु केतुवुलु कूडा अस्तित्वंलेनि काल्पनिकबिंदुवुलु. अवे छायाग्रहालु अनि विवरिंचिन आर्यभट सिद्धांतालनु कॊंदरु कनुमरुगु चेशारु.

खगोळशास्त्रानिकि विशिष्टसेवलु अंदिंचिन आर्यभटपट्ल अतडि परिशोधनलपट्ल मतसंस्थलु चिकाकुलुपडटं वलन आ तर्वात खगोळ परिशोधनलु निलिपि, गणितशास्त्र

परिशोधनलो प्रवेशिंचारनि चरित्रकारुलु पेर्कोन्नारु. अप्पटिके आर्यभट्ट शास्त्रवेत्तगा ऐंतपेरु संपादिंचारो सामाजिकंगा कूडा अंते सुप्रसिद्धुलु. ई नेपथ्यंलो ईयन मत दृक्पधानिकि अनुयायिगा नटिस्तूने गणितशास्त्र रंगंलो प्रवेशिंचारु. वृत्तंचुट्टू कोलत, व्यासानिकि उंडे निष्पत्ति, π विलुव 3.1416 (3.1429) अनि तेल्चिचेप्पारु. सैन्स् पट्टिकलु रूपोंदिंचारु. वर्ग समीकरणं उदा. $ax^2 - by^2 = c(ax^2 + bx + c = 0)$नु प्रतिपादिंचि गणितशास्त्र पुरोभिवृद्धिकि पुनादुलु वेशारु. वर्गमूलं, त्रैमूलकपट्टिकलु तयारुचेशारु. आर्यभटसूचिंचिन कोन्नि गणितसमीकरणलु ई नाटिकी प्रतिष्ठात्मकंगा निवाळुलु अंदुकुंटुन्नायि π विलुवनु तोलिसारिगा चेप्पिंदि ईयने. ग्रीक् गणितशास्त्रवेत्त टोलेमि इच्चिन विलुवलकन्ना इदि खच्चितमैनदनि गणितशास्त्रज्ञुलु अंगीकरिस्तुन्नारु. ax, by, c वंटि समीकरणलु ईयनतो प्रारंभं कावडं ई रोजुन महाविचित्रंगा तोस्तुंदि. अंतेकादु, पेद्द पेद्द संख्यल्नि "कोड्" ल रूपंलो विवरिंचिन घनतकूडा ईयनके दक्कुतुंदि.

भूम्याकर्षणशक्तिकि हेतुवेमिटो आर्यभट विवरिंचारु. भूमिलो (अभिघात) आकर्षणशक्ते कारणं. ई शक्ति मूडुरकालु. निरंतर ऒत्तिडि (रोदन) आकर्षण (अभिघात) स्वयं आकर्षणलु.

"आर्यभटीयं" तो पाटु "आर्यभट्ट सिद्धांत" अने शास्त्रप्रमाण ग्रंथान्निकूडा ईयने रचिंचारु. ई ग्रंथरचनलोने खगोळशास्त्रानिकि संबंधिंचिन अनेकानेक अध्ययन, परिशोधनांशमुलनु गूर्चि सहेतुकंगा वेल्लडिचेयगल सामर्थ्यान्नि प्रदर्शिंचारनि आधुनिक खगोळ शास्त्रवेत्तलु अंगीकरिंचारु. अयिते ई ग्रंथं केवलं पंचांगकर्तलु मात्रमे उपयोगिंचुकोगलगडं संभविंचिंदि.

आर्यभट गणितशास्त्रान्नि भास्कराचार्युलु प्रचारंचेस्ते खगोळ शास्त्रान्नि "लतदेव" वेलुगुलोकि तीसुकुवच्चारु. आर्यभट शिष्युललो ऒकरैन लतदेवकूडा खगोळशास्त्रज्ञुले. आर्यभट प्रतिपादिंचिन अनेकानेक नूतन खगोळशास्त्र विषयालु, समस्यल परिशीलनलु, परिष्कारालु अतिसरळंगा, सुबोधकंगा वुंडि ई नाटिकी अनुसरणी यालुगा उन्नायि. चंद्रग्रहं स्वयंप्रकाश शक्तिलेनि चीकटि बिलमनि, केवलं सूर्यग्रहकिरणाल प्रसरणवलनने प्रकाशिस्तुंदनि निर्धारिंचारु. भूकेंद्रक सिद्धांतान्नि विश्वसिंचारु.

अंकेलस्थानंलो अक्षरालु

आर्यभट गणितशास्त्रंलो ऒक विनूत्नपद्धतिनि प्रयोगा त्मकंगा प्रवेशपेट्टारु. अंकेलकु प्रत्याम्नायमुलुगा अक्षरालनु प्रयोगिंचारु.

अ = 10, इ = 100 उ = 10,000, ऋ = 10,00,000,

ऐ=100,000,000 ऎ = 10,000,000,000 उ = 100,000,000,000

क = 1, ख = 2, ग = 3, घ = 4, य = 30, र = 40, ल = 50, व = 60, श = 70,
ष = 80, न = 90, ह = 100

ई पद्धतिप्रकारं सूर्यग्रहं वयसुन "गयखउ" गा अंचना वेशारु. (43,20,000 संवत्सरालु). कालविभजननु कूडा अतिसूक्ष्म विधानंलो निर्वचिंचारु. ईयन सूचिंचिन "कालक्रिय सिद्धांतंलो मॊत्तं 25 श्लोकालु वुन्नायि. इंदुलो संवत्सरं, मासालु, पक्षालु, ोजुल लॆक्क अनंतरं रोजुकु 60 नाडुलुगा पेर्कॊन्नारु. दींतो ऒक्कॊक्क नाडिनि 60 विनाडुलुगा विभजिंचारु. नाडिकि 24 निमिषाल कालं. विनाडि कालपरिमिति मनं आरुसार्लु श्वासपील्चे समयंगा तॆलिपारु.

मनदेशपु तॊलि उपग्रहान्नि (इस्रो रूपॊंदिंचगा, 360 किलोल बरुवुगल दानिनि, सोनियट् रष्यालोनि अंतरिक्षकेंद्रंनुंचि सोवियट् राकॆट् सायंतो 1975, एप्रिल् 19न तॆल्लवारुजामुन 1 गंटकु प्रयोगिंचारु. दानिकि "आर्यभट्ट" अनि नामकरणं चेशारु. एप्रिल् 22न दानिनि मनवारु नियंत्रिंचारु).

भूभ्रमणं

अनुलोम गतिर्नौस्थः पश्चत्यचलं विलोमगं
यद्वत् अचलानिभाति तद्वत् समपश्चिमगानि — आर्यभट

नावमीद प्रयाणिस्तुन्नवारिकि चलनंलेनि (गट्लमीदवुंडे चॆट्लु मॊ.) अभिमुखंगा परुगॆडुतुन्नट्टु कनिपिंचिनविधंगा भूमंडलं कदलडंचेत स्थिरंगाउन्न नक्षत्रालु पश्चिमदिशगा प्रयाणिस्तुन्नट्टु भावन कलुगुतुंदि.

भूभ्रमणान्निगूर्चि गॆलीलियोकन्ना आर्यभट चालामुंदे चॆप्पारु. सूर्यकेंद्रसिद्धांतं तॊलिगा मनदेशंलोने रूपुदिद्दुकुन्नदि.

> अंतरिक्षान्नि हेतुदृष्टितो चूचिन तॊलिमानवुडु आर्यभट. आयनमेधस्सु अंटे नाकु भयभक्तुलु. आयन तर्वात 1500 सं.ल तदनंतरं ऐन् स्टयिन् रूपंलो मळ्ळी अंतटि गॊप्प मेधस्सु अवतरिंचिंदि. — ऎ.पी.जॆ.अब्दुल् कलाम्

ग्रहाल अध्ययनंलो क्रमपद्धतिनि आविष्करिंचिन आर्यभट

भूमिपरिधि 4,967 योजनालु, व्यासं 15,81 1/24 योजनालु अनि आर्यभट स्थिरीकरिंचारु. ऒकयोजनं अंटे 5 मैळ्ळु. ई पद्धतिमीद भूमिपरिधि 24,835 मैळ्लु कागलदु. आधुनिक लॆक्कलप्रकारं 24,902 मैळ्ळु. वंदल संवत्सरालक्रितमे ऎटुवंटि परिकराल संपत्ति लेकुंडाने आर्यभट इंत खच्चितंगा अंचनावेयडं आश्चर्यकरं. भूमि तनइरुसु आधारंगा तिरुगुतुंडटंवल्लने ग्रहालु तिरुगुतु न्नायनि आर्यभट्ट स्पष्टीकरिंचारु. ग्रहालसंचार वलयमार्ग व्यासार्धान्नि गणिंचारु. भूमि सूर्युडि ग्रहसंचारमार्ग व्यासार्धान्नि ग्रहिंचारु. सूर्युनिचुट्टू अदि तिरगडानिकि पट्टे समयान्नि विवरिंचारु. चंद्रुडु, इतर ग्रहालु सूर्यकांति प्रतिफलिंचडंतो मॆरुस्तुन्नायनि विवरिंचारु. अंतेकादु, ग्रहाल संचारं अंडाकारंलो उंटुंदनि आश्चर्यकरमैन विशेषं वॆलिबुच्चारु. अंतटितो आगक सूर्य,

चंद्र ग्रहणालकु खच्चितमैन कारणालनु विश्लेषिंचारु. 1,582,237,500 सार्लु भूमितिरिगिते अदि 55,753,366 चंद्रग्रह संचारालतो समानमनि विवरिंचारु. इदि चाला खच्चितमैन अंचना. इंतटि अपूर्व विज्ञानसंपदनु ज्योतिषं अणगदोक्कि मूढत्वान्नि, मूर्खत्वान्नि व्यापिंपचेसिंदि. आर्यभट तॊलिपिन स्थिरांकं बहुशा मानवुडिकि तॊलिसिन अति प्राचीन खगोळशास्त्र स्थिरांकालेमो.

आर्यभट-ग्रीकुलु

आर्यभट्टीयंलो-भूमि तनइरुसुमीद आधारपडि तिरुगु तुंदनी ग्रहालु सूर्युडिकि अभिमुखंगा गमनं सागिस्तुन्नायनि आर्यभट प्रतिपादिंचारु. पैथागरस् कूडा इदेविधंगा परिशीलिंचिना, सिंहभागं तात्त्विकधोरणि वॊलिबुच्चाडु. ग्रीकुलु चालाकालंतर्वात इदे सिद्धांतान्नि सूर्यकेंद्रक सिद्धांतंगा प्रचारं चेसुकुन्नारु. 1633लो गॆलीलियो मतवादुल प्राबल्यानिकि ऐदुरॊड्डि निलुवलेक तन सूर्य केंद्रकसिद्धांत भावालनु तृणीकरिस्तुन्नट्लुगा ऒक बलवंतपु प्रकटन चेयवलसिवच्चिंदि.

> षष्ट्यब्द्यानां षड्भिर्यदाव्यतीतास्त्रयश्च युगपादाः
> अधिकाविंशतिरब्दान्त देहामम जन्मनोऽतीताः

"आर्यभट्टीयं" ग्रंथरचनलो आर्यभट तन जन्मकालान्नि पेर्कॊंटू ई श्लोकं चॆप्पारु. दीनिनि आधारंगा चेसुकॊने "षड्भि" नि पष्टिगा भाविंचि, आर्यभट तन 23व एट रासिन ग्रंथंगा निर्णयिंचि आ कालान्नि क्री.श. 476गा निर्धारिंचारु. "षड्भि" पदान्नि यधाविधिगा अंगीकरिस्ते क्री.पू. 2766 कागलदु. ई तरहा संदेहालु, संदिग्धतलु पूर्वकालपु मेधावुल कालनिर्णयाललो सर्वसाधारणमैनायि.

आर्यभट गणितशास्त्र आविष्करणलु

आर्यभट तन आर्यभट्टीयं द्वारा गणितशास्त्राभिवृद्धि चेसिन नूतन आविष्करणललो कॊन्नि प्रधानमैनवि.

1. अव्यक्तराशुल गणनल्नि सुलभसाध्यं कावडानिकि अच्चुलु, हल्लुल्नि (अक्षराल)नु उपयोगिंचारु.
2. अंक गणित पट्टिकलनु अंदिंचारु.
3. त्रिभुज वैशाल्यान्नि कनुगॊनडानिकि सुलुवुगा ऒक सूत्रान्नि रूपॊंदिंचारु.
4. $ax - by = c$ सूत्रान्नि साधिंचडानिकि कूडा ऒक सूत्रान्नि प्रतिपादिंचारु.
5. "पै" π विलुवनु सुमारुगा 3.14146 अनि चॆप्पारु. आधुनिक कालंलोनि विलुवकु इदि दरिदापु समानंगा उंदि.

6. वृत्तव्यासार्धं, पोडवुनु कनुगोनडानिकि ओक सूत्रान्नि अंदजेशारु.
7. गोळं घनपरिमाणान्नि कनुगोनडानिकि ओक सूत्रान्नि सूचिंचारु.
8. वृत्त वैशाल्यमुनु कनुगोनडानिकि ओक सूत्रान्नि प्रतिपादिंचारु.
9. वड्डी रुसुं लेक्कललो वड्डीनि कनुगोनडं, संबंधित कालान्नि गणन चेयडं तदितर सूत्रान्नि तोलिसारिगा कनुगोन्नारु.
10. अंकेलकु पेद्द पेद्द संख्यललो वरुस स्थानालनु इव्वडंलो तोलि सारिगा सूचनलंदिंचारु (ओकट्लस्थानं, पदुलस्थानं, वंदलस्थानं मो.)
11. भारी स्थायि अंकेलनु वर्गीकरिंचडंलो (कोटि=पदिमिलियन्, अर्बुद=वंद मिलियन् मो.लो तोलिसारिगा विजयं साधिंचारु.

ई तरहालो आर्यभट गणित खगोळशास्त्राललो अनेक नूतन आविष्करणलु चेशारु. आधुनिक गणितशास्त्र अध्ययनंलो वाडुकुं टुन्न विधानालु अनेकं "आर्यभट्टीयं" लो इमिडि वुन्नायि. क्यूब्, क्यूब् रूट्, स्क्वेर्, स्क्वेर् रूट्, त्रिभुजं, वृत्तं सैन् टेबुल्स् तदादि अनेकानेक गणितशास्त्र अंशालनु आविष्करिंचिन घनत ईयनके दक्कुतुंदि. क्री.श. 476 मार्चि मासंलो जन्मिंचिनट्टु चेबुतुन्न आर्यभटतम 29व एटने इंतटि अत्यद्भुत शास्त्रग्रंधं रायटं ईयन मेथाशक्तिकि, परिशोधना पाटवानिकि तार्काणंगा निलुस्तुंदि.

34

वाल्मीकि रामायणंलो ज्योतिषांशालु

आर्. अनंत पद्मनाभरावु

आदिकवि वाल्मीकिकृत रामायणं ऒक रसवत्तर काव्यं. तानु ऒक पात्रगा वुंडि यावद्रामचरितनु दर्शिंचि, लवकुश जननानिकि सीतम्मकु आश्रमान्नि आश्रयंगा यिच्चिन तपस्संपन्नुडु. ऒक जातिकि परमपवित्र ग्रंथंगा मलचिन वाल्मीकिमहर्षि प्रसक्तानु प्रसक्तंगा रामायणं आरुकांडललो नक्षत्रालनु गूर्चि, ग्रहसंपदनु गूर्चि पेर्कॊन्नारु.

रामायण पुराणप्रवचनंचेस्तुन्न ब्रह्मश्री मल्लादि चंद्रशेखरशास्त्रिवंटि महापंडितुल्नि सामान्यमानवुडु जिज्ञासतो अडिगे प्रश्न ऒकटिवुंदि. वसिष्ठमहर्षिवंटि महनीयुडु श्रीरामपट्टाभिषेकानिकि मुहूर्तं निर्णयिस्ते अदि ऎंदुकु जरगलेदु. अदि वनवास गमनानिकि मुहूर्तं ऎंदुकैंदि? इलांटि संदेहालु सर्वसाधारणं.

अलागे मरोप्रश्न. सीतारामुल विवाहमुहूर्तान्नि शतानंद महर्षि उत्तरफल्गुणीनक्षत्र समयंलो भगुडु देवतगागल उत्तरा नक्षत्रंलो जरिपिंचाडु गदा. वारिकि वियोगं रॆंडु दफालु ऎंदुकु कलिगिंदि? इक्कड बालकांडलो जनकुडु दशरथुनितो मुहूर्तंगूर्चि चॆप्पाडु.

मघ ह्यद्य महाबाहो तृतीयदिवसे प्रभो
फल्गुन्यामुत्तरे राजन् तस्मिन् वैवाहिकं कुरु
रामलक्ष्मणयो राजन् दानं कार्यं सुखोदयम् — बालकांड 26.23-24

दशरथ महाराजा! ई रोजु मघ नक्षत्रं, नेटिकि मूडोरोजु उत्तर फल्गुणी नक्षत्रंलो सीतारामुलकु, ऊर्मिळालक्ष्मणुलकु विवाहनिमित्तं गो हिरण्य भूदानालु चेयिंचंडि.

ऒके मुहूर्तंलो रॆंडुविवाहालु जरिगायि. सीत अडवुल पालैते, ऊर्मिळ भर्तृवियोगंतो 14 संवत्सरालु अंतःपुरंलो कुमिलिपोयिंदि.

श्रीरामजननं

कौसल्यादेवि 12व मासंलो चैत्र शुक्ल नवमिनाडु पुनर्वसु नक्षत्रंलो श्रीरामचंद्रुनि प्रसविंचिंदि.

> ततश्च द्वादशेमासे चैत्र नवमिकी तिथे
> नक्षत्रेऽदितिदैवत्य स्वोच्छ संस्थेषु पञ्चसु
> ग्रहेषु कर्कटलग्ने वाक्सताविन्दुनासह
> कौसल्या जनयाद्रामं सर्वलक्षण संयुतं
> — बालकांड 18.9-10

ऐदुग्रहालु तमतम उच्चस्थानाललो वुन्नायि. सूर्युडु मेषंलो, कुजुडु मकरंलो, गुरुवु कर्काटकंलो, शुक्रुडु मीनंलो, शनि तुलाराशिलो उन्नारु. कर्काटक लग्नंलो रामचंद्रमूर्ति जन्मिंचाडु.

శుక్ర	రవి	బుధ	కేతు
	శ్రీరామచంద్రులు పునర్వసు నక్షత్రం		ల, గురు, చంద్ర
కుజ			
రాహు		శని	

श्रीरामचंद्रुनि जातकान्नि परिशीलिस्ते

गजकेसरियोगमु, रुचक, हंस, शशक (पंचमहापुरुष) योगालु, चंद्र मंगळयोगमु उन्नायि. रविकि दिग्बलंवल्ल कीर्ति, प्रतापमु, मंचिपुत्रुलु लभिंचायि. चंद्रुडु लग्नंलो वुंडटंवल्ल सुन्नितहृदयुडु अय्याडु. बुधुडु लाभंलो वुन्नाडु. स्नेहितुलैन सुग्रीव, विभीषण, हनुमंतुलकु सहायकारि अय्याडु. अदे बुधुडु शत्रुक्षेत्रंलो वुंडि दुःखान्नि कलिगिंचि बाधकारकु डय्याडु. बुधमहर्दशलो 14 सं.लु अरण्यवासं चेशाडु. सीतनु पोगॊट्टुकुन्नाडु. समुद्रान्नि दाटाडु.

लग्नंलो गुरुवु योगदायकुडु. महाराजयोगं कलिगिंदि. चक्रवर्तिगा पालनसागिंचाडु. मर्यादापुरुषोत्तमुडनिपिंचुकॊन्नाडु. शुक्रुडु भाग्यस्थानंलो वुन्नंदुन समस्तसंपदलु लभिंचायि. ऋषुलु, पंडितुलपट्ल गौरवं चूपाडु. लग्नाधिपति चंद्रुनिकि शुक्रुडु शत्रुवु.

कळत्रकारकुडु शुक्रुडु – विवाहानंतरं बाधलु तप्पलेदु.

कुटुंबसौख्यं तक्कुव. एकपत्नीव्रतुडय्याडु. नवमं पितृस्थानं. चिन्नतनंलोने तंड्रिनि रामुडु कोल्पोयाडु.

नाल्गिंटि शनि केंद्रंलो उन्नंदुन —

बंधुस्थिते भानुसुते नराणांजातस्य
नष्टः क्रमरोहिबंधवाः स्त्री पुत्रगेहे
अर्धविनाशकारांच स्थानातयति सुक्नहीनः

श्रीरामुडु चक्रवर्तिपदविनलंकरिंचाडु. प्रजामोदंपॊंदाडु. रामराज्यमनिपेरु. शास्त्रालु, अस्त्रालु नेर्चाडु. पराक्रमवंतु डय्याडु. धर्मप्रवर्तनकु मारुपेरु. शनि चंद्रुनिकि (लग्नाधिपतिकि) विरोधि. सप्तम स्थानाधिपति सप्तमं कळत्रस्थानं. भार्यनु केवलं ऒक वस्तुवुगा भाविंचाडु. (materialistic) ऎनिमिदिंट अधिपतिकूडा कावडंवल्ल अष्टकष्टालु अनुभविंचाडु. भार्यावियोगं रॆंडुसार्लु संभविंचिंदि.

धर्मकर्माधिप अवयोगं सिद्धिंचिंदि.

पंचम षष्ठाधिपतुलु केंद्रमुलो उंडटंवल्ल शंखयोगं कलिगिंदि. राहुकेतुवुलु उच्छलो वुंडटंवल्ल अष्टलक्ष्मीयोगं कलिगिंदि. आरिंट राहुवु शत्रुस्थानंलो वुंडि शत्रुजयं कलिगिंचाडु.

धनूराशिलो राहुवु वुंडि कोदंडराहुयोगं कोदंड रामुनिकि कलिगिंचाडु. पंचमाधिपति कुजुडु उच्छलो वुन्नाडु. अलागे षष्ठाधिपति लग्नंलो गुरुवु उच्छ, शनि सप्तमदृष्टि, दशम दृष्टिवल्ल चक्रवर्तियोगानिकि भंगंवाटिल्लिंदि. सप्तम कुजदोषंवल्ल भार्या वियोगं.

ब्राह्मणशापं

गुरुवुनकु पापग्रहयोगं, शनिदृष्टिवल्ल, कुजदृष्टिवल्ल पूर्वजन्मलो, वर्तमान जन्मलो ब्राह्मणशापं कलिगिंदि. 14 एळ्ल अरण्यवासं कलिगिंदि. ऐदु ग्रहालु उच्छलो उंडडं बाधाकरं अनि कॊंदरि अभिमतं.

राशिलो चंद्र गुरु संयोगंवल्ल चक्रवर्तियोगं कलिगिंदि. गुरुवु तनु भावंलो उंडडंवल्ल, शनि सप्तम, अष्टामाधिपति कावडं वल्ल ब्राह्मणुडैन रावणुनि चंपाडु. रविनुंडि रॆंडो इंट एदो ऒक ग्रहं उंडडंवल्ल उभयाचारयोगं समकूरिंदि.

ई विधंगा श्रीरामचंद्रुनि जातकान्नि निशितंगा परिशीलिस्ते फलितालु अला समकूरायि. इक भरत, लक्ष्मण, शत्रुघ्नुल जननं कूड वाल्मीकि महर्षि विवरिंचाडु.

पुष्ये जातस्तु भरतो, मीनलग्नेप्रसन्नधीः
सार्पेजातेतु सौमित्र कुळीरेऽभ्युदिते रवे — बाल. 18.13

भरतुडु पुष्यमीनक्षत्रंलो मीनलग्नंलो पुट्टाडु. आश्लेषा नक्षत्रंलो श्रीरामुडु पुट्टिन कर्काट

कलग्नंलो मरुनाडु मध्याह्न समयंलो लक्ष्मण, शत्रुघ्नुलु जन्मिंचारु. आ नलुगुरु ऐला वुन्नारो चॆप्पटानिकि महर्षि नालुगु नक्षत्रालु ऎंचुकुन्नाडु.

गुणवन्तो अनुरूपाश्च रुच्याप्रोष्ठपदोपमाः बाल. —18.15

पूर्वाभाद्र, उत्तराभाद्र अने नालुगु नक्षत्रालवंटि कांति कलवारै बुद्धिमंतुलुगा जन्मिंचारु. नलुगुरु अन्नदम्मुल्लो ऒक्कॊक्करि जातकं ऒक्कॊक्करकंगा जरिगिपोयिंदि.

श्रीरामचंद्रुडु राज्यपट्टाभिषेकार्हुडैना अडवुलकु वॆळ्ळाडु. भार्यावियोगान्नि भरिंचाडु. राक्षससंहारंचेसि मुनिजनपरितोषकु डय्याडु. भार्यनु दूरंचेसुकॊन्नाडु. चिवरकु सीत भूमात ऒडिलो तलदाचुकुंदि. रामुनिबिड्डलु अंतःपुरंलोकाक आश्रमंलो पुट्टवलसि वच्चिंदि. आयिते आदर्शपुरुषुडुगा, आराध्यदैवंगा, विग्रहवान् धर्मंगा त्रेतायुगंनुंडि नेटिवरकु पूजिंपबडुतुन्नाडु. सीतारामुलु आदर्शदंपतुलय्यारु. रामुडु पितृवाक्य परिपालकु डय्याडु.

राज्यान्निपॊंदे अवकाशं वच्चिना भरतुडु त्यजिंचाडु. भ्रातृभक्तितो पादुकलकु पट्टाभिषेकंचेसि नंदिग्रामंलोने 14 एळ्ळु रामुनिपेर अयोध्यापरिपालन कॊनसागिंचाडु. मीनलग्नजातकु डायन. पुष्यमीनक्षत्रजातकुडु.

आश्लेषानक्षत्रंलो लक्ष्मणशत्रुघ्नुलु सुमित्रकु जन्मिंचारु. वारिद्दरु रामभरतुलकु छायगा मॆलिगारु. तमकंटू ऒकव्यक्तित्वं लेनिवारुगा भ्रातृभक्तिलो जीविंचारु. कर्काटकलग्नंलो श्रीरामुडु, लक्ष्मण शत्रुघ्नुलु जन्मिंचडं गमनार्हं. लग्नाधिपति चंद्रुडु.

श्रीरामयुवराजपट्टाभिषेक मुहूर्तमु

दशरथमहाराजु सभामध्यंलो श्रीरामयुवराजपट्टाभिषेक विषयान्नि प्रकटिंचाडु.

चैत्रः श्रीमानयः मासः पुण्यः पुष्पितकाननः
यौवराज्याय रामस्य सर्वमेवो कल्प्यताम्
राज्ञस्तूपरते वाक्यजनघोषोमहानभूत् — अयोध्या. 3.4

शोभायुक्तमैन चैत्रमासं रामुनि यौवराज्यपट्टाभिषेकानिकि तगिनदनि वसिष्ठवामदेवादि ऋषुल समक्षंलो प्रकटिंचाडु — दशरथुडु. रामुनि पिलिपिंचि सभलो पट्टाभिषेक मुहूर्तान्नि निर्णयिंचाडु.

यतस्त्वया प्रजाश्चेमाः स्वगुणैरनुरञ्जिताः
तस्मात्त्वं पुष्ययोगीन यौवराज्यमवाप्नुहि — अयोध्या. 3.40

रामा! नीवु नी गुणालतो प्रजलनु रंजिंपजेशावु. अंदुचे पुष्यमीनक्षत्र युक्तमैन रोजु निन्नु

यौवराज्य- पट्टाभिषिक्तुण्णि चेस्तानु अनि प्रकटिंचाडु. रामुडु माटाडकुंडा तन गृहानिकि वॆळ्ळिपोयाडु. पौरुलु अंदरू वॆळ्ळिनपिदप, दशरथुडु रामुनि मळ्ली तीसुकुरम्मनि सुमंत्रुनि आज्ञापिंचाडु.

श्वपव पुष्याभविता श्वोऽभिषेच्यस्तुमेसुतः
रामो राजीवताम्राक्षो यौवराज्य इति प्रभुः — अयोध्या. 4.2

रेपे पुष्यमी नक्षत्रं. रामुनि यौवराज्यपट्टाभिषेकं चेयालनि निश्चयिंचानु अनि सुमंत्रुनितो अंटाडु दशरथुडु. तॊंदर एल? एकांतंगा दशरथुडु रामुनितो तनकु गल भयान्नि चॆप्पाडु.

अवष्टब्दंच मे रामनक्षत्रं दारुणैर्दहैः
आवेदयन्ति दैवज्ञाः सूर्यांगारक राहुभिः — अयोध्या. 4.18

रामा! क्रूरग्रहालैन रवि, कुज, राहुवुलु ना जन्मनक्षत्रान्नि आक्रमिंचियुन्नायनि दैवज्ञुलु चॆबुतुन्नारु. इलांटिअपशकुनालु कनबड्डप्पुडु राजुनकु मृत्युवुगानि, घोरमैन आपदगानि रावच्चु.

ना मनस्सुलो मरो आलोचन वच्चेलोगा नी पट्टाभिषेकं जरिगिपोवालि. दैवज्ञुलु निर्णयिंचिन मुहूर्तं रेपे-अंटू

अद्यचंद्रोऽभ्युपगतः पुष्यात्पूर्वं पुनर्वसू
श्वः पुष्ययोगं नियतं वक्ष्यन्ते दैवचिन्तकः — अयोध्या. 4.21

"ई रोजु चंद्रुडु पुष्यमी नक्षत्रानिकि वॆनकवुंडे पुनर्वसु नक्षत्रंलो उन्नाडु. (रामुनि जन्मनक्षत्रं). रेपु पुष्यमी नक्षत्रंलो पट्टाभिषेकं. भरतुडु नगरानिकि दूरंगा उंडगाने अभिषेकं जरगालि. अतडु सन्मार्गवर्तनुडे. कानि मनुष्युल चित्तं चंचलं कदा!

रामुडु अंगीकरिंचि आ वार्त चॆप्पडानिकि तल्लि अंतःपुरानिकि वॆळ्ळाडु. आमॆ देवतागृहंलो ध्यानासक्तयै मौनंवहिंचि लक्ष्मी देविनि प्रार्थिस्तोंदि. सुमित्र, लक्ष्मणुडु, सीत अप्पटिके चेरि उन्नारु. इदंता ऒक सिनिमालो सन्निवेशंला कन्पिस्तुंदि.

कौसल्य प्राणायामंचेसि श्रीमहाविष्णुवुनु स्मरिस्तोंदि. कौसल्य ई संदर्भंलो ऒक माट अंदि.

कल्याणे बत नक्षत्रमयि जातोऽसि पुत्रन्।
येन त्वया दशरथोगुणै राराधितः पिता — अयोध्या. 4.40

कुमारा! नीवु नाकु जन्मिंचिन नक्षत्रं मंगळकरमैनदि. अंदुके नी तंड्रिनि आनंदिंपजेशावु-अंटुंदि.

कैकेयिवरालतो पट्टाभिषेकं आगिपोयिंदि. रामुडु तंड्रि आज्ञपाटिंचि अडवुलकु वॆळ्ळडानिकि सिद्धमै सीतवद्दकु वच्चाडु. सीतकु आ विषयं तॆलियक इला अंदि.

अद्य बार्हस्पत्यः श्रीमान्युक्तः पुष्योऽनुराघव
प्रोच्यते ब्रह्मणैः प्राज्ञैः केनत्वमसिदुर्मनाः — अयोध्या. 26.8

रामा ! नेडु लक्ष्मीप्रदमैन बृहस्पतिदेवतगा गल पुष्यमी नक्षत्रं अभिषेकानिकि तगिन समयमनि प्राज्ञुलु चॆप्पारु. मरि मीरु चिंतिंचडानिकि कारणमेमि? अनि अडिगिंदि सीत.

अप्पटिकि वारि विवाहमै 12 सं।।लु. सुखंगा संसारसुखालु अनुभविंचारु. ई माट सुंदरकांडलो सीतासाध्विहनुमंतुनितो चॆप्पिन संदर्भंलो वुंदि.

समाद्यादश तत्राहं राघवस्य निवेशने
भुंजानामानुषान् भोगान् सर्वकामसमृद्धिनी — सुंदर. 33.17

12 सं।।ल तर्वात पट्टाभिषेक प्रयत्नं दशरथमहाराजु चेशाडु.

आ पट्टाभिषेक मुहूर्तं चिवरकु अरण्यवासमुहुर्तमैंदि. श्रीरामुनि जातकचक्रानिकी, श्रीकृष्णुनि जातकचक्रानिकी तेडालु गमनिद्दां. द्वापरयुगंलो जन्मिंचिन श्रीकृष्णुनि कुंडलिनि ई संदर्भंलो परिशीलिद्दां.

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<tr><td></td><td>శని</td><td></td><td>బుధ</td></tr>
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रोहिणीनक्षत्रंलो वृषभराशिलो वृषभलग्नंलो जन्मिंचाडु श्रीकृष्णुडु. श्रावणमास कृष्णाष्टमि तिथि. गजकेसरियोगं. कर्काटक लग्नाधिपति चंद्रुडु. वृषभंलोनु, वृषभशुक्रुडु, कर्काटकंलोनु वुंडि परिवर्तनयोगं कलिगिंदि. बुधुडु उच्छलो उन्नाडु.

वृषभे पंचमे सौम्ये अखंडराजयोगस्य
विद्यावाहन उद्योग पुत्रलाभदा

पंचम बुधुडु अखंड राजयोगकारकुडय्याडु.
शुक्रमहर्दश प्रशांतंगा जरिगिपोयिंदि.

राहुमहर्दशलो रावणसंहारं चेशाडु.

कुजदशलो यादवकुल क्षयमै तानू निर्याणं चेंदाडु.

श्रीराम श्रीकृष्णुल जीवितालु राजयोगजातकालैना इरुवुरि जीवनगमनं भिन्नं.

वाल्मीकिरामायणंलो प्रसक्तानु प्रसक्तंगा वाडिन ज्योतिषविषयालु

हनुमंतुडु लंकानगरंलोकि प्रदोषकालंलो प्रवेशिंचाडु.

प्रदोषकाले हनुमान् तूर्णमुत्ल्पुत्यवीर्यवान् — सुंदर. 2.50

ऎडमकालु मुंदुपॆट्टाडु — सुंदर 4.2

प्रयाणकाले च गृहप्रवेशे विवाहकालेऽपि च दक्षिणांघ्रिं
कृत्वाग्रतः शत्रुपुरप्रवेशे वामं निधद्यात्पुरतोनृपालः — बृहस्पतिवचनं शत्रुवुल पट्ट
णंलो ऎडमकालु उंचालि - अनेदि शास्त्रप्रमाणं.

अंगारकग्रहंचे पीडिंपबडिन रोहिणीनक्षत्रंवलॆ सीत राक्षसस्त्रील मध्यलो वुंदि.

ग्रहेणांगारकेणेव पीडितामिवरोहिणीम् — सुंदर. 15.22
मरॊकचोट ग्रहालमध्य वुन्न रोहिणीनक्षत्रंतो सीतनु पोल्चाडु.
ताभिः परिवृतां तत्र सग्रहामिव रोहिणीम् — सुंदर. 17.24

राहुवुमिंगिन चंद्रमंडलंवलॆ कांति विहीनंगा उंदि सीत अनि मरो रॆंडुचोट्ल चॆबुताडु वाल्मीकि.

राहुग्रस्तेंदुमंडलाम् — सुंदर. 19.15
राहुमुक्त इवोडुराट् — सुंदर. 36.5

हनुमंतुडु समुद्रान्नि दाटि तिरिगि जांबवदादुलनु चेरे संदर्भंलो नक्षत्रालप्रसक्ति वच्चिंदि.

स चंद्र कुमुदं रम्यं सार्क कारंडवं शुभमे
तिष्य श्रवणकां बमभ्र शैवालशाद्वलम्
पुनर्वसु महामीनं लोहितांग महाग्रहम्
ऐरावतमहाद्वीपं स्वातिहंस विलोलितम्
वातसंघात जातोर्मिचंद्रांशु शिशिरांबुमत्
भुजंगयक्षगंधर्वप्रबुद्धकमलोत्पलम् — सुंदर. 57. 1.3

आकाशसमुद्रंलो चंद्रुडने तॆल्लकलुव, सूर्युडने कारंडव पक्षि, पुष्यश्रवणनक्षत्रालने कलहंसलु, मेघालने पच्चिकबीळलवंटि नाचुलु, पुनर्वसु अने गॊप्पमीनं, कुजुडने पॆद्दमॊसलि, ऐराव तमने पॆद्दद्वीपं, स्वातिनक्षत्रमने हंस इला सागुतुंदि वर्णन.

रामुडु वानरसैन्यंतो युद्धानिकि वॆळ्ळडानिकि मंचि मुहूर्तं निर्णयिंचाडु. नेडु उत्तरफल्गुनी नक्षत्रंलो बयलुदेरिते मंचिदनी, रेपु हस्तानक्षत्रमनी रामुडंटाडु.

उत्तराफल्गुनी ह्यद्यश्वस्तु हस्तेन योक्ष्यते
अभिप्रायाम सुग्रीव! सर्वानीकसमावृताः — युद्ध. 4.5

नक्षत्राल प्रस्तावन

विमले च प्रकाशेते विशाखे निरुपद्रवे
नक्षत्रं परमस्माकमिक्ष्वाकूणां महात्मनाम् — युद्ध. 4.51

विशाखनक्षत्रं उपद्रवमेमी लेनिदै प्रकाशिस्तोंदि. इदि इक्ष्वाकु वंशीयुल नक्षत्रं.

नैरृतं नैरृतानां च नक्षत्रमभिपीड्यते
मूलो मूलवता स्पष्टो धूप्यते धूमकेतुना — युद्ध. 4.52

निरृति देवतगागल राक्षसनक्षत्रं, मूल-पीडिंपबडताडु. तोकचुक्क स्पृशिंचुटलो मूलनक्षत्रं तपिंपजेयबडुतोंदि. इदि राक्षसविनाशनानिकि सूचकं अनि लक्ष्मणुडु अंटाडु.

मिट्टमध्याह्नसमयंलो लक्ष्मणुनिकि नक्षत्रालु कनबडटं असंबध्धमनि आचार्य पुल्लॆल श्रीरामचंद्रुनि अभिप्रायं.

वाल्मीकंलो सामुद्रिकशास्त्र प्रस्तावनकूडा वच्चिंदि.
रामुडु चनिपोयाडने भ्रमनु रावणुडु कल्पिंचिनपुडु सीत

ऊचुर्लक्षणिका ये मां पुत्रिण्यविधवेतिच — युद्ध. 84.2

“ना हस्तरेखलु चूचिन सामुद्रिकशास्त्रवेत्तलु नाकु वैधव्यमुलेदनि चॆप्पारु” अंटुंदि.

वज्रदंष्ट्रुडु, अंगदुडु युद्धंलो रक्तसिक्तमै बुधांगारक ग्रहालवलॆ नुन्नारट.

बभूवतुः सुविक्रांतावंगारक बुधाविव — युद्ध. 54.28

ई विधंगा वाल्मीकंलो ज्योतिषप्रस्तावनलु कन्पिस्तायि. महर्षि बहुशास्त्रपांडित्यं इंदुलो विदितमवुतुंदि. त्रव्विनकॊद्दी अनेक मणुलु.

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प्राचीन भारतीय साहित्यं नवीन खगोळविज्ञानं

वि. गिरिधर् कुमार्

प्राचीनकालंनुंचि प्रपंचव्याप्तंगा महनीयुलु तमकु तॆलिसिन समाजंलो तमकालंनाटिकि उन्न जीवनविधानंकन्ना उत्तम मैन, उन्नतमैन पद्धतिनि व्यवस्थीकरिंचटानिकि आयारंगाल्लो चेसिन कृषि, त्यागालवल्लने इप्पटिकि मनमिला उंडगलिगां. ऐते प्रस्तुत प्रधानविषयं "Manuscripts Heritage on Astronomy" अनेदि काबट्टि मनपूर्वुलु खगोळं विषयंलो ऎटुवंटि अभिप्रायाल्नि व्यक्तं चेशारु, अवि यीनाटि खगोळशास्त्रविषयालतो ऎंतवरकु सानुकूल पडुतुन्नै अने विषयान्नि चॆप्पदलिचानु. इंदुकुगानु ना व्यासानिकि पॆट्टिन शीर्षिकलो मॊदट "प्राचीनभारतीयसाहित्यं" अनि वुंचानु. साहित्यं गूडा नेटि खगोळविज्ञानंलागा महासमुद्रमे. अंतेगाक ना "साहित्यंलो" शास्त्रसाहित्यंगूडा कलिसे वुंदि. अंदुवल्ल इंदुलो वैदिकवाङ्मयं, पुराणालु, इतिहासालु दर्शनाललोनि विषयालु प्रस्ताविस्तानु. संदर्भवशात्तू अप्पुडप्पुडु भूगोळविषयालु गूडा चॆबुतू असलु विषयान्नि अंदिंचदलिचानु.

"ई चराचर जगत्तु यावत्तू अणुनिर्मितं". इदी यीनाटि रसायन भौतिक खगोळशास्त्रालु निग्गुदेल्चिन सत्यं. ऐते अणुवादं यीनाटिदि कादु. प्राचीन नागरिक प्रपंचंलोनि मेधावुलु ऊहिंचिंदे. वित्तु मॊलकॆत्ति महावृक्षमै मरिन्नि गिंजल्नि प्रसादिंचटं चूचिनप्पुडो, शरीरानिकि तगिलिनगायं — चिन्नदैते कालक्रमंलो मानिपोवटमेकाक, गायंतालूकु मच्चगूडा तॊलियनिविधंगा शरीरं तयारुकावटं, लेक गायं पॆद्ददैते गायंमानिना आ गायं मच्चरूपंलो मिगिलिपोवटं — वीटिनि चूसिन अलनाटि मेधावुल्लो आलोचन रगिलि, स्थूलपदार्थालकन्ना कंटिकि कनिपिंचनि सूक्ष्मपदार्थालु वुंडिवुंडालने योचन कलिगिवुंडवच्चु. वाटिनि आनाटि मनवारु पुद्गलमनि (रूपं, मूर्तं अनेविगूडा दीनिकि पर्यायालु) कॊंदरु, पीलुवुलनि, अणुवुलनि मरिकॊंदरु पिलिचारु.

ई अणुवादं मॊदट लेवनॆत्तिंदि डेमोक्रिटस् अने ग्रीकु तात्त्विकुडंटारु पाश्चात्युलु. वारिवरकु अदि निजंकावच्चु. कानि मनविषयंलो अदि डेमोक्रिटस् कन्ना कॊन्नि शताब्दालु मुंदुदि. जैनुलु, चार्वाकुलु, आजीवकुलु, बौद्धुलु — वीरंता क्षणिकवादं चेसिन वारे. वाळ्ळु "सर्वं क्षणिकं"

अन्नारंटेने अंतकु कौन्नि शताब्दालकु पूर्वं अणुवादं सर्वांग सुंदरंगा, समर्थवंतंगा ऒक सिद्धांतंगा रूपॊंदि वुंडिवुंडालि. आधुनिक युगंलो ई अणुवादं मळ्ळी तॆरपैकि रावटंतो मन कणादुनि वैशेषिकदर्शनानिकि ऐक्कडलेनि गौरवं लभिंचिंदि. अंतकुपूर्वं विविध मतशाखलवारु तमतम मतस्थापनकोसं (मनवेदांतुल आचारं प्रकारं) चेसे विविध अन्यमत खंडनल्लो भागंगा, ई दर्शनंकूडा खंडिंपबडटानिकि पनिकॊच्चिंदि. आधुनिकयुगारंभंलो ब्रिटन् रसायनशास्त्रवेत्त जान् डाल्टन् मळ्ळी अणुवादान्नि लेवनॆत्तटं, अदि परिशोधन अने गीटुरायि मीद क्रमंगा बलपडुतू रावटंतो मनवारु वैशेषिकान्नि आकाशानि कॆत्तारु.

इंतकू मनदेशंलो मॊट्टमॊदट अणुवुल उनिकिनिगुरिंचि पेर्कॊन्नवारॆवरु? अने प्रश्नवस्ते दॊरुकुतुन्न आधाराल्निबट्टि जैनुले अनि चॆप्पक तप्पदु. ऎंदुकंटे चार्वाकुल, आजीवकुल ग्रंथालेवी दॊरकलेदु. संदर्भवशात्तु वाळ्ळनु गुरिंचि इतरमतस्थुलु चॆप्पिन दान्निबट्टि चूस्ते वाळ्ळु क्षणिकवादुलनेदि स्पष्टं. कागा, कणादुडु क्री.पू. 2व शताब्दंवाडनि चरित्रकारुल माट. क्री.पू. 6व शताब्दमनि, 9व शताब्दमनि, असलु ऋषुल कालनिर्णयं चेयटानिकि साध्यंकादनि संप्रदायं वादिस्तुंदि. कानि, विश्वासंवेरु सत्यंवेरु गदा! जैनुल्लो क्षणिकवादान्नि मॊदलॆट्टिन आश्वमित्रुडु क्री.पू. 4-3व शताब्दिवाडनि चरित्र चॆप्तोंदि. काबट्टि जैनुले मॊदट अणुवादान्नि प्रवेशपॆट्टि नवारु अन्नानु. इक अणुवुल्निगुरिंचि वारें चेप्पारो चूडालि.

पदार्थानिकि आकारं वुंटुंदि. अंदुवल्ल "अदिमूर्त". पदार्थं परमाणुरूपंलो वुंटुंदि. अणुवुलन्नी ऒकेस्वभावं, ऒके धर्मं कलिगिवुंटै. वाटिकि रंगु, रुचि, वासन, स्पर्श अनेवि 4 गुणालु. चलनं वल्ल परमाणुवुल कलयिक येर्पडुतुंदि. अंदुवल्ल वेरुवेरु नूतन गुणालु आविर्भविस्तै. ई परमाणुवुलु जीवुलदेहंलो अनुक्षणं प्रवेशिस्तू, विडिचि पोतूवुंटै. वीटिलो जीवं, चैतन्यं, अनुभूतुलु अनेवि "जीव" अने आत्मवल्ल कलुगुतायि. जैनुल आत्मगूडा सांख्य अद्वैतुल आत्मलागे शुद्धचैतन्यस्वरूपं, स्वयंप्रकाशं. अणुवुलु वाटंतट अवे संयोग वियोगालकु लोनवुतायि. परिणमिस्तायि. इवि स्वयंसिद्धालु. आद्यंतालु लेकुंडा प्रपंचं कालाकाशालल्लो धर्मा धर्मसूत्राल सहायंतो (जैनुल धर्माधर्मालु वेदांतुलुचॆप्पे धर्माधर्माल वंटिविकावु) "वर्तिस्तुंटुंदि" अन्नारु.

पैन चॆप्पिन विषयाल्लो आधुनिक शास्त्राल प्रकारं अणुवुलन्नी ऒके स्वभावं, धर्मं कलिगिलेवु, रंगु, रुचि, वासन, स्पर्श अने गुणालु कलिगिलेवु. वीटिकि जीवं चैतन्यं अनुभूतुलनेवि वुंडटानिकि मरोदानिसायं अवसरंलेदु. ऎंदुकंटे ई भूमिपै जीवं एर्पडक मुंदुनुंची अणुवुलुन्नै. मनउनिकि वीटि अनुग्रहमे. जैनुलु चॆप्पिन तक्किन विषयालु सरैनवे.

इक अणुवुलु अंटेने मनकु चप्पुन गुर्तुकु वच्चेवैशेषिकं एमंदो चूद्दां. निप्पु, नीरु, गालि, भूमि अने चतुर्भूतालु परमाणु रूपंलो वुंटायि. परमाणुवुले शाश्वतं. दानिलो भागालु लेवु.

सूर्यरश्मिलो कंटिकगुपिंचेकणंलो परमाणुवु आरववंतु वुंटुंदि. प्रति परमाणुवुकू एदोऑक प्रत्येकत वुंटुंदि. ऐते यी परमाणुवुलु तमंत तामुगा ए कार्यान्नि पुट्टिंचलेवु. अंदुकु अदृष्टमनेदि कारणमौतुंदि. प्रळयकालंलो 4 भूतालू परमाणु वुलदाक विडिपोतायि. ई विधंगा वैशेषिकुलु अणुवुलु आत्मलु इंका इतर अंशालु अन्नीगूडा (प्रतीदि) वेरुवेरु विशेषत्वं कलिगिवुंटा यनि चेप्पटंचेत यी दर्मनानिकि वैशेषिकमवे पेरु वच्चिंदि. वैशेषिकुलु-परमाणुवुलु शाश्वतं अनटं निजमेगानि अवि छेदिंचटा निकि कुदरदु अनटंतप्पनिनेटि प्रयोगालु ऋजुवुचेशायि. अलागे अणुवुलु स्वयंगा ये कार्यान्नी निर्वहिंचलेवु अनेदिगूडा तप्पे. महा प्रळयकालंलो चतुर्भूतालु परमाणुवुलदाका विडिपोतायि अनेदि कोंतवरकु ऒप्पुकोवच्चु. ऎंदुकंटे आधुनिकशास्त्राल प्रकारं प्रळयकालंलो अणुवुलु निजानिकि स्वस्वरूपाल्लोगूडा वुंडवट. ऐलक्ट्रान्लु, प्रोटान्लु, न्यूट्रान्लुगूडा पूर्तिगाविडिपोतायट. इक इक्कड चेप्पवलसिन मरो विशेषविषयमेमंटे यी समस्तविश्वं एर्पड टानिकि असलुकारणं वैशेषिकुलु चेप्पिन चतुर्भूतालु, वैदिकुलु चेप्पे पंचभूतालु, सांख्युलूहिंचिन 25 मूलतत्त्वालु, योग शास्त्रं चेप्पे 26 मूलतत्त्वालू कादु. असलु प्रकृतिलो मोत्तं भूताल संख्य (मूलकालसंख्य) तोंभैरेंडु. (हैड्रोजन् नुंडि युरेनियं दाका). ई तोंभैरेंडु भूतालु एवो कोन्नि निष्पत्तुल्लो कलवटंवल्ल यी समस्तप्रपंचं (विश्वमंता) एर्पडिंदि. अविगाक मरिकोन्निंटिनि (युरेनियं तर्वात अनगा 93 नुंडि 106व मूलकं दाका — इंका ऐक्कुवे नंटुन्नारु) शास्त्रवेत्तलु कृत्रिमंगा प्रयोग शालल्लो राबट्ट् गलिगारु. कागा अणुवुलु वेटिकवि प्रत्येकस्वरूप स्वभावालु कलिगि वुंटवनि वैशेषिकं चेप्पटं अद्भुतविषयं.

काबट्टि अणुवुलविषयंलो मनपूर्वुलु कोन्नि पोरपाटु वूहलुचेसिना आ नाटिकि प्रपंचकारणानिकि मूलं अणुवुलनि वूहिं चटमे गोप्पगा भाविंचालि. खगोळ विषयानिकि वेळ्ळबोये मुंदु असलु सृष्टिकि मूलकारणं अणुवुलनि आधुनिकयुगंलो परिशोधनलु चेपुतुंडटंवल्ल वाटि विषयंलो मनवारि वादालेंटो ऐंतोकोंत चेप्पक तप्पलेदु. समस्तप्रपंचं अणुवुलवल्ल एर्पडिंदनि तेलुसु कुन्नांगदा ! मनंनिवसिंचे यी भूमिगूडा अलांटिदेननि मन वैशेषिकुलु ऐप्पुडो ग्रहिंचारु. अटुवंटि मनभूमिकि सुदूरंगा आकाशंलो ऐन्नोग्रहालु, नक्षत्रालु निरंतरं चलिस्तुन्नै. वीटि नि गुरिंचि मनपूर्वुलु एं चेप्पारो तेलुसुकुंदां.

प्रपंचंलोने तोलिवाङ्मयं "ऋग्वेदं" अनि अंदरिकी तेलिसिंदे. अटुवंटि ऋग्वेदंलो 1व मंडलं, 35व सूक्तं, 6व मंत्रंलोनि द्वितीयार्थं इला उंदि. ". . . . आणिं नरथ्यममृताधि तस्थुरिहब्रवीतुय उतच्चिकेतत्" ताः — ". . . . शीलपै आधारपडि रथचक्रं निल्चिनट्ले नक्षत्रादुलु सूर्युनिपै आधारपडि वुन्नायि.

"चंद्रुनिलोनि कांति सूर्युनिवल्लने कलुगुतुन्नदि" — "अत्राह गोरमन्वत नामत्वष्टुरपीच्यं। इत्थाचंद्रमसोगृहे" (ऋ.1.84.15). आनाटि ऋषुलकु (12 मासालतोपाटु) अधिकमासालनु

गुरिंचि तॆलुसु. "वेदमासो धृतव्रतो द्वादश प्रजावतः। वेदाय उपजायते" वारिकि नक्षत्राल्नि गुरिंचि तॆलुसु (ऋ.1.25.8), (ऋ.10.85.13) विषुवत्तुलु, अयनालनु गुरिंचि चक्कनि विज्ञानान्ने साधिंचारु. सप्तर्षि मंडलं, धृवनक्षत्रान्नि गुरिंची चॆप्पारु. इंत परिज्ञानं वैदिक वाङ्मयंलो उन्नदि अंटे नाटिवारि परिशीलन परिशोधनलु ऎंतटिवो अर्थंचेसु कोवच्चु.

मरि यिंत परिज्ञानान्नि अंत प्राचीनकालंलोने साधिंचिन वैदिकार्युल तर्वात, भौतिकशास्त्रालपट्ल वारि वारसुलकु अंत आसक्तिलेक पोयिंदि. इंदुकु एवैना अवरोधालु कलिगि वुंडवच्चु. नेनु कॊन्नि कारणालनु वूहिस्तुन्नानु.

1. आनाडु प्रतिविद्या ऒकरहस्य विषयं. अंदुवल्ल अदि ये कॊद्दिमंदिको मात्रमे तॊलिसे अवकाशं वुंडटं.
2. गणितं, खगोळं, रसायनादि शास्त्रालु ऎंतो ओपिकतो नेर्चु कोवलसिन विद्यलु कावट . शास्त्राललो कॊन्नि संदर्भाल्लो तप्पनि सरैन जटिलत्वान्नि अर्थंचेसुकॊने ओपिक येकॊद्दिमंदिको वुंडटं.
3. उपनिषत्तुल आत्मज्ञानंवैपु अधिक संख्याकुलु मॊग्गटं.

पै वाटितोपाटु समाजंलो उन्नतवर्गाल स्वार्थपरत्वंकूडा भौतिकशास्त्राल पुरोभिवृद्धिनि आटंकपरचिवुंडवच्चु. ईजिफ्टुलो नूति गट्टुपैन नीळ्ळुतोडुकोवटंलोनि कष्टान्नि गुर्तिंचिन ऒक सामान्युडु तन मेधनुपयोगिंचि गिलक (नीळ्ळु तोडुकुने साधनं)नि तयारु चेस्ते, दान्नि अप्पटि फारो(ईजिफ्टु चक्रवर्ति) ध्वंसं चेयिंचि, आ तयारुचेसिन व्यक्तिकि शिरच्छेदं चेयिंचाडट . ग्रहगतुल्नि जाग्रत्तगा परिशीलिंचि अनेकवंदल संवत्सराल अनुभवंतो तॊलुसुकॊन्न सूर्य चंद्र ग्रहणालनु मानवातीतशक्तितो तॊलुसुकुन्नट्लुगा सामान्युल्नि विभ्रांतुल्निचेसे प्रक्रिय प्राचीननागरिक प्रपंचंलो अंतटा जरिगिंदे. दीनिकि तोडु इंद्रजालादि विद्यल्निकूडा सामान्युल्नि गुप्पॆट्लो पॆट्टु कोवटानिकि उपयोगिंचारु. काबट्टि वर्गस्वार्थंवल्ल शास्त्रपरिशोधनलु वॆनकबडि वुंडवच्चुननि वूहिंचटंलो तप्पेमीलेदु.

इंते काकुंडा मनदेशंलोनि मरिकॊन्नि संघटनलुकूडा इंदुकु सहकरिंचि वुंडवच्चु. राम रावणसंग्रामंवल्ल लोकं संक्षुभितमैपोयिन दाखलालु लेवु गानि, कुरुक्षेत्रसंग्रामंवल्ल आर्यावर्तं दारुणंगा (सामाजिकं गानु, नैतिकंगानु) दॆब्बतिन्नदनि अंदरू चॆप्पेदे. कृष्णुनि मरणानंतरं युगधर्ममे मारि पोयिंदनि (कलियुगं प्रवेशिंचिंदनि) अन्नारु. कानि, दुर्योधनुडु कलि अंशतो जन्मिंचाडने विषयान्निमात्रं स्मरिंचरु. (अंटे कुरुक्षेत्रसंग्रामं कलियुगंलोने जरिगिंदनि सारांशं) ऒक्क कुरुपांडवुल रणंतोने अल्लाडुतुन्न आर्यावर्तान्नि पुंडुमीद कारं चल्लिनट्लु अचिरकालंलोने जरिगिन यादवकलहं (कुरुक्षेत्रसंग्रामं तरुवात 36 संवत्सरालकु जरिगिंदनि वुंदिकानि अदिनम्मदगिंदिगा

लेदु) मरिंत कुंगदीसिंदि — भौतिकंगानु मानसिकंगानु. कृष्णुडु यादवुल्नि प्रभासतीर्थानिकि पंपिंचाक उद्धवुनितो माट्लाडुतू इंक वारंरोजुलकु जलप्रळयंलो द्वारक मुनिगिपोतुंदनि अन्नाडु. दीन्निबट्टि नाटिवारिकि भूकंपालु ऐप्पुडुवच्चेदी, दानिद्वारा ऒक्कोक्कप्पुडु कलिगे जलप्रळयालनु गुरिंची, अवि एएप्रांतालनु मुंपुकु गुरि चेसेदिगूडा तॆलुसुकॊने विशेषपरिज्ञानं वुंदनि अर्थमौतुंदि. इदि गॊप्प विषयमे. रावण संग्राममंवल्ल लोकसंक्षोभं कलिगिनट्लु दाखलालु लेवु. कानी, कुरुक्षेत्ररणं आर्यावर्तंलो विपरीतमैन अराचकं तॆच्चिपॆट्टिंदि. अंते कादु, अदि यादव कलहमने मरो उपद्रवानिकि कारणमय्यिंदि.

इंतकू यादवकलहानिकि असलु कारणमेंटि? कुरुक्षेत्रंलो जरिगिन युद्धंलोनि अक्रमालप्रसक्ति. अदिगूडा तागिनमत्तुलो. विचक्षण कोल्पोयिन मानवुलु ऐला प्रवर्तिंचगलरो यादवकलहंद्वारा अर्थं चेसुकुन्न आर्यसमाजंलोनि पॆद्दलु भौतिकशास्त्रालद्वारा अभिवृद्धि चेयबडे आयुधालु अटुवंटि वारिचेतुल्लो पडिते ऐलांटि परिस्थिति यी पृथिविकि वाटिल्लुतुंदोननि भयपड्डारु. इंदुकु मळ्ळी तिरुगुलेनि उदाहरणगा अश्वत्थामे निलुस्ताडु. इतनिकि ब्रह्मशिरोनामकास्त्रान्नि प्रयोगिंचटं तॆलुसुगानि उपसंहरिंचटं तॆलियदु. ऐनासरे अपांडवं चेय्यालने आवेशंलो ब्रह्मशिरान्नि अर्जुनुडिपै प्रयोगिंचाडु. आ अस्त्रंवल्ल कलगबोये संक्षोभान्नि निवारिंचटानिकि व्यास वासुदेवुलकु तलप्राणं तोक्कॊच्चिंदि. पुराणाललो इटुवंटि चोट्ल मानवातीतशक्तुल माहात्म्याल्नि पक्कनबॆट्टि कॊंचॆं जाग्रत्तगा आलोचिस्ते तेले सत्यमिदे. अंदुवल्ल —

इक अप्पटिनुंचि भौतिकशास्त्रालपट्ल "विमुखतपैकि प्रकटिंचटं" मॊदलयिंदि. कानी लोलोपल कॊनसागुतूने वुंदि-अति गोप्यंगा. जिज्ञासुवुलैन ऋषुलु (वीरु नेटि सैंटिस्टुल लांटिवारु कारु, सैंटि स्टुले) तामु तॆलुसुकॊन्न विषयालन्नी पुराणाललो अक्कडक्कडा अति मानुषविषयालुगा कथलरूपंलो निक्षिप्तं चेसेटट्लुगा तम अनुयायुल्नि सिद्धंचेशारु. आ विधंगा भौतिकविषयालु समस्तं आध्यात्मिकरूपान्नि संतरिंचुकुन्नै. आधुनिक शास्त्रालनु सक्रमंगा अध्ययनंचेसिनवारिकि यी विषयं तप्पक अर्थं अवुतुंदि. अदेंटो यिप्पुडु चूद्दां.

हैड्रोजन् नुंचि युरेनियंदाका उन्न मूलकालु (ऐलिमॆंट्स्) वरुसगा ऒकदानिकन्ना ऒकटि अणुभाराधिक्यत कलिगिवुंटै. ऐते ऒक वस्तुवुयॊक्कभारं अधिकाधिकंगा पॆरिगिपोवटानिकि कारणं अणुवुल सांद्रत अंटुंदि नवीनशास्त्रं. उदाहरणकु "सिरियस् बि" अने नक्षत्रंलोनुंचि ऐवरैना ऒकग्लासुडु पदार्थान्नि तीसुकॊनितूस्ते अदि 12 टन्नुल बरुवुंटुंदि (मनभूमिमीदने ऒकग्लासुडु नीळ्ळकु ऒक ग्लासुडु पादरसानिकिमध्य बरुवुलोभेदान्नि मनं गुर्तिस्तुन्नां) अलागे अणुवुल्नि तीसुकॊनि अधिकंगा नॊक्किवेसि ऒकमुद्दलागा चेसिनट्लैते(?) अंदुलोनि ऒक सॆंटीमीट रुपदार्थं ऒक कोटिटन्नुल बरुवु तूगुतुंदि. ई विषयं मनप्राचीनुलकु तॆलुसु. तामु तॆलुसुकॊन्न

आ विषयान्नि सामान्युलबुर्रल्लोकि आध्यात्मिकपरमैन चिंतनगा दट्टिंचटानिकि ऒककथनु अल्लारु. “गरुत्मंतुनि गर्वभंगं” अनि दानिकिपेरु. इदि महाभारतंलोदि. ऒकप्पुडु गरुत्मंतुडु विष्णु मूर्ति अंतटिवानिकि वाहनमय्यानुगदा! अनि पॊंगिपोवटमे काकुंडा, नेनु मोयकपोते विष्णुवुकु क्षणालव्यवधिलो यी चतुर्दश भुवनालनु चुट्टिरागलिगिन भाग्यं कलिगेदा!, अनि अहंकरिंचाडट. विषयं तॆलुसु कॊन्न विष्णुवु “मॊत्तं ना शरीरान्नि भरिंचनक्करलेदु नायना! ऒक्कचेतिनि मोयगलिगिते चालु” अनि तन कुडिचेतिनि अतनि मूपु (मॆड) मीदपॆट ्टाडट. अंते, अंतकालं विष्णुवु पूर्तिदेहान्नि अवलीलगा मोसुकॆळ्ळगलिगिन गरुडुडु इप्पुडु आ ऒक्कचेतिभारानिकि मुल्लोकालू मीदपड्डट्टुगा गिलगिललाडिपोयाडट. तर्वात विष्णुवुनु वेडुकोवटं, आयन क्षमिंचि वैनतेयुण्णि ऒदिलेयटंतो कथमुगुस्तुंदि. इलांटिदे मरॊक सुप्रसिद्धमैन कथ भागवतं चॆप्पिंदि. अदे-बालकृष्णुडु गोवर्थन पर्वतान्नि चिटिकॆनवेलुपैन निल्पि गोपालकुल्नि कापाडाडु अनेगाध.

पै रॆंडुकथलू भगवंतुनि लीलगा कॊंदरु विश्वसिस्ते, पुक्किटि पुराणमनि कॊंदरु निश्वसिस्तारु. कानि, असलुविषयं-कृष्णुडु अणुवु लसांद्रतनु अवसरमैते तलुचुकुन्नप्पुडु साधिंचे प्रक्रियनु तॆलिसिनवाडै वुंडवच्चु. लेदा, आ विषयं ऋषुलुगा पिलवबडु तुन्न नाटि मनशास्त्रवेत्तलु तॆलुसुकॊनि वुंडवच्चु. पर्वतान्नि पैकॆत्तिन संघटन यी भूमिपैन जरिगिना जरक्कपोयिना आ कालानिके वारु अणुसांद्रतलोनि विशेषान्नि ग्रहिंचारनेदि मात्रं निजं.

ई भूमिपैन विविधरकाल प्राणुलु, चॆट्लु, चेमलु, राळ्ळु रप्पलु एर्पडटानिकि कारणं अणुवुल पेर्पु अंटुंदि नेटिसैन्सु. अनगा-आया वृक्षालु, तीगलु, जंतुवुलु, मानवुलु अंता ऒक क्रम पद्धतिलो जरिगे ई अणुवुलपेर्पुवल्लने आया आकृतुल्नि पॊंदगलगटं जरिगिंदि. अंतेकाकुंडा अवि जीवुल शरीरंलो पुनरुत्पत्तिकि तग्ग विधंगा (एदो ऒकरूपंलो) निक्षिप्तमै वुन्नै. अंदुवल्लने मनभूमि पैन वुन्न चराचरप्राणिकोटि अंता तमतमजातिनि अभिवृद्धि चेसुको गलुगुतुन्नै. ऐते अणुवुनि कंटितो चूडटानिके ऎंतो अवस्थपडिन मेधावुलकु वाटिनि ऒकक्रमपद्धतिलो अमर्चेसामर्थ्यं प्रस्तुतं साध्यमय्येदिगा लेदु. कानि यिदि साध्यपडेविषयंगाने मन संप्रदायं चॆप्तुन्नदि. सुप्रसिद्धमैन त्रिशंकुनिगाध रामायणं (बालकांड)लो वुंदि. अतनि कोसं इंद्रुण्णि धिक्करिंचि मरो कॊत्त स्वर्गान्नि विश्वामित्रमहर्षि सृष्टिं-चाडु. अदि ऐलासाध्यं? अणुवुल्नि तन अभीष्टानिकि अनुगुणंगा (स्व इच्छगा-इक्कड संधि कूडदु) पेर्चगलिगिन नेर्पुनु अतडु साधिंचाडु काबट्टे. अतडंटाडु — “ना तपः प्रभावंचूडु”अनि. गिट्टनिवाळ्ळु कौशिकुण्णि “श्वामित्रुडनि” अंटारुगानि, लोतुगा आलोचिस्ते अतिप्राचीन कालंलो मनदेशंलो पुट्टिन गॊप्प संघसंस्कर्त (शुनश्शेफुण्णि प्राणापायस्थिति नुंडि रक्षिंचाडु), गायत्रीमंत्र प्रवर्तकुडु, ऒक गॊप्प शास्त्रवेत्त विश्वामित्रुडनेदि निर्विवादांशं.

इक मनवारि समस्त खगोळशास्त्र परिज्ञानानिकि मूलकारणमैन, अतिकीलकमैन विषयं कालगति (कालं विविध प्रदेशाल्लो प्रवर्तिंचे तीरु) नि गुरिंचिन विज्ञानं. ई परिज्ञानान्नि आधुनिकयुगंलो (20व शताब्दं प्रारंभंलो) पाश्चात्य भौतिक खगोळशास्त्रवेत्तलकु अंदिंचिंदि ऐन्स्टयिन्. विश्वरहस्याल परिशोधनकु, भौतिकशास्त्रविवरणकु कालान्नि गूडा परिगणनलोकि तीसुकोवालनि ईयन प्रतिपादिंचाडु. अंतकु पूर्वं शास्त्रवेत्तलु पॊडवु, वॆडल्पु, ऎत्तु अने मूडुकोलतल आधारंगाने विश्वान्निगुरिंचि तॆलुसुकोव- टानिकि यत्निंचेवारु. कानि ऐन्स्टयिन् 4व कॊलतगा कालान्निगूडा स्वीकरिंचकतप्पदनि चॆप्पाडु. ईयन खगोळशास्त्रवेत्त काकपोयिना तन गणितं आधारंगा भौतिकनिय मालनु विवरिंचटानिकि यत्निंचाडु. अवि अनुकोनिविधंगा अनंत विश्वान्निताकायि.

रॆंडु बिंदुवुल मध्यनुन्न दूरान्नि स्थलं अनि ऐला अंटारो, अलागे रॆंडु संघटनलमध्य व्यवधिनि कालं (time) अंटारु. "संघटन" अनेदि मूडु कॊलतलुन्न प्रपंचंलो (पॊडवु, वॆडल्पु, लोतु लेदा ऎत्तु लेदा मंदं) एदो जरगटं औतुंदि. इक्कड "जरगटं" अनेदानिकि उन्न रॆंडु अर्थालनू स्वीकरिंचालि. संघटन जरगटं- (गडिचिपोवटं)अनेदि ऒकटैते, जरगटं = कदलटं लेक चलिंचटं अनेदि रॆंडोदि. संघटन 3 कॊलतलुन्न स्थलंलोनेकाक, नाल्गव कॊलतऐन कालंलोकूडा जरुगुतुंदि. अंतेकाक स्थलकालालु (space and time) अविभाज्यालु. ई विषयालु 20व शताब्दि प्रारंभंनाटि कि मेधाविप्रपंचानिकंता तॆलुसुगानि, विश्वरहस्यंछेदिंचटानिकि कालान्नि 4व कॊलतगा तप्पक स्वीकरिंचालनेदि पाश्चात्यवैज्ञानिकप्रपंचानिकि तॆलियदु. ऐन्स्टयिन् चेसिंदल्ला "कालं" यॊक्क "विलुव" एंटो वारिकि तॆलियजॆप्पटमे. ऐते, इदि मनवारिकि चाला शताब्दालकु पूर्वमे तॆलुसु. (अमरकोशादि निघंटुवुल्लोकिकूडा ई विषयं ऎक्किंदि). दादापु अन्निपुराणाल्लोनु सृष्टिक्रमान्नि गुरिंचि चॆप्पेटप्पुडु यी विषयान्नि चॆप्पटं जरुगुतूने वच्चिंदि.

दीनिकि मुंदु कालगणन कालविभजन गुरिंचि कॊंचॆं-काल विभजन अनेदि कालगणनलोनि भागमे. मनवाळ्ळु 18 निमुषालकालान्नि 1 काष्ठ, 30 काष्ठलु 1 कळ, 30 कललु 1 क्षणं, 12 क्षणालु 1 मुहूर्तं, 30 मुहूर्तालु 1 अहोरात्रं (= 1 रोजु), 15 अहोरात्रालु ऒक पक्षं (15 रोजुलु) (अप्पटिकि 7 रोजुलु 1 वारं अनेविभागं रालेदु) अटु वंटि 2 पक्षालु 1 मासं, इत्यादिगा कालगणनचेशारु. दीन्नि वॆनक्कु चदिविते कालविभजनवस्तुंदि.

इक-प्रपंचसाहित्यंलोने कालगतिनिगूर्चि चॆप्पिंदि मन पुराणाले. तक्किन अनेक भौतिकशास्त्रविषयाल्नि मानवातीत विषयालु गा-कथल रूपंलो-सामान्युलकु एमात्रं बोधपडनि विधंगा निक्षिप्तं चेसिन वारु, कालगतिनिमात्रं इंतबाहाटंगा विवरिंचटं आश्चर्यं. अंते काकुंडा आ कालगतिनि ऒककथगागूडा कूर्चारु. आ कथ इदि.

रेवतुडने ऒक मनुवुन्नाडु (मनुवु आटोमेटिग्गा राजु गूडा औताडु, ऋग्वेदंलो 5.45.6, 5.21.16, 9.91.5 मंत्रालप्रकारं मनुवु विशिशिप्रुण्णि, दासुल्नि, दस्युल्नि जयिंचिन राजेकादु, आर्युल तॊलिराजुगा कनिपिस्तुन्नाडु). अतनिकि रेवति अने ऒक कूतुरुंदि. आमॆ युक्तवयस्कुरालु कागाने अप्पटि आर्यावर्तंलोवुन्न राजुल्लो ऎवरिको ऒकरिकिच्चि चेद्दामनुकुन्नाडु. कानि ऎंदुवल्लनो आ राजुलु, राज कुमारुलु ऎव्वरू तन कुमार्तॆयॊक्क रूपगुणवयोलावण्यालकु तगिनवारुकारनि तोचिंदि. अंदुवल्ल अंदरितलरातलु रासे ब्रह्मदेवुण्णे सलहा अडुगुदामनि कूतुर्निगूडा वॆंटबॆट्टुकॊनि वॆळ्ळाडु. ब्रह्म तनदग्गरकु वच्चिनकारणमडिगाडु. रेवतुडु असलु विषयंचॆप्पि, तन कुमार्तॆनु यिप्पुडु भूलोकंलो वुन्न ये राजुकिच्चि चेयमंटा वनि अडिगाडु. अंदुकु ब्रह्मनव्वि रेवता! इप्पुडु नुव्वुचॆप्पिन वारंता ऎप्पुडो गतिंचारु. वारेकादु, वारिमुनिमनुमलु, वारि मुनिमनुमलु इला ऎन्नोतरालु इप्पटिकि गडिचिपोयायि. कारणं इप्पुडु नुव्वुन्नदि नालोकंलो. इक्कड कालं इलागे नडुस्तुंदि. नुव्वु तिरिगि भूलोकानिकि वॆळ्ळे टप्पटिकि अक्कड 27व महायुगंलो द्वापरं नडुस्तू वुंटुंदि. अक्कड द्वारकलो बलरामकृष्णुलनि वुंटारु. वाळ्ळलो पॆद्दवाडैन बलरामुडिकि नीकुमार्तॆनु भार्यगाचेय् अन्नाडु. विधातमाटलकु आश्चर्यपोयिन रेवतुडु "अट्लैते तिरिगिवॆळ्ळे समयानिकि नाकूतुरु कडुवृद्ध औतुंदिकदा! अन्नाडु. अंदुकु ब्रह्म अलांटिदें जरगदनि अभयमिच्चि पंपाडु. दांतो रेवतुडु संतोषंगा भूमिकिवच्चि रेवतिनि बलरामुनिकिच्चि विवाहं चेशाडु".

पै कथ देवीभागवतं, 7व स्कंधं, 8व अध्यायान्ननुसरिंचि चॆप्पिंदि. ई कथलो प्रस्तुतं मनकु मुख्यविषयं कालप्रवर्तनलोनि वैचित्रि. दान्नि नेनु "कालगति" अन्नानु. आधुनिकशास्त्रालु यीविषयंलो ए मंटायि? अंटे –

अनंतविश्वंलो अत्यंतदूराल्लोवुन्न ग्रहनक्षत्रादुल स्थानाल्नि गुर्तिंचटानिकि भूमिमीद चॆप्पुकुने हॆक्टार्लु, किलोमीटर्लु, वंदलवेल मैळ्ळलांटि कॊलमानालतो चॆप्पटं साध्यंकादु. वाटिनि कांति वेगंतो कॊलवालि. कांति ऒकसॆकनुकु 1,86,282 मैळ्ळवेगंतो प्रयाणं चेस्तुंदि. आ विधंगा अदि ऒकसंवत्सरकालानिकि ऎंतदूरं प्रयाणं चेयगलदो दान्नि कांतिसंवत्सरं अंटुंदि सैन्स्. (कांति 1 संवत्स- रानिकि 6लक्षलकोट्ल मैळ्ळदूरं प्रयाणं चेस्तुंदि).

एदैना ऒकवस्तुवु कांतिवेगंतो प्रयाणं चेस्ते आ वस्तुवु कंटिकि कनिपिंचदु. आ वस्तुवु सॆकंडुकु 1,67,000 मैळ्श (सुमारु कांतिवेगंलो 90शातं) वेगंतो प्रयाणंचेस्ते अदि सगानिकि कुंचिं चुकुपोतुंदि. अदे ऒकव्यक्ति आ वेगंतो प्रयाणंचेसिनट्लैते अतनि वयस्सु ऒकसंवत्सरानिकि 6नॆललकालमे गडुस्तुंदि. ऒकवेळ अतडु कांतिवेगंतोने प्रयाणंचेसेपक्षंलो अतनिकि असलु वयस्से मीद पडदु. अनगा कालं स्तंभिंचिपोतुंदनि अर्थं. गिजापिरमिड्लांटि

यी नेलमीदि भारीकट्टडालवद्द कालं गंटकु 20 निमुषालचोप्पुन (तेडातो) नॆम्मदिगा सागुतुंदनि सैंटिस्टुलन्नारु. ऐनप्पुडु मनभूमिनुंडि कोटानुकोट्लमैळ्ळदूराल्लोवुन्न नक्षत्रालु, गॆलाक्सीलवद्द कालं स्तंभिंचटमेकादु, ई भूमिमीद नडिचिनट्टुगा कालं भूतकालंनुंचि भविष्यत्तुलोकि प्रवहिंचदु, भविष्यत्तुनुंचि भूतंलोकि नडुस्तुंदि. अंटे कालं वॆनक्कुनडुस्तुंदि. ऎवरैना ऒकव्यक्ति कांतिवेगंतोगानि, अंतकुमिंचिन वेगंतोगानि प्रयाणिस्तू (निजानिकि आ व्यक्ति निरंतरं आ वेगालतो प्रयाणंचेयवलसिन पनिलेदु. अला प्रयाणिंच गलिगिन शक्तिवुन्नवाडैते चालु) अनंतविश्वंलोकि चूडगलिगिते अतनिकि भविष्यत्तु स्पष्टंगा गोचरिस्तुंदि. भविष्यत्तुलोनुंचि भूतकालंलोकि चूडगलु गुताडु. दीनि सारांशं — आ व्यक्ति भूतकालंलो जरिगिन प्राणुल, पदार्थाल संघटनलतालूकु भविष्यत्तुनु निर्णयिंचे कर्त (=विधात) औताडु. उदाहरणकु — ऒकव्यक्ति कारुप्रमादंलो मरणिंचाडनु कुंदां. इप्पुडतन्नि तिरिगि ब्रतिकिंचटमा लेक अलागे ऒदिलेयटमा अनेदि कालंतो पोटीपडि प्रयाणंचेयगलिगिन व्यक्तियॊक्क इच्छनुबट्टि वुंटुंदि. अतनु संकल्पिस्ते आ व्यक्तिनि ब्रतिकिंचगलडु. इंत विषयान्नि पैनचॆप्पिन कथलो पुराणकर्त क्लुप्तीकरिंचाडु. अंत प्राचीन कालंलो ई कालगतिनि गुर्तिंचगलगडं अत्यद्भुतविषयं. लेकपोते आ पुराणकर्त आ कथनु आ विधंगा चॆप्पडु. अंतेकादु, कालस्वभावं बोधपड्डाक इक भौतिकशास्त्रं ई देशंलो अतिवेगंगा अभिवृद्धिचॆंदि वुंडालि. कानि, अला जरगलेदु. भौतिकांशालन्नी आध्यात्मिक रूपान्नि संतरिंचुकॊन्नै. अंदुकु कारणालु अनूह्यमेंकादु. अवेंटो तॆलुसुकोबोये मुंदु मनवारु आत्मज्ञानसंपादनलो भागंगा चॆप्पे "अंतरीक्षणनु" गुरिंचि कॊंत चॆप्पवलसिंदि वुंदि.

अंतरीक्षण (व्यक्ति तनलोपलिकि चूडगलगडं) अनेदि अबद्धं कादु. कानि, अदि अतिप्राचीन भौतिकांशं. शरीरधर्मालनु गुरिंचि शास्त्र वेत्तलु परिशोधनलु चेस्तुन्नप्पुडु ऒक विंतविषयं कनुगॊन्नारु. वॆन्नॆमुकगलिगिन जीवुल्लो मॊदट मॆदडु चूसेदि. अप्पट्लो वाटिशरीरं पारदर्शकंगा वुंडेदि. अंटे अद्दंलागानु, कॊंत पॆळुसुगानु वुंडेदि. कालक्रमंलो वाटिशरीरं पारदर्शकंगा वुंडडं मानेसिंदि. अप्पुडु कांतिनिगुर्तिंचे कणालसमूहपु मुद्दलकि मॆदडुनु ऒदिलेसि बयटकु रावलसिन अवसरं एर्पडिंदि. अप्पटि-नुंडि सकशेरुकालैन अन्निप्राणुलकळ्ळू अदेपनि चेस्तुन्नै. ऒक निर्दिष्टदशलो दानि मॆदडु यॊक्क रॆंडुमुक्कलु विडिवडि क्रमंगा कळ्ळुगा रूपॊंदायि. आ विधंगा मॆदडुलोनुंडि बयटपड्ड रॆंडुमुक्कले मन ई कळ्ळु.

वेदकालंनाटिकि वॆन्नॆमुकप्राणुल्लो ऒकटैन मानवजातिकि शरीरं पारदर्शकंगा वुंडटं असंभवं. ऐते तरंनुंचि तरानिकि तमकु तॆलिसिन प्राचीन विषयाल्नि अंदिंचटं मानवजातिकुन्न अलवाटु. कानि, वेदर्षुलकालंलो कनिपिंचनि "अंतरीक्षण", उपनिषत्तुल कालंनाटिकि वॆलुगुलोकि वच्चिंदि. दीन्नि चरित्रलो मरुगुन पडिपोयिन विषयान्नि उपनिषत्कारुलु वॆलिकितीसिन अंशंगा भाविंचवच्चु. गतंलोवुंडि, लयिंचिन घट्टालनु प्रकृति येदो ऒकरूपंलो मनकु अंदिंचटानिकि

चूस्तुंदि. उदाहरणकु डैनोसार्लनु गुरिंचि मनकु यी आधुनिक युगंलोने तॆलिसिवच्चिंदि. वीटि निगुरिंचि प्रपंच प्राचीनसाहित्यंलो येमी कनिपिंचदु. गंडभेरुंडपक्षुलवंटि कॊन्निंटिनि गुरिंचि अन्नि मानवसमाजालू यॆंतोकॊंत चॆप्पिवुंडवच्चु. अदिगूडा अद्भुत गाधल्लो भागंगाने. कानी, पूर्तिविषयान्नि मनकंदिंचिंदि मात्रं प्रकृते. अदि, फासिल्सुरूपंलो वाटिअस्थुल्नि तनगर्भंलो वुंचि सुदीर्घ कालं तर्वात मनकंदिंचिंदि. काबट्टि वेदालकु पूर्वयुगंगूडा सुदीर्घंगा वुंदनि अंगीकरिंचक तप्पदु. अलागे यी "अंतरीक्षण" अनेदि ध्यानमने साधनंतो (बहुशा यिंदुलो योगशास्त्र प्रमेयं गूडा वुंडवच्चु) तॆलुसुकुन्नारु. मॊन्नमॊन्नटि वेमनगूडा "तोलु कडुपुलोन दॊड्डवाडुंडगा, वॆरुचोट वानिवॆदुकनेल?" अनि वूरके अनलेदु. काबट्टि शरीरं पारदर्शकंगा वुन्नकालंलो मानवुलु शरीरं लोपलि नेत्रंद्वारा समस्तविषयालनू दर्शिंचिवुंटारु. अंदुलो वारु अणुवुल्नि स्पष्टंगा चूसिवुंटारु. विश्वरहस्यालनु खच्चितंगा यीनाटि वारिकन्ना गॊप्पगा अवगाहन चेसुकॊनि वुंटारनटंलो संदेहंलेदु. अयिते क्रमंगा कालंतोपाटु वच्चिनमार्पुलकु मनंकूडा गुरि अय्यां. अंदुवल्लने मनसंप्रदायं वेदविद्यनु गुरिंचि चॆबुतू 'तॊलुत वेदाल्नि कंठगतं चेसुकोगलिगारु. रानुरानु मानवुलु दुर्बलुलय्यारु. फलितंगा मॊदट वेदविभजन, तर्वात लिखित पूर्वकंगानू वाटिनि तॆलुसुकोवलसिवच्चिंदि" अनिचॆप्पिंदि. इदि निजमे. ऎंदुकंटे उपनिषदृषुललो आत्मज्ञानंविषयंलो एक वाक्यत लेदु. ऒकरु आ आत्म व्यक्तिशरीरंलो सगं उंटुंदन्नारु. कॊंदरु अंगुष्ठ परिमाणमन्नारु. मरिऒकरु वड्लगिंजंत अन्नारु, कादु वड्लगिंज मॊन अंत अन्नारु. चिवरकु "एकंसत् विप्राः बहुधा वदन्ति" अनि सर्दुकुन्नारु.

लोपालुः

ऎंदरो महनीयुल्नि मेधावुल्नि प्रसादिंचिन भारतीय आत्म भौतिकशास्त्राभिवृद्धिपरंगा मात्रं ऎदगलेकपोयिंदि. इंदुकु मूलालु यी सामाजिकव्यवस्थलोने वुन्नै. प्राचीनकालंलो अन्नि नागरिकजातुल्लोनि उन्नतवर्गालवारू सामान्यमानवुलु विद्या वंतुलु, योचनापरुलु काकूडदने वांछिंचारु. अंदुकु तग्गट्टु गाने वारिनि नडिचे शवालुगा वुंडेट्लु वारि आर्थिक, भौतिकादि विषयालपट्ल चालाजाग्रत्तलु तीसुकॊन्नारु. ऐते यीविषयंलो प्रपंचमॊत्तं ऒकयॆत्तु, भारतदेशं ऒक्कटे ऒकयॆत्तु. ग्रीकुलु गूडा आर्यशाखीयुलेगानि, वारंदिंचिन नागरिकताप्रभावं यूरोपि यन्लनु "ऒक कुक्कनु चंपदलिस्ते दानिकि मुंदुगा पिच्चिदि अनि पेरु पॆट्टालि" अन्नंतवरके तीसुकॆळ्ळिंदि. (अंटे पाश्चात्य नागरिकुडु तानु चेयदलचिन मोसान्नि बहिर्गतं चेसेस्तुन्नाडु) कानि, भारतीय आर्युलु वारिकन्ना गॊप्प नागरिकुलुकदा! अंदुवल्ल पुट्टुकतोने ऒक व्यक्तियॊक्क गुणगणालु, अतडु जीविंचवलसिन विधानान्नि निर्णयिं चेशारु. आ विधंगा कॊद्दिमंदिकि मात्रमे बुर्रवुंटुंदनि खच्चितंगा चॆप्पेशारु. अंदुवल्ल विद्य अतिरहस्यमे काकुंडा, कॊद्दि मंदिकि मात्रमे अर्हमयिंदिगा तयारयिंदि. इदि चिवरकु "आत्म ज्ञानं" पट्ल व्यामोहं, भौतिकशास्त्रालपट्ल

अलविमालिन विमुखतगा रूपॊंदिंदि. फलितंगा ये कॊंतो भौतिकांशाल्नि गुरिंचि चर्चिंच तल पॆट्टिन सांख्य, वैशेषिक, न्याय दर्शनालुगूडा चिवरकु भाववादं लोकि लागबड्डै. पूर्वमीमांसकूडा देवुडु लेडंटुंदि. कानि वेदालु परमप्रमाणमनि आमोदिंचिंदि. निजानिकि वेदाल्लोवुन्नदि भौतिकांशाले. दान्नि आधारंगाचेसुकॊनि तर्वात तयारैन ज्योतिष शास्त्रंगूडा भौतिकशास्त्रमे. आकाशंलो तिरिगे सूर्यचंद्र नक्षत्रादुलु एमिटि? वृत्त दीर्घ वृत्तादि कक्ष्यल्लो परिभ्रमिस्तुन्न बृहद्वस्तुवुलु लेक पदार्थालु. ऐनप्पुडु वाटिगमनान्नि अनुसरिंचि निर्णयिंपबडे मानव देशादि भविष्यत्तुलुगा चॆप्पबडे अदृष्टदुरदृष्टादि फलितालन्नी भौतिक विषयाल्लोनि भागाले औतायि.असलु वेदर्षुलु नेलविडिचि सामु चॆय्य लेदु. पुष्कलमैन पालिच्चेआवुलु, वडिगा परिगॆत्ते गुर्रालु, दासदासीलु, बंगारं, रथालु यिंका युद्धरंगाल्लो तमकु विजयं, तम शत्रुवुलकु शृंगभंगं कावालनि कोरुकुन्नवारे येक्कुव. अक्कडक्कड आध्यात्मिकचिंतन शकलालुगा लेकपोलेदु. कानि, ऋग्वेदं चिवरिमंडलंलो उन्न नासदीयसूक्तं, पुरुषसूक्तालनु आत्मज्ञानाभि रुचि पॆरिगिपोयाक सामाजिकव्यवस्थनिर्माणानिकि तगिनविधंगा यी रॆंडिंटिनी पलुरूपाल्लो विस्तरिंपजेयटं जरिगिंदि.

वर्गसमाजंलोनि कॊंदरिस्वार्थं, भावालरीत्या मरी गिडसबारि पोयि-वर्णव्यवस्थनु निर्मिंचट मे काकुंडा, कॊंदरिनि असलु मनुषुलुगा गुर्तिंचटानिके अंगीकरिंचलेदु. अंदुवल्ल वर्ण कारणंगा व्यक्तुल्लो येर्पडे आत्माधिक्यत, आत्म न्यूनताभावालु meritनि चॊरि वॊकवैपु लाक्कॆळ्ळिनै. अंटे उत्तमवर्णभावं दानि मंचि चॆडुलतो संबंधंलेकुंडा अप्रतिहतंगा कीर्तिंपबडिते, अधमवर्णभावं कूडु गुड्ड गूडु वॆदुकुलाटलो लयिंचिंदि. अंदुवल्ल क्रीस्तुकुपूर्वं 2व शताब्दंवरकु ऒकमोस्तरुगा सागिन भौतिकशास्त्रचर्च अप्पुडप्पुडु मिनुकुमिनुकुमंटू वच्चि चिवरकु क्री.श. 5व शताब्दानिकि ऒक्कसारिगा आर्यभट वराहमिहिरुल रूपंलो तळुक्कुमंदि.

वीरिलो आर्यभटुनि ज्योतिश्शास्त्र, गणितशास्त्रग्रंथाले मनकु लभिंचिन वाटिलो अतिप्राचीनमैनवि. भूमिकिकूडा परिभ्रमणंउंदनि, चतुर्युगाल कालप्रमाणं वेर्वेरुकादनी, अन्नियुगाल प्रमाणमू सममेननि ईयन चॆप्पाडु. बीजगणितानिकि संबंधिंचिन भुजज्यानि (सैन्) पेर्कॊन्नाडु. तनकु पूर्वुलैन गणित खगोळशास्त्रवेत्तलकु भिन्नंगा यीयन कॊन्नि साहसोपेतमैन सिद्धांतालु चेशाडु. नेटि सैन्सुतो वीटिकि समन्वयं कुदुरुतोंदि. कालप्रवाहंलो कॊंतकालं कनिपिंचकुंडापोयिन आर्यभटीयं कॆर्न् पंडितुनि कृषिफलितंगा 1874लो लीडन्लो मुद्रिंचबडि तिरिगि लभिंचिंदि. बहुश यीग्रंथं कॊन्निशताब्दालपाटु कनिपिंचकुंडा पोवटानिकि आर्यभटुनि स्वतंत्र भावालु (पूर्व सिद्धांतालकु विरुद्धंगा वुंडटमे) कारणमै वुंडवच्चु. एमैना आर्यभट्टु गॊप्प अदृष्टवंतुडनि चॆप्पक तप्पदु.

वराहमिहिरुडु भूमिनिगुरिंचि चॆबुतू "अयस्कांताल मध्य लोहं उन्नट्लु आकाशंलो तारागणमने पंजरंलो निरालंबनं गा भूमि निल्चिवुंदि" अन्नाडु. चंद्रग्रहण सूर्यग्रहणालकु कारणं-भूमिनीड

पडडंचेत चंद्रग्रहणं, चंद्रुनि नीड पडडंचेत सूर्य ग्रहणं जरुगुतुंदनी अंतेकानि राहुकेतुवुलवल्ल कादनी चॆप्पाडु. ऐते अला चॆप्पिन वराहमिहिरुडे "सूर्यचंद्रोपराग समयाल्लो चेसे दान होमालफलितं राहुवुकु चॆंदेट्लु ब्रह्मवरमिव्वटंचेत आ समयंलो राहुवु सन्निहितुडै वुंट ाडनि गूडाचॆप्पाडु." (बृहत्संहित 5.14-15 श्लोकालु) ग्रहणालकु कारणान्नि खच्चितंगा चॆप्पिन मेधावि मळ्ळी यिला अन्नाडंटे कारणंऒक्कटे. तन ग्रंथान्नि संप्रदायपु क्रोधाग्निकि गुरिकाकुंडा कापाडुकुनेंदुकु वराह- मिहिरुडेगानि, अतनि संततिवारुगानि लेक अतनि शिष्युलुगानि यी श्लोकान्नि चेर्चिवुंटारु. ऎंदुकंटे भास्कराचार्युडुगूडा तन सिद्धांत शिरोमणिलोनि गोळाध्यायंलोनि ग्रहणवासनाध्यायंलो खच्चितंगा यी सूर्यचंद्र ग्रहण विषयंदग्गरने वराहमिहिरुडु चॆप्पिनट्ले आयनकन्ना मरिंत विवरंगा ग्रहण, मोक्षालु येये दिक्कुल्लो जरिगेदि चॆप्तू "आ समयंलो राहुवने तमोमयुडैन असुरुडु शंभुनि वरप्रभावंचेत चंद्रुण्णी भूच्छायनू आश्रयिंचिवुंट ाडु. अंदुवल्ल केवलं गोळविद्यने आधारंचेसुकॊनि राहुवुकु ग्रहणंतो ए संबंधमू लेदनि चॆप्पटं सर्वागमालकू पुराणप्रसिद्धिकि विरुद्धं अदि न्यायं का" दन्नाडु.

> दिग्देश कालावरणादि भेदान्नच्छादको राहुरिति ब्रुवन्ति
> यन्मानिनः केवल गोल विद्यास्तत् संहितावेद पुराणबाह्यम् — 29.10

काबट्टि (ई अड्डुतडिक माटलन्नी) "सांप्रदायंपैन अभिमानंतो पै सिद्धांतकर्तलु अला चॆप्पलेदु" अनेदि स्पष्टं.

12व शताब्दिवाडैन यी भास्कराचार्युल तर्वात खगोळाध्य यनं वॆनकबडिंदने विषयं तॆलिसिंदे. शास्त्रं सूर्यचंद्रग्रहनक्षत्रसंबंधिसंचारानिकि चॆंदिन "पंचांगं" निर्माणानिकि परिमित मयिंदि. पोनी, आ शास्त्रमैना निर्दुष्टंगा नेडु वुंदा अंटे लेदने चॆप्पालि. ईक्रिंदि विषयं चूडंडि.

> वसंत विषुवत्तु मेषराशिलो वुंडिनकालंलो अंटे क्री.पू. 2950 - क्री.श. 100 सं. ल मध्य दक्षिणायनांतं मकरराशिलो जरिगेदि. . . . कानि, विषुवच्चलन फलितंगा प्रस्तुतं दक्षिणायनांतं धनूराशिलो जरुगुतुंदि. अदि डिशंबर् 22न अवुतुंदि. अंटे उत्तरायणं मॊदलु अयिपोयिन 23रोजुल तरुवात एमी संबंधंलेनि जनवरि 14न मनं पंडुगचेसुकुंटुन्नामन्न माट. मन पंचांगकर्तलकु ई विषुवच्चलन रहस्यं तॆलियकपोवडंवल्ल इट्ला जरिगिंदि.

पै वाक्यालु डा. महीधर नळिनीमोहन्गारु रासिन केलंडर् कथलोनि 70-71पेजील्लोवि.

मनं शुभाशुभ कर्मलन्निंटिकी पुरोहितुण्णि संप्रदिस्तां. पुरोहितुडु पंचांगान्नि आश्रयिस्ताडु. अयिनप्पुडु पंचांगकर्त ई कंप्यूटर् युगंलोकूडा पॊरबाट्लुचेस्तुन्नाडंटे अर्थं एंटि? निर्लक्ष्यं

आनुपूर्विकमना? ऋषुल्नि निजंगा अनुसरिस्तुन्नाडना? सूर्यगमनं चित्रमैनदि. पंचागकर्त गमनं कड्ड विंतयिनदि. काबट्टे प्रपंचंलो ऐक्कडालेनि व्यवस्थ मनके वुंदि.

नडमंत्रंगा वच्चिन कॊन्नि विधिनिषेधालु मन शास्त्रपरि ज्ञानान्नि, आर्थिकाभिवृद्धिनी कुंट ुपरिचायि. उदाहरणकु समुद्रयान निषेधं (नाटि यूरपुखंडवासुलकु तॆलियनि) कॊन्नि खंडाललो मन वलसल्नि स्थापिंचे अदृष्टानिकि दूरंचेसिंदि. ई निषेधं लेनिकालंलो आग्नेयासियालो मनसंस्कृती संप्रदायालु, साहित्यं वगैरालु व्याप्तिचॆंदायि; राज्यालनू स्थापिंचिंदि. कंबोडि यालो यिप्पटिकीवुन्न राजवंशं ईदेशंनुंडि वॆळ्ळिन ओ भारतीयुण्णि मध्ययुगालनाटि कंबोडिया युवराणि पॆळ्ळाडगा येर्पडिंदि. विद्यल्नि, मुख्यंगा संस्कृतान्नि यितरुलकु दूरंगा वुंचटंवल्ल अदि प्रपंचभाष कालेकपोयिंदि. कनीसं देश जातीयभाष कूडा कालेक पोयिंदि. समुद्राधिपत्यं लेकपोवटं परायिवारि युद्धविजयालकु मुख्यकारणमैंदि. ईविधमैन अनेक लोपालवल्ल शास्त्रसांकेतिकरंगाल्लो पूर्तिगा वॆनुकबडिपोयि, चिवरकु पाश्चात्युलवद्द नेर्चुकोवलसिन स्थायिकि दिगिंदि. कट्ट ेवंकर पॊय्यितीर्चिनट्लु मनसामाजिकलोपाल्नि कालमे तीर्चिंदि. पाश्चात्युलुरावटं, संस्कृतान्नि आदरिंचटं, संप्रदायपुपॆद्दल्लोने संघसंस्कर्तलु पुट्टुकुरावटं, फ्रॆंचिविप्लव प्रभावं पत्रिकादि प्रचार, प्रसारसाधनालवल्ल व्यापिंचि जाति जागृतं कावटं आधुनिकयुगंलो वच्चिन मार्पुलु. लक्षलोपालुन्ना प्रजा स्वाम्यानिकि मिंचिंदिलेदु. वाक्स्वातंत्र्यं, विद्यनार्जिचटानिकि व्यक्तु लकु स्वेच्छ वुंडटं, भावप्रकटना स्वातंत्र्यं वगैरालु कलिगिन यी कालमे कृतयुगं. काबट्टि धर्मं नालुगुपादालतो नडिचे कालं कोसं यॆदुरुचूडवलसिन अवसरं लेदु. ऎंदुकंटे अटुवंटि कालंलो गूडा मधुकैटभुलु, हिरण्यकशिप हिरण्याक्षुलवंटिवारु लेकपोलेदु. अंदुवल्ल कनीसं नेटि युवत अयिना तामुसाधिंचे शास्त्रसांकेतिक परमैन विज्ञानान्नि सन्मार्गंलो (निर्दुष्टंगा) विनियोगिंचट ानिकि यत्निंचगलदनि कांक्षिंचटमे मनं चेयवलसिंदि, चेयगलिगिंदीनु.

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जानपद विज्ञानंलो खगोळ विज्ञानं

पि.सि. वेंकटेश्वर्लु

जानपद विज्ञानमनेदि नेडु ओक प्रत्येकमैन शास्त्रंगा रूपु दिद्दुकुंदि. समाजान्नि गुरिंचि विवरिंचेदि सामाजिक शास्त्रमयिते, विविध वस्तुवुल भौतिकतत्त्वान्नि गुरिंचि तॆलिपेदि भौतिकशास्त्रमैते, मनिषि मानसिक प्रवर्तननु अंचनावेसेदि मनस्तत्वशास्त्रमैते मनिषि पुट्टिंदि मॊदलु मरणिंचेंतवरकु समस्त विषयालनु विवरिंचेदि जानपदविज्ञानं. अंतेकादु अन्नि शास्त्रालकु संबंधिंचिन विषयालनु कॊद्दोगॊप्पो जानपद विज्ञानं तनलो इमुड्चुकॊनि वुंटुंदि. जानपद विज्ञानमनेदि इप्पुडु कॊत्तगा पुट्टुकॊच्चिंदि कादु. मानवुडु भूमिमीद जीवनं सागिंचिनपुडे अदि प्रारंभमैंदि. अला आरंभमैन ई विज्ञानंलो ऎन्नो अंशालु मिळितमै वुंटायि. अंदुलो भौतिक, रसायन शास्त्रमेकादु, भूगोळ, खगोळ अंशालु कूडा ऎन्नो दागिवुन्नायि.

जानपदुलंटे अक्षरज्ञानं लेनिवारु कावच्चुकानि, विज्ञानं, तॆलिवितेटलु, लोकज्ञानं तॆलियनिवारु मात्रं कादु. वारु तमचुट्टू जरिगे मार्पुल्नि, परिणामाल्नि व्याख्यानं चेयगलिगिनंत मेधावुलु. वैद्यं, खगोळं, भूगोळं वंटि वाटिकि संबंधिंचि चाल विषयालनु वारि अनुभवालतो मेळविंचुकॊनि तर्वात तरानिकि पदिलंगा अंदिस्तारु. ब्रून्वांग् अने विद्वांसुडु *The Study of American Folklore* अने ग्रंधंलो जानपद विज्ञानान्नि "जानपद मनस्तत्वं कलिगिन जन समूहंलो सांप्रदायकंगा गानि, मौखिकंगा गानि, अभ्यासबलं वल्लगानि, परोक्षंगा गानि प्रसारंपॊंदे विविध पाठालु कल्गिन संस्कृती संबंधमैन विषयालु" अनि निर्वचिंचाडु. अयिते ब्रून्वांड् चॆप्पिन निर्वचनंलो शास्त्रसंबंधमैन विषयाल्निकूडा चेर्चु कोवल्सिन अवसरं ऎंतैना वुंदि. ऎंदुकंटे वारि विज्ञानंलो ऎन्नो शास्त्रविज्ञान संबंधमैन अंशालुकूडा वुन्नायि.

जानपदुलु ऎलांटि विज्ञानशास्त्रान्नि अध्ययनं चेयकुन्ना वारि जीवितानुभवंतो ऎन्नोशास्त्रसंबंधमैन विषयाल्नि तम जानपद विज्ञानंलो पॊंदुपरिचारु. आ जानपदविज्ञानंलो दागिवुंडे खगोळ संबंधमैन विषयालनु तॆलुसुकोवडं ई व्यासोद्देशं. अयिते जानपदविज्ञानंलोनि खगोळविषयाल्नि तॆलुसुकॊनेमुंदु

जानपद विज्ञानंलोनि शाखल्नि तॆलुसुकॊनि ए ए शाखल्लो खगोळांशा लुन्नायो परिशीलिद्दां.

विशालमैन जानपदविज्ञानान्नि रिचर्ड् ऐम्. डार्सन्, 1. मौखिक जानपद विज्ञानं, 2. वस्तुसंस्कृति 3. जानपद सांघिकाचारालु 4. जानपद कळलु अने नालुगु विभागालुगा चेशाडु. तर्वात जानपदविज्ञान परिशोधकुलु पै विभागानिकि अदनंगा "जानपदुल भाष" नु कूडा चेर्चि मॊत्तं 5 शाखलुगा निर्णयिंचारु. ई जानपद विज्ञानंलो मॊदटिदैन मौखिक जानपदविज्ञानंलो जानपदुनि नोटि नुंडि वॆलुवडे साहित्य परमैन अंशालन्नी चेरुतायि. अंटे जानपदगेयालु, कथागेयालु, गद्याख्यानालु (ऐतिह्यालु, पुरागाथलु, कथलु), पॊडुपुकथलु, सामॆतलु मॊ।। अन्नी मौखिक जानपदसाहित्यंलो अंतर्भागमे. मुंदुगा ई मौखिक जानपद साहित्यंलो खगोळांशालु एविधंगा वुन्नायो परिशीलिद्दां.

जानपदगेयाल्लो खगोळांशालु

जानपद साहित्यमंता चदुवु संध्यलु लेनि अमायकुलैन पल्लॆप्रजल निर्मलमैन मनस्सुनुंडि बैट किवच्चिंदे अयिना वारि साहित्यंलो ऎंतो हृद्यमैन विषयालतोपाटु वैद्य, मनस्तत्वं, खगोळ, भूगोळ संबंधमैन विषयालु उंटायि. अयिते अवि शास्त्र संबंध विषयालने आलोचन वारिकि वुंडदु. भावितरालकु अंदिंचालने कोरिक मात्रमे वुंटुंदि. वारु अप्रयत्नंगा, अलवोकगा पाडुकुनेपाटल्नि जाग्रत्तगा परिशीलिंचिचूस्ते ऎन्नो खगोळ संबंधविषयालु बैटपडतायि. खगोळमंटे, खगोळविज्ञानमंटे वारिकि तॆलियकुन्ना आकाशं, दानिकन्ना पैनुंडे लोकालनुगुरिंचि मात्रं ऎप्पुडु आलोचिस्तुंटारु.

जानपदगेयाल्नि मेधस्सु कलिगिन जानपदुलु सृष्टिंचिना अवि ऒकरिनुंडि मरॊकरिकि वारसत्वंगा वस्तुन्नवि काबट्टि अंदरि संपद अयिनायि. गेयानिकि खगोळानिकि वुन्न संबंधं एमिट नि परिशोधकुलकु आश्चर्यं कलिगिनट्लयिते ई गेयंलोनि खगोळांशाल्नि परिशीलिंचाल्सिंदे.

अनंगनंग अनि पिसिगाडु
कल्लमंत दिरिगिते कंदिगिंज
कंदिगिंजकु कंडिन्नर
कंडिन्नरकि सीडिन्नर
सीडिन्नरकि कावुलपंचि
कावुलपंचिकि कॊम्मुलपॊट्टिल
कॊम्मुलपॊट्टिलकि तेजी गुर्रं
तेजीगुर्रम्कि पट्टपेणिगि
पट्टपेणिक्कि बिंदिन्नरारालु
बिंदिन्नरारालकि रॊट्टिन्नर

రొట్టిన్నరకి సెంపున్నర
సెంపున్నరకి గొరిగెవా గొరగలెవా — త్రివేణి పుట 16

ఈ గేయంలోని చరణాలు ముక్తపదగ్రస్తాలంకారంలో సాగినాయి. గేయంలోని అర్థాన్ని త్రివేణి సంపాదకులు వివరిస్తూ పొలంలో గింజలు, కందులు, పొట్టేలు, గడ్డం గొరగడం వంటి విషయాలున్నట్లు చెప్పారు. పైకి ఈ గేయంలో అర్థం అలాగే అన్పిస్తున్నా కొంచెం లోతుగా గేయ చరణాలను పరిశీలిస్తే పొడుపుకథలాగా సాగిపోతున్న, ఖగోళాంశాల్ని ప్రస్తావించినగేయమిది. త్రివేణి సంకలన కర్తలు అనిపిసిగానికి కందిగింజ దొరిగిందని చెప్తూవచ్చారు. ఈ భావంలో స్పష్టత లేదు. ఈ గేయంలో జానపదులు ఖగోళసంబంధమైన విషయాల్ని తమ ఊహలకు జోడించి కూర్చారు. విశ్వ నిర్మాణం ఇలా వుంటుందని వాళ్లకు స్పష్టంగా తెలియకున్నా ఏవరైనా చెప్పింది వినడం వల్లనో, తాము చేసిన ఆలోచనల్లో తెలిన ఫలితాలవల్లనో ఇలాంటి ఖగోళ విషయాలను గేయాల్లో ప్రస్తావించారని చెప్పవచ్చు. పై గేయంలోని చరణాలను ఆధునిక ఖగోళ పరిజ్ఞానం దృష్టిలో ఇలా విశ్లేషించి చెప్పుకోవచ్చు.

అనంగనంగ అసిపిసిగాడు	అనగనగా విశ్వం
కల్లమంత తిరిగె కందిగింజ	విశ్వంలోని పాలపుంత
గందిగింజకి కందిన్నర	పాలపుంతల్లో ఉండే సూర్యుని పోలిన అగ్ని గోళాలు
కందిన్నరకి వెడిన్నర	సమీపంలో ఉంటే సూర్యగోళం
వెడిన్నరకి కావులపంచి	సూర్యుడు కన్పించే ఆకాశం
కావులపంచికి కొమ్ముల పొట్టిల	ఆకాశంలో కన్పించే పొట్టేల్లాంటి మేఘాలు
కొమ్ముపొట్టిలకి తెజీగుర్రం	మేఘాల్లో కన్పించే చంద్రుడు
తెజీగుర్రంకి పట్టపేణిగి	తేజస్సుగల చంద్రుడు కన్పించే రాత్రి
పట్టపేణిక్కి బిందిన్నరాలు	రాత్రిళ్లు ఆకాశంలో కన్నించే నక్షత్రాలు
బిందిన్నరాలికి రొట్టిన్నర	నక్షత్రమండలం నుండి కన్పించే భూగోళం
రొట్టిన్నరకి సెంపన్నర	భూమండలంలో మనం నివసించే భూప్రదేశం

ఈ గేయాన్ని ఖగోళాంశాల్ని, సౌరవ్యవస్థ నిర్మాణాన్ని ఆకళింపు చేసుకొన్న జానపదుడు కవిత్వీకరించి పాడివుండవచ్చు. దాన్ని అర్థం తెలియకున్నా భావం బోధపడకున్నా తర్వాతవారు అనుకరించి ఉంటారు.

అదేవిధంగా జానపదులు సూర్యుని ఒక దేవతగా ఆరాధిస్తారు. ఆయన రూపాన్ని, గమనాన్ని గురించి జానపదులు రకరకాలుగా వర్ణిస్తారు. సూర్యునికి ఒక బంగారు రథం ఉంటుందని, దాన్ని వేలు వడిగల గుర్రాలు, వాయువేగంతోలాగుతూ ఉంటాయని జానపదులు చెప్పుకోవడమేకాదు అనేక గేయాల్లో పాడుకుంటూరు.

సూర్యబాణము దొడిగి సూర్యరథమెక్కి

नीपुण्यमुल राशी वच्चेनिनि पाडुरु अंटू पाडुकोने गेयंलो तमबिड्डलु सूर्युनिला तेजोमूर्तुलु, शौर्यवंतुलु, चैतन्य शीलुरु कावालने तीरुकन्पिस्तुंदि.

अलागे सूर्यचंद्रग्रहणालु जापदुल्लो भयान्नि, उत्साहान्नि कलिगिस्तायि. अप्पडप्पुडु तमनु कलवरपॅट्टे ग्रहणालनु गुरिंचि अन्यापदेशंगा पाडुकोने ई गेयान्नि चूडंडि.

बालनय्य बालनय्य बालसंजीवा
ऊरिनुंचि वच्चिनावा बाल मादवा
रोटिकाड पिललकोडि रोसमॊच्चि रोलु मिंगा
सूड वॊच्चिन सुट्टालनू सुंचुमिंगॆनू

ई गेयंलोनि चरणालु विनडानिकि अतिशयोक्तिगा, हास्यंगा अन्पिस्तुन्नायि. रोलु दग्गर उंडे पिल्ललकोडि मुक्कुतो नेलपै गिंजल्नि पॊडुचुकोनि तिंटू ऒकसारि कोपं वच्चि आ रोलुनेमिंगेसिंदने आ विंतनु चूडडानिकिवच्चिन चुट्टालनु चुंचुमिंगेसिंदनि साधारणार्थं चॆप्तुंदि. कानि इदि असहजंगा उंदि. लोतुगा ई चरणालनु परिशीलिस्ते खगोळसंबंधमैन सूर्यग्रहण विषया लुन्नायि.

ई गेयंलो रोटिकाड पिललकोडि अंटे चुक्कलनु चुट्टू कलिगिन चंद्रुडनि अर्थंचेसुकुंटे भावं अर्थमैपोतुंदि. पिल्ललकोडि लांटि चंद्रुडु ऒकसारि कोपंवच्चि पक्कने वुन्न रोलु अंटे सूर्युडिनि मिंगेशाडु. अंटे सूर्यकिरणालु भूमिनि चेरकुंडा अड्डु कुन्नाडु. (भूमिकि सूर्युनिकि मध्य चंद्रुडु अड्डुगावच्चिनप्पुडु सूर्यग्रहणं एर्पडुतुंदनि खगोळविज्ञानं चॆप्तुंदि.) पूर्तिगा मिंगेसिंदि. ई विंतनु अंटे ग्रहणान्नि चूडटानिकि वच्चि सूर्यचंद्रुल चुट्टालै मनुषुलनु "सुंचु" अने चीकटि मिंगेसिंदनि अर्थं चेसुकुंटे गेयचरणाल्लोनि अंतरार्थं बोधपडुतुंदि. कवितात्मक प्रतीकलतो जानपदुलु पाडुकोने गेयंलो खगोळांशालु इला दागि वुन्नायि.

इक आकाशंलो सूर्युनि चुट्टू परिभ्रमिंचे ग्रहालपेर्लनु मनं चालामटुकु वाराल पेर्लुगा पॆट्टुकुन्नां. आ पेर्लपै आया वाराल्लोनि मंचि चॆड्डलपै जानपदुलकु नम्मकं ऎक्कुव. आ वाराल पेर्लनु चिन्नप्पटिनुंडे पिल्ललकु पाटलरूपंलो नेर्पिस्तारु. पसि पिल्ललकु उग्गुपालतो नेर्पिंचे वारालु ग्रहाल पेर्लनु किंदिगेयंलो चूडवच्चु.

रविवारं नाडु राममम्मपुट्टॆ
सोमवारं नाडु चुरुकुगा नडिचॆ
मंगळवारंनाडु माटलुनेर्चॆ
बुधवारंनाडु बुद्दुलु नेर्चॆ
गुरुवारंनाडु परिणयंबायॆ

शुक्रवारंनाडु चनॆ सुडिदॆलंदॆ
शनिवारंनाडु चनॆ अत्तवारिंटिकि — त्रिवेणि पु. 5

इलांटि पाटलवल्ल पिल्ललु पसिवयसुलो ऎंतो विज्ञानान्नि तॆलुसुकोगलुगुतारु.जानपदगेयाल्लो इंका रुतुवुलकु संबंधिंचिन विषयालु, नक्षत्रालकु संबंधिंचिन विषयालु, ए नक्षत्रंलो पुट्टिन बिड्ड ऎलांटि प्रवर्तनतो मुंदुकुसागुताडु, ए ए कार्तॆल्लो वातावरणं ऎला वुंटुंदि मॊदलैन विषयालु तॆल्पेविकूडा वुन्नायि.

गद्याख्यानाल्लो खगोळांशालु

मौखिक जानपदसाहित्यंलो गेयशाख तर्वात चॆप्पु कोवल्सिंदि गद्याख्यानालनु गुरिंचे. गद्यरूपंलो उंडे आख्यानालु अंटे ऐतिह्यालु, पुरागाथलु, जानपदकथलु ई विभागंलो चेरुतायि. पाटलु अल्ललेनि जानपदुलु तम कवितात्मनु गद्या ख्यानाल रूपंलो प्रकटिस्तारु. जानपदुलु चॆप्पुकॊने आ ख्यानालु ऒक प्रत्येकतनु कलिगि उंटायि. निजानिजालु, वास्तवास्तवालतो जानपदुलकु पनिलेदु. कथलागा चॆप्पुकॊनि आनंदिंचडं वारि लक्ष्यं. खगोळ विज्ञानान्नि तॆल्पे गद्याख्यानालु कूडा जानपदुल्लो ऎन्नोवुन्नायि.

ऐतिह्यं अंटे ऒक चॆट्टुनो, गुट्टनो, कॊंडनो गुरिंचि जानपदुलु चॆप्पुकॊने चरित्र कॊंतकलिगिन चिन्न कथ. पल्लॆलो चॆरुवुकु, चॆट्टुकु कॊन्नि प्रत्येक कथलुंटायि. वाटिनि स्थानिक ऐतिह्यालु अंटारु. मॆकंजी कैफीयत्तुल्लो कूडा कॊन्नि स्थानिक ऐतिह्यालनु गुरिंचि चॆप्पिनाडु. आकाशंलो उंडे चंद्रुनिलो उंडे मच्चलनु गुरिंचि, पॆद्दलु अव्वदोसॆलु पोस्तुंटुंदनि, चंद्रुडु वाहनमैन कुंदेलु बॊम्म अनि रकरकालु विषयालु चॆप्तुंटारु. इवन्नी खगोळ संबंध ऐतिह्यालुगा चॆप्पवच्चु.

गद्यकथनाल्लो रॆंडो उपविभागं पुराणगाथलु. इवि पुराणानिकि संबंधमैन कथनु कलिगि प्रजल्लो नम्मकान्नि कल्गिस्तायि. ऒकप्पुडु इला जरिगिंदि अनि चरित्रनु चॆप्तू, कॊंत पुराण कथल मेळविंपुतो मुंदुकु सागे पुरागाथल्लो कूडा खगोळ संबंधमैन अंशालु ऎन्नोवुन्नायि. सूर्य चंद्रग्रहणालकु संबंधिंचि राहुवु, केतुवु सूर्य चंद्रुल्नि ऎंदुकु मिंगालनुकुन्नारो चॆप्पेकथ पुरागाथ किंदके वस्तुंदि. अलगे चंद्रुनिलोनि मच्चलकु अतनु पॊंदिन शापान्नि कारणंगा जानपदुलु चक्कनि पुरागाधगा चॆप्तारु. चंद्रुनिचुट्टू उंडे चुक्कलनु अतनि भार्यलुगा, पक्कन वुन्न सप्तर्षि मंडलान्नि गुरिंचि, अरुंधति, ध्रुवुडुवंटि नक्षत्रालगुरिंचि चॆप्पुकॊने अनेक कथलु खगोळ पुरागाथलुगा चॆप्पुकोवालि. ई विधंगा जानपदुलु तमकु दूरंगा उन्न आकाशं गुरिंचि, मॆरुपुलगुरिंचि, पिडुगुल गुरिंचि ऎन्नोकथलु चॆप्तुंटारु. ई कथलन्नी निजमने नम्मकंलोने वारि तरालु गडिचि पोतुन्नायि.

पॊडुपुकथल्लो खगोळांशालु

मौखिक जानपद साहित्यंलो पॊडुपुकथ ऒक प्रत्येक प्रक्रिय. इवि जानपदुल्लोनि तॆलिवितेट ल्नि निग्गुतेल्चे साहित्यप्रक्रिय. विवेक वंतुडु, मेधावि अयिन जानपदुडु पॊडुपुकथल्नि सृष्टि स्ताडु. ऐदुटि व्यक्तिनि तिकमकपॆट्टेंदुकु, प्रश्नलकु समाधानं राबट्टेंदुकु ई पॊडुपुकथलु पुट्ट ुकॊच्चायि. जानपदुल्लो कॊंदरु तमदे पैचेसि अनि चॆप्पुकोडानिकि सृष्टिंचिन ई पॊडुपुकथल्लो कॊन्नि खगोळ विषयाल्नि प्रबोधिंचेविकूडा वुन्नायि. कथनु पॊडिचे व्यक्ति सामर्थ्यान्निबट्टि पॊडुपुकथ ऒकटिनुंडि आरु चरणाल वरकु वुंटुंदि. समाधानं चॆप्पेव्यक्ति मात्रं ऒक्क माटलो चॆप्पालि.

उदा।। ईटिनुंडि चूस्ते गुंडु　　आडिकि पोयिचूस्ते पंडु
पंडुकु पन्नेंडु ऒप्पुलु　　ऒप्पुकु मुप्पै गिंजलु

पै पॊडुपुकथ पूर्तिगा खगोळसमबंधमैनदे, ई दीनिलो ऒक्कॊक्क चरणानिकि ऒक्कॊक्क समाधानं वुंदि. पॊडुपु कथनु विप्पेवानिकि आ परिज्ञानं उंटेने समाधानं चॆप्पगलडु. दीनिलो मॊदटि चरणानिकि "चंद्रुडु", रॆंडो चरणानिकि "भूमि", मूडो चरणानिकि "१२ नॆललु", नालुगोचरणानिकि "रोजुलु" अनेदि सरैन समाधानं. ई चिन्न पॊडुपुकथलो जानपदुलु भूमि, आकाशं, चंद्रुडु, नॆललु, रोजुलकु संबंधिंचिन विज्ञान विषयाल्नि पॊंदुपरिचारु.

अलागे "अंदनि वस्त्रं मीद अन्नी वडियाले"अने पॊडुपुकथलो अंदनिकाशंलो उंडे नक्षत्रालनु कवित्वीकरिंचि चॆप्पारु जानपदुलु. आकाशानिकि हद्देलेदनेदि सैन्स् चॆप्तुन्न अंशं. दीन्ने जानपदुलु चक्कटि पॊडुपुकथगा "ऊरिकंता ऒक्कटे दुप्पटि" अनि मलिचारु. इलांटि भूमिकि, आकाशानिकि, रोजलकु अमावास्य, पौर्णमिकि संबंधिंचिन पॊडुपुकथलु ऎन्नो जानपदसाहित्यंलो वुन्नायि.

सामॆतल्लो खगोळांशालु

सामॆतलनेवि जानपदुल जीवितसारं नुंडि पुट्टुकॊच्चिनवि. "सामाजिकमैन तरतराल अनुभवान्नि इमुड्चुकॊनि साम्यत प्रभावोत्पादकत, ध्वनिप्राधान्यत, प्राचुर्यं, श्राव्यत कलिगि संभाषणा योग्यमैन संक्षिप्तवाख्यं तॆलुगु सामॆत" अनि आचार्य पि. नरसिंहारॆड्डिगारु "तॆलुगु सामॆतलु जनजीवनं"लो निर्वचिंचारु. जानपदुल नित्यव्यवहारंलो उंडे सामॊतलन्नी मौखिक जानपद साहित्यं किंदके वस्तायि. ई सामॆतल्लो वृत्तुलकु, आहारपु अलवाट्लकु, विद्य वैद्यालकु, न्यायं, परिपालन मॊ।। अंशालकु संबंधिंचिनवे काकुंडा वातावरणं, खगोळ विज्ञानानिकि संबंधिंचि ऎन्नो वंदल सामॆतलुन्नायि.

जानपदुलु मुख्यंगा तॆलुगुवारु वर्षान्नि, ऎंडनु, चलिनि मॊत्तं वातावरणान्नि कार्तॆलनुबट्टि अंचनावेस्तारु. एकार्तॆ ऎलांटि तत्वान्नि कलिगिवुंटुंदो वारु जीवितानुभवं द्वारा चॆप्तारु. अश्वनि,

भरणि, कृत्तिक, रोहिणि, आरुद्र, हस्त, चित्त, स्वाति, विशाख, उत्तर, आश्लेष, पुनर्वसु वंटि कार्तेलु व्यवसायानिकि ऐंत अनुकूलमो, व्यतिरेखमो ऒक्क क्षणंलो चॆप्तारु. आ विषयंलो शास्त्रवेत्तलकंटे वीरे मुंदुंटारु. ऐंदुकंटे तॊलिव्यवसाय शास्त्रज्ञुलु जानपदुले कदा!

व्यवसायानिकि ए ए कार्तुलु व्यतिरेखमो वारिसामॆतल्नि बट्टि परिशीलिस्ते, ऎन्नोविषयाल बोधपडतायि. उदाः "रोहिणिलो वित्तुट रोटिलो वित्तुटे" अने सामॆलो ऎंतो वास्तवमुंदि. ऎंदुकंटे साधारणंगा ऎंडलु विपरीतंगा उंडे मे, जून् नॆलल्लो ई कार्ते वस्तुंदि. आ समयंलो वच्चे ऎंडलवल्ल रोळ्ळुपगुलुतायनि जानपदुले चॆप्तारु. अटुवंटि ऎंडल्लो भूमिलो वित्तनालु चल्लिना रोटिलो चल्लिना ऒकटे अनि अनुभवपूर्वकंगा कालान्नि अंचनावेसि जानपदुलु चॆप्पिन सामॆत इदि.

अलागे "उत्तरलो चल्लिन पैरु कत्तेरलो नरिकिन कोय्य" अने सामॆत वातावरण रीत्या आ कालंलो पैरुवेस्ते तॆगुळ्ळु बागावस्तायनि अनुभवपूर्वकंगा जानपदुलु चॆप्पिंदे. अलांटिदे "पुब्बलो चल्लिना बूडिदलो चल्लिना ऒक्कटे" अने सामॆत. तोंदरपडि कालान्नि, वातावरण स्थितिनि अर्थंचेसुकोकुंडा व्यवसायपनुलकु दिगवद्दनि कार्तेल आधारंगा जानपदुलु चॆप्तुन्न जीवितानुभवमे ई खगोळ विषयालतो मुडिपडिन सामॆतलु.

व्यवसायानिकि ऎलांटि कालं, ऎटुवंटि वातावरण परिस्थितुलु अनुकूलमैनवो चॆप्पे सामॆतलुकूडा उन्नायि. "चित्तलो चल्लिते चिट्टिडुकापु", "आरुकार्तेलकु पोतु आरुद्र", "आरुद्र कुरिस्ते दारिद्र्यं लेदु" वंटि सामॆतलु आयाकार्तुल समयाल्लो भूमि, आकाशं, वातावरणाल्लो वच्चेमार्पुलु, अवि व्यवसायानिकि ऎला उपयोगपडतायो स्पष्टं चेस्तुन्नायि. अदेविधंगा "विशाखलो कुरिसिन वर्षं विषमुपॆट्टिनट्लु" अने सामॆत नेडु मनं चॆप्पुकॊने आम्लवर्षालनु गुर्तुचेयगा, "अनूराधलो तडिस्ते मनोरोगालु पोतायि" वंटि सामॆतलु ऎलांटि वर्षालु मनिषिकि, चॆट्टू, चेमलकु मंचिदो विवरिस्तायि.

अदे विधंगा मेघं रंगुनु, चंद्रुनि रूपुनुबट्टि वातावरणं ऎला उंटुंदो चॆप्पे सामॆतलु ऎन्नो वुन्नायि. चंद्रुनि चुट्टू गुडि वेस्ते वर्षंदने विषयान्नि "चंद्रपरिवेषंबु वर्षयोगमु" अने सामॆत चॆप्पगा, आकाशं रंगुबट्टि वर्षं वच्चे तीरुनु "ऎर्रनि आकाशानिकि बुरुन वान" अने सामॆत विवरिस्तुंदि. अंतेकादु नल्ल मब्बुल्नि चूसि मनं ऎंतोवर्षं वस्तुंदनि संबरपडुतां कानि जानपदुलकु मात्रं आ विषयं बागा तॆलुसु अंदुके "नल्लमॊगुलु वानकॊट्टदु, नव्वुमॊगमुवाडु दानं चेय्यडु" अने सामॆतचॆप्पि ऒकमाट लो नल्लमब्बु विषयं तेल्चेशारु. अंतेकादु खगोळान्नि चदिविन शास्त्रवेत्तलागा "आकाशंलो गॊर्रे तोक्कुडु पडिते अति समीपंलो वर्षं" वंटि सामॆतलु चॆप्पि वर्षं कुरिपिस्तारु. ई विध खगोळ विज्ञानान्नि तमलो निंपुकुन्न सामॆतल्नि जानपदुलु संदर्भान्निबट्टि उपयोगिस्तुंटारु.

सांघिकाचाराल्लो जानपदविज्ञानं

जानपदविज्ञानंलो मरो प्रथानशाख अयिन सांघिक आचाराल्लोकूडा ऎन्नो खगोळ संबंध विषयालु दागिवुन्नायि. जानपदुलु एपनि चेसिना मुख्यंगा वारि प्रधानवृत्ति अयिन व्यवसायपनुलु प्रारंभिंचालंटे मंचि रोजुकोसं ऎदुरुचूस्तारु. चंद्रुनिकि जानपदुलकु उन्न संबंध ऎंतो दग्गरैंदि व्यवसाय पनुल प्रारंभिंचडानिकि वारु पुन्नमिने ऎंचुकुंटारु. वारु चेसुकॊने एरुवाक पुन्नमि, मॊलकल पुन्नमिकि वंटिवि वारिलो शास्त्रविज्ञानं लेदनि कॊट्टिपारेसे अंशालुकादु. अलागे अमावास्य मंचिदिकादनि वाळ्ळु भाविंचिना इंट्लो उंटे दान्यालनु अमावस्य रोजुने बैट आरबोस्तारु. दीनिकि जानपदुलु चॆप्पेकारणं अमावास्य रोजु आरबोस्ते धान्यानिकि पुरुगु पट्टदनि वारु जीवितानुभवंतो नेर्चुकुन्न विज्ञानं. आ विज्ञानंलो शास्त्रीयत ऎंतो अमावास्यरोजु आकाशं नुंचि वच्चे ए अदृश्य किरिणालु धान्यनानिकि आ शक्तिनि कल्गिस्तायो शास्त्रवेत्तलु तेल्चालि.

अदेविधंगा सूर्योदयानिकि मुंदु निद्रलेववडं, सूर्य स्तमयंलोपु भोजनं चेयडं मंचिदनि जानपदुलु वेल संवत्सरालनुंडि चॆप्तुन्न अंशान्नि नेटि आरोग्यवेत्तलंदरू नॊक्कि चॆप्पडं मनं गमनिंचालि. अलागे उदयकालपु सूर्युनि किरणाल्लो, सायंत्रपु सूर्यकिरणाल्लो एमुंटुंदो जानपदुलु चॆप्पलेक पोयिना आ सूर्यकिरणालु मंचिवनि वारु चेसे सूर्यनमस्काराल द्वारा अर्थमवुतुंदि. पनिकिमालिन आचारालनि नेटि नागरिक समाजं कॊट्टि पडेस्तुन्ना जानपदुल आचाराल्लो कॊन्निटिनि नेटि खगोळविज्ञानं कूडा निजमनि चॆप्पे संदर्भालु ऎन्नो उन्नायि. दक्षिणं, पडमरल वैपु मात्रमे तलवुंचि निद्रिंचालि. उत्तरं, तूर्पुवैपु तलपॆट्टडं, मंचिदिकादनि चॆप्तुन्न जानपदुल माट ल्लो वास्तवं ऎंतवुंदो तॆलुसुकोवालंटे मनं, मनदेशं भूमध्यरेखकु ऎटुवैपु उन्नां, मनं निवसिंचे प्रांतं ऎटुवैपु एटवालुगा वुंदने विषयाल्नि कूडा तॆलुसुकोवलसिन अवसरं उंदि. इला जानपदुल जीवन विधानंलो आचारव्यवहाराल्लो मनकु अंतुबट्टनि खगोळ विषया लुन्नायि. अयिते वाटिलो कॊन्नि शास्त्रीयमैनवे काकुंडा कॊन्नि आशास्त्रीय मैनविकूडा उन्नायि. वाटिनि गुर्तिंचि ग्रहिंचाल्सिन अवसरं ऎंतैना वुंदि.

ई विधंगा जानपद विज्ञानंलो अंतर्भागंगा उन्न मौखिक जानपद साहित्यंलोनि गेयालु, गद्याख्यानालु, पॊडुपुकथलु सामॆतलतो पाटु, जानपदसांघिकाचाराल्लोकूडा ऎन्नो खगोळ संबंधमैन विषयालु कन्पिस्तुन्नायि. ई विषयालनु परिशीलिंचाक खगोळ विज्ञानानिकि मूलं कूडा जानपदविज्ञानमे अन्पिस्तुंदि. ऎंदुकंटे मॊदटगा मंडे सूर्यगोळान्नि, चल्लनि चंद्रगोळान्नि, होरुनकुरिसे वर्षान्नि, मलमल मंडे ऎंडल्नि, मुडुचुकुपोये चलिनि अंचना वेसिंदि जानपदुले. आ आलोचन विस्तृतरूपं दाल्चि खगोळं गुरिंचि आलोचन प्रारंभमैंदि. चॆट्टुपैनुंडि राले पंडुनु वेलसंवत्सरालुगा

ऍंदरो चूसिना न्यूटन् चूपुतो सरिकॊत्त सिद्धांतं रूपॊंदिंदि. अलागे खगोळविज्ञानपु आलोचनलु जानपदुनि तललो आरंभमैना विवेकवंतुलैन शास्त्रवेत्तल मस्तिष्काल्लोनि आलोचनल फलितंगा कॊत्तकोणालनु आविष्करिंचुकुन्नायि.

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सामेतलु पोडुपुकथल्लो खगोळपरिज्ञानं

ऐलवर्ति चंद्रमौळि

जानपदवाङ्मयं ऒककालानिकि संबंधिंचिंदि अनि खच्चितंगा चॆप्पडानिकि वीलुकादु. जानपदुलकु संबंधिंचिन भाष, साहित्यं, संस्कृति अन्नि विषयालू अनादिनुंडी उन्नवे. अंदुलोनि शाखले सामेतलु, पॊडुपुकथलु कूडा. वेदालु महर्षुलयॊक्क ज्ञानसमु दायमुलैते सामॆतल्नि सामान्यजनुल यॊक्क अनुभवसागरालुगा पेर्कॊनवच्चुनु "(कालिपु वीरभद्रुडु) अनडं ऎंतो समंजसं अनिपिस्तुंदि. तरतराल अनुभवाल्नि भद्रपरचुकॊन्न निधुलु सामॆतलु अनडं अतिशयोक्तिकादु".

जानपदुलु अक्षरज्ञानं लेनिवारैना खगोळानिकि संबंधिंचिन परिज्ञानं मात्रं अतिप्राचीनकालंनुंडे वारिकि लभिंचिंदि. आ विषयं आकाशं, वान, ऎंड, चंद्रुडु, मेघालु, इंद्रधनुस्सु, मॆरुपुलु, उरुमुलुवंटि विषयालकु संबंधिंचि वारिकुन्न अनुभवान्नि, अवगाहननुबट्टि परिशीलिस्ते स्पष्टमौतुंदि. इंदुकु संबंधिंचिन विषयालु अनादिगा जानपदुल जीवनाधारमैन व्यवसायानिकि संबंधिंचिन अनेक सामॆतलु व्यक्तं चेस्तुन्नायि.

ऎंड

सूर्युडु ऒक्को नक्षत्रंलो 14रोजुलु उंटाडु. आ कालान्नि कार्ते अंटारु. आ नक्षत्रं पेरुतो आ कार्ते पिलवबडुतुंदि. वातावरणं ऒक्को कार्तॆलो ऒक्को विधंगा उंटुंदि. रोहिणिकार्तॆलो ऎंड अधिकंगा उंटुंदि. अंदुके "रोहिणिलो रोळ्ळुपगुलुनु", "भरणि ऎंडलकु बंडलुपगुलुनु", "चित्तऎंडकु पिट ्ट तल पगुलुनु" वंटि सामॆतलु व्यवहारंलोकि वच्चिनायि.

वानः

इदेविधंगा वर्षानिकि संबंधिंचिन सामॆतलुकूडा अधिक संख्यलो कनिपिस्तुन्नायि. मृगशिरलो वर्षं अधिकंगा उंटुंदि. आ विषयं "मृगशिर कुरिस्ते मुंगारु पंडुनु", "मृगशिर कुरिस्ते मुसलि ऎद्दु रंकॆ वेयुनु" वंटि सामॆतलु तॆलुपुतुन्नायि. इंका वर्षानिकि संबंधिंचि "आरुद्रवान अदनु वान", "अन्नि

कार्तॆलु तप्पिना हस्त तप्पदु" वंटि अनेकसामॆतलु व्याप्तिलोकि वच्चिनायि. "वृष्टि प्रमाणं उत्तर हस्तलु" अन्नदि वारि नम्मकं. अनावृष्टितो बाधपडुतुन्न रैतु उत्तरकार्तॆलो वर्षं पडकुंटे दिगालु पडिपोताडु. कॊंत आश उन्नवारु हस्त चूद्दां एमैना वर्षं वस्तुंदेमो अंटारु. ई विषयं "उत्तर चूचि ऎत्तर गंप अंटे, हस्त चूसुकॊनि अंदरू पोदां अन्नाडंट" अन्न सामॆत द्वारा स्पष्टमौतोंदि. आ परिज्ञानं जानपदुनिकि उंदि काबट्टे ए कार्तॆलो वित्तिते अधिकंगा पंट चेतिकि वस्तुंदो अतनिकि बागातॆलुसु. खगोळशास्त्रपरमैन ज्ञानं अतनिकि लेक पोयिना, तनपूर्वीकुलु वारसत्वंगा अंदिंचिन परिज्ञानं उंदि. कॊन्नि कार्तॆललो वानकुरिस्ते नष्टंकूडा उंटुंदि. आ विषयंकूडा कॊन्निसामॆतलु पेर्कॊंटुन्नायि. "ज्येष्ठ चॆडकुरियुनु मूल-मुरुगकुरियुनु", "विशाखकुरिसिन विषमुपॆट्टिनट्लु", "मूलकार्तॆलो कुरिस्ते मुंगारु पाडु" अनुभवपूर्वकंगा तॆलिसिन विषयालनु सामॆतलरूपंलो तरुवाति तरालकु अंदिव्वडं जरुगुतुंदि.

व्यवसायं

वित्तडानिकि अदुनु ऎंत मुख्यमो जानपदुडैन रैतुकि बागा तॆलुसु. अदनु मुख्यत्वान्नि कॊन्नि सामॆतलु तॆलुपुतुन्नायि.

> अदुनुलो चूचि पॊदलो चल्लिना पंडुतुंदि
> ऒकनाटि अदुनु ऒकएडादि ब्रतुकु
> प्रायान पॆट्टिन पंट प्रायान कन्न कॊडुकु

वंटि सामॆतलु अदुनुकुन्न प्राधान्यतनु तॆलुपुतुन्नायि. अदुनु अन्नदि चॆप्पडानिकि नाडु शास्त्रज्ञुलु लेरु. पॆद्दलदग्गर विन्न, अनुभवं द्वारा तॆलिसिन विषयालवल्ल वारु तगिनसमयंलो तगिनपंट वित्तेवारु, मंचिदिगुबडि पॊंदेवारु. आ परिज्ञानं अंता वारि सामॆतल द्वारा तॆलुस्तोंदि.

मच्चुकि कॊन्नि —

> आरुद्रलो अड्डॆडु चल्लिते पुनासकु पुट्टॆडु पंडुतुंदि
> चिन्नपुश्यालकार्तॆलो चिट्टॆडु वड्लु चल्लिते पुट्टॆडु वड्लु पंडुनु
> मघलो मानॆडु चल्लुटकंटे आश्लेषलो अड्डॆडु चल्लुटमेलु
> मूललो चल्लिन उलवलु मूडु पुव्वुलु आरु कायलु
> उत्तर पदुनु उलवकु अदुनु
> आरुद्रलो वेसिन आरिक आकुलो पॆट्टिन अन्नमू ऒक्कटे
> भरणिकार्तॆलो चल्लिन नुव्वुचेनु कायकु बरिगॆडु गिंजलु

खगोळानिकि संबंधिंचिन परिज्ञानं उंडबट्टे जानपदुडैन व्ययसायदारुडु अन्निविधाला लॆक्कलुवेसि

पंटलु वेयगलिगाडु. गडियारालु, केलंडर्लु लेनि, आधुनिकविज्ञानं विकसिंपनि नाटि कालंलो कूडा पंटलु ऐप्पुडुवेय्यालि, ऐप्पुडु कोतकोय्यालि, ऐप्पुडु वित्तिते पंटदिगुबडि अधिकंगा उंटुंदि अन्न परिज्ञानं रैतुकि उंडडं गमनिंपवलसिन विषयं. आ परिज्ञानं जानपदुल विज्ञानंलो भागमैन सामेतल्लो निक्षिप्तमै तरानिकि तरानिकि अंदिंचडं जरिगिंदि.

जानपदरैतु वर्षंकोसं ऐदुरुचूडडं सहजं. वर्षं पडितेने, पंटलु पंडितेने तिनडानिकि तिंडिलभिस्तुंदि. वर्षंकोसं निंगिकेसि चूडडंवल्ल कालक्रमंलो आकाशं ऐलाउंटे वर्षं कुरुस्तुंदि, मेघाल रंगु ऐला उंटे वर्षं वस्तुंदि, अवि ए दिक्कुलो उंटे वर्षंवस्तुंदि, चंद्रुडु ऐलाउंटे वर्षंवस्तुंदि, इंद्रधनुस्सु ऐटुवैपु उंटे वर्षं ऐलापडुतुंदि, उरुमुलु ऐटुवैपु उरिमिते वर्षंपडुतुंदि, ऐटुवैपु मेरिस्ते वर्षंवस्तुंदि अन्न विषयालु पूर्वीकुलु चेप्पडंद्वारा लेदा अनुभवं द्वारा तेलुस्तुंदि. अवे विषयालु सामेतललो निक्षिप्तमै दर्शनमिस्तायि.

आकाशं

आकाशं उदयं ऐर्रगा उंटे वर्षं वस्तुंदनि, सायंकालं आकाशं ऐर्रबडिते वान रादनि नम्मकं. आ विषयान्नि किंदि सामेतलु चेबुतुन्नायि.

ऐर्रनि आकाशानिकि बर्रुनवान
कन्नु ऐर्रबड्डा-मिन्नु ऐर्रबड्डा कारक मानदु
निंगि सायंत्रं ऐर्रनयिते वच्चे वानकूडा रादु

मेघालु

मेघालु कारुनलुपुगा उंटे वर्षंरादनि नम्मुतारु. नव्वु मोगंतो उंडे वाडि दानगुणंतो पोल्चि

नल्ल मोगुलु वान कोट्टदु-नव्वुमोगमुवाडु दानमु चेय्यडु

अन्न सामेत द्वारा चक्कगा पेर्कोवडं जरिगिंदि. उत्तरं, दक्षिणं, पडमर दिक्कुललोनु, ईशान्यं मूललोनु मब्बुलु उंटे वान वस्तुंदनि कोन्नि सामेतलु पेर्कोंटुन्नायि.

दक्षिणान मब्बु वालिते वान तप्पदु
पडमर पूरेडु पिट्टंत मोयिलु, बंडलु दोर्लिंचे वान
उत्तरान मब्बु एलिते ऊरके पोदु

अन्नवि मेघालकु संबंधिंचिन कोन्नि सामेतलु.

चंद्रुडु

चंद्रुनिचुट्टू वृत्ताकारंगा ओकवलयं एर्पडुतुंदि. दानिनि गुडि अंटारु. आ गुडि दूरंगा कडिते वान

दग्गर वस्तुंदनि, दग्गर कडिते वान दूरमनि अंटारु. आ विषयान्नि

दूरं गुडि कडिते दग्गर वान-दग्गर गुडि कडिते दूरं वानु

अन्न सामॆत स्पष्टं चेस्तुंदि.

उरुमुलु, मॆरुपुलु

उरुमुलु, मॆरुपुलु खगोळंलोनि विशेषाले. वीनिनि आधारंगा चेसुकॊनि वर्षंरावडान्नि राकपोवडान्नि कूडा कॊन्निसामॆतलु पेर्कॊंटुन्नायि.

पडमट मॆरिसिन पदि गडियलकु वर्षं

अनि पडमटि दिक्कुलो मॆरिसे मॆरुपु तॊंदरलो वच्चे वर्षं राकनु तॆलियजेस्तुंदि अनि ई सामॆत तॆलियजेस्तोंदि. “मॆरुपुकॊद्दी वर्षमु” मरो सामॆत अधिकंगा मॆरिस्ते अधिकंगा वर्षं कुरुस्तुंदनि तॆलुपु तोंदि. “उरिमिन मब्बु कुरियक मानद” “उरिमिन मब्बु तरिमिन पामु ऊरकपोवु” अन्न मरि कॊन्निसामॆतलु उरिमिते तप्पक वान वस्तुंदनि चॆबुतुन्नायि. कॊन्नि सामॆतलु इंदुकु भिन्नमैन भावान्नि कूडा व्यक्तं चेस्तुन्नायि. “वट्टिगॊड्डुकु अरुपुलु मॆंडु” अने अर्थं वच्चेविधंगा अवि कनिपिस्तुन्नायि.

वानकन्ना मुंदु उरिमे उरुमुनु, माटकन्ना मुंदु एड्चे आडदान्नि नम्मरादु

“वट्टि गॊड्डुकु अरुपुलेक्कुव वानलेनि मब्बुकु उरुमु लेक्कुव” वंटि सामॆतलु तॆलिपे विषयं भिन्न ऋतुवुलकु संबंधिंचिंदिगा भाविंचवच्चु.

इंद्रधनुस्सु

वर्षाकालंलो अप्पुडप्पुडु आकाशंलो इंद्रधनुस्सु एर्पडुतुंदि. इंद्रधनुस्सु एर्पडडान्नि बट्टि कूडा वान रावडान्नि ऊहिस्तारु. तूर्पु पडमर दिक्कुल्लो इंद्रधनुस्सु एर्पडिते वर्षं बागा पडुतुंदनि चॆप्पे कॊन्नि सामॆतलु कनिपिस्तुन्नायि.

तूर्पुन इंद्रधनुस्सु दूरान वान
तूर्पुन कॊर्रु वेस्ते दुक्किटॆद्दु रंकॆ वेस्तुंदि
पडमट कॊर्रु बडिते पंदिळ्ळमीद राजनालु पंडुतायि
पडमट कॊर्रुवेस्ते पाडिआवु रंकॆ वेस्तुंदि

चिन्न वान पडिन तरुवात कूडा कॊन्नि समयाल्लो इंद्रधनुस्सु एर्पडडं मनं चूडगलं. कॊर्रुपडिंदि इक वर्षंलेदु अनडं कूडा विंटुंटां. ई विषयालु ऒक्को ऋतुवुलो ऒक विधंगा उंटायि.

इदेविधंगा पॊडुपुकथलु कूडा कॊंतवरकु खगोळानिकि संबंधिंचिन समाचारान्नि कलिगिउंडडं गमनिंचदगिन विषयं. जानपदुलु तम विज्ञानान्नि, प्रज्ञापाटवान्नि व्यक्तीकरिंचि, तद्वारा विनोदान्नि, विकासान्नि पॊंदडानिकि उपयोगपडेवि पॊडुपु कथलु. पॊडुपुकथल्लो भाष स्पष्टंगा सरळंगा उंटुंदि. वाटि निर्माणं ज्ञापकं उंचुकोवडानिकि तगिनविधंगा उंटुंदि. अंदुवल्ल आनोटा ईनोटा व्याप्तिचॆंदडं सुलभं. ऒकतरंनुंडि मरॊकतरानिकि संक्रमिंचडं कूडा सुलभं.

पॊडुपुकथल्लो खगोळानिकि संबंधिंचिन आकाशं, सूर्युडु, चंद्रुडु, नक्षत्रालु, इंद्रधनुस्सु, मेघं वंटि विषयालकु संबंधिंचिन विषयालु उन्नायि.

ऊरिकंता ऒक्कटे दुप्पटि (आकाशं)
इंतिंत गुडि कादु ईश्वरुनि गुडि कादु
कंचु कॊप्पर कादु कदिलिंच तरं कादु (आकाशं)
आकाशमंता अंगळ्लु (नक्षत्रालु)
अंदगाडु रोजुको आकारंगा मारुताडु
आखरिकि निंडुसुन्नवुताडु

अनि चंद्रुनिलो वच्चे मार्पुल्नि ऒक पॊडुपु कथ चॆबुतॊंदि.

अक्कडक्कडि बंडि-अंतराल बंडि
मद्दूरि संतलोन-मायमैन बंडि (सूर्युडु)

इदेविधंगा कालानिकि संबंधिंचिन संवत्सरं, नॆललु, दिनालनु तॆलिपे पॊडुपुकथलु कूडा उन्नायि. इविकूडा खगोळ संबंधमैनवे.

ईटिनुंचि चूस्ते गुंडु
आडिकि पोयि चूस्ते पंडु
पंडुकु पन्नॆंडु ऒप्पुलु (नॆललु)
ऒप्पुकु मुप्पै गिंजलु (दिनालु)
ऒक पंडु पंडुकु पन्नॆंडु तॊनलु
तॊनकु मुप्पै गिंजलु
पदहैदु नलुपु पदहैदु तॆलुपु (कृष्ण, शुक्ल पक्षालु)

जानपद वाङ्मयंलो मुख्यमैन सामॆतलु, पॊडुपु कथल्लो खगोळानिकि संबंधिंचिन विषयान्नि स्पृशिंचडं ई व्यासं उद्देशं.

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जानपदुल नम्मकाल्लो खगोळविज्ञानं

सत्यभूषण राणि

खगोळशास्त्रं (astronomy) अंटे नक्षत्रालनि लॆक्कपॆट्टडं अनि अर्थं. Astro अंटे नक्षत्रं nomy अंटे लॆक्कपॆट्टडं. ख अंटे स्पेस् (space) गोळं अंटे स्पियर् (sphere) ख = आकाशंलो, गोळं = अंतरिक्ष संचारमूर्तुलैन सूर्य चंद्रादि, नक्षत्रालु उपग्रहालु मॊदलैन गोळालु. आकाशंलो मनकि कनिपिंचे सूर्य, चंद्र, ग्रह नक्षत्रादुल गुरिंचि चॆप्पे विज्ञानपरमैन अध्ययनमे खगोळशास्त्रं.

खगोळ परिशोधनलो विशेषकृषि चेसिन न्यूटन्, कोपर्निकस्, कॆप्लर्, गॆलिलियो, ऐन्स्टयिन् मॊ।। ई ऐदुगुरिवल्ल खगोळशास्त्रं ऐंतो आभिवृद्धि साधिंचिंदि. प्रस्तुतं मनं अनुभविस्तुन्न विज्ञानं (सैन्स्) अंता वीरि पुण्यमने चॆप्पालि.

सामान्य जनजीवनानिकि रमणीयदर्पणमेकाक आनंदं, आवेशं, सुखं, दुःखं, भयं, भक्ति अनुरागं, अपकारं, व्यामोहं, वात्सल्यं, क्रोधं मॊदलैन मानवस्वभावाल सहजव्यक्त रूपमे जानपद वाङ्मयं. ई जानपद साहित्यं मानवचरित्रनु अर्थं चेसुकोवडानिकि तोव चूपिस्तुंदि.

जानपदुल जीवितान्नि प्रतिबिंबिंपचजेसे जानपद विज्ञान प्रक्रियललो नम्मकानिकि विशिष्ट स्थानमुंदि. नम्मकानिकि जीवितानिकि चाल दग्गरि संबंधमुंदि. मानसिकानुभवंनुंचि नम्मकालु उद्भविं चायि. इवि मानव जीवितंलो असाधारण पात्र वहिस्तुन्नायि.

एदैन ऒकतरंलो वैयक्तिकंगागानि सामूहिकंगागानि तॊलिसि कानि तॊलियकगानि अंकुरिंचिन ऒक अंशं तरुवात तरालवारिकि अनु करणीयमै आचरणयोग्यमै संप्रदायकंगा संक्रमिंचि नम्मकं अने सामूहिकमुद्र वेसुकुंटुंदि. जानपदुल नम्मकालु लेदा विश्वासालु अने पदान्नि folk belief अंटामु. ई नम्मकालु जन्मतः वच्चिनवि, अनुभवपूर्वकंगा वच्चिनवि अनि रॆंडुरकालुगा चॆप्प वच्चु. जन्मतः वच्चिन नम्मकाल्लो खगोळानिकि संबंधिंचिनवि कूड उन्नायि.

ग्रहान्निबट्टि सूर्युडु आयाराशुल्लो संचरिंचडान्निबट्टि पंडुगदिनान्नि इंद्रधनुस्सु,

आकाशं रंगुनुबट्टि, उरुमुलु, मेरुपुल्निबट्टि, मेघान्निबट्टि वानराकडनि, तम जीवितानुभवान्निबट्टिमतविश्वासाल्नि निर्णयिंचुकोन्नट्लु तेलुस्तुंदि.

कोळ्ळुकूसेवेळनि तेल्लवारे समयमनि
काळ्ळुकालेवेळनि मध्याह्नमनि
दीपंपेट्टेवेळ सायंकालमनि लेदा पोद्दुकूकडंअनि
मंचालदग्गरिकिपोयेवेळ रात्रिकि चिह्नमनि

दिनमु, पूट, घडिय, निमिषं, क्षणं, अमावास्य, पौर्णमि, नेल, संवत्सरमनि कालान्नि (समयान्नि) सूचिंचे कोलतलु. सूर्युडु, चंद्रुडु, अंगारकुडु, बुधुडु, बृहस्पति, शुक्रुडु, शनि, राहु केतुवुलु अने ग्रहाल्लो कोन्नि शुभग्रहालु, कोन्निक्रूर ग्रहालु न्नायि. क्रूरग्रहाल्लो अंगारकुडु, शनि मुख्यमैनवनि चेप्तारु.

ग्रहालु, ग्रहणालु

1. ग्रहालु सरिगा लेकपोते कष्टनष्टालोस्तायनि नम्मुतारु.
2. ऐक्कडिकि पोयिना आखरिकि रामेश्वरं पोयिना शनि तप्पदंटारु. शनि खच्चितंगा एडेळ्ळु पट्टि पीडिस्ताडनि ऐन्नि तीर्थयात्रलु चेसिना समुद्रालु दाटिना शनि बारिनुंचि तप्पिंचुकोलेमनि नम्मकं.
3. सूर्यास्तमयमयेटपुडु इंटिवेनुक तलुपु मूस्ते धनलक्ष्मि बयटिकि पोदनि नम्मकं.
4. सूर्युनि मुखान उम्मेस्ते तन मीदने पडुतुंदि. नेरुगा कंटितो कूड चूडलेनि आकाशंलो उंडे सूर्युनिपै उम्मिवेस्ते तिरिगि अदि वेसिन वारि मुखंपैने पडुतुंदि. अंटे गोप्प वारिनि (उन्नतमैन वारिनि) अवमानिंचालनुकुंटे वारे अवमानाल पालवुतारने भावं.
5. अंगारकजपंचेस्ते बाधलु तोलिगिपोतायि अनि नम्मकं. अंगारक ग्रहान्नि देवुनिगा भाविंचि चेसे जपं इदि. साधारणंगा अप्पुल पालैन वाळ्ळु ई जपंचेस्ते रुणबाधलनुंडि विमुक्तुलवुतारनि नम्मकं.
6. ग्रहण समयंलो आहार पदार्थालु वंडडं कानि तिनडं कानि मंचिदि कादने नम्मकं.
7. ग्रहण समयंलो गर्भिणी स्त्रीलु बयटिकिवस्ते गर्भस्थ शिशुवुकि हानि कल्गि अवयवलोपंतो पुडताडनि नम्मकं.
8. पदि पेर्लतो उन्न अर्जुनुनि श्लोकं चदिविते पिडुगु पडदनि नम्मकं.

दिक्कुलु

1. उत्तरदिक्कुकि तलपेट्टि पडुकोकूडदु.

2. तूर्पु वाकिलि चालमंचिदि.
3. उत्तरंवैपु अरटिगेलवेस्ते चालमंचिदि.
4. वंटगदि आग्नेयंलोने उंडालि.
5. ईशान्यंवैपु बरुवुंडकूडदु.
6. दक्षिणंवैपुनुंडि प्रेतात्मलु मनिषिनि गमनिस्तायनि नम्मकं अंदुके मंत्रगाळ्ळंदरु दक्षिणंवैपुके नमस्करिंस्तुंटारट.

नक्षत्रालु

अज्ञानं नुंचे विज्ञानं आविर्भविस्तुंदि. नक्षत्रालु शाश्वत ज्योतुलैनप्पटिकि चीकट्लोने वेलुगुतायि. शुभकार्यालकु नक्षत्रं बागुंदो लेदो अडिगि तेलुसुकुंटुंटामु. चेप्पे पुरोहितुडिकि विंटुन्न वरुडिकि (पगटि-विवाहाल्लो) अरुंधतीनक्षत्रं कनिपिंचकपोयिना पुरोहितुड्डु चूपिंचिन चोटुलो उंदनुकोवडं स्थूलारुंधती न्यायं. विधिलेक आमोदिंचडं, लेकपोते तप्पनिसरिगा नम्मटं अंतेकाक चूसी चूडकुंडा तेलिसी तेलियकुंडा चेप्पेमाटल्नि नम्मडान्नि स्थूलारुंधती न्यायमंटारु.

1. तोकचुक्क आकाशंलो कन्पिस्ते गोप्पव्यक्तियोक्क अंतर्थानमनि नम्मकं.
2. नक्षत्रालु रालुतुन्नट्लु कललो कन्पिस्ते निजजीवितंलो दुःखं कल्गुतुंदि अनि नम्मकं.
3. अश्वनि, रोहिणी नक्षत्रालु शुभकार्यालकु मंचिवनि नम्मकं.
4. मूलानक्षत्रं शुभकार्यालकु चेड्डदनि नम्मकं.
5. उत्तराषाढ, पूर्वाषाढलागा कलिसुन्ना नष्टं - लाभं लेदने नम्मकं.

ई रेंडुनक्षत्रालवल्ल मानवजीवितंलो स्पष्टमैन लाभनष्टालु रेंडु लेवु. जंटगा पक्कपक्कने वुंटायि. जंटगा वच्चे रुग्मतल्नि ई नक्षत्रालकि मुडिवेसि (पोल्चि) चेप्तारु.

उदा।। वांतुलु , विरोचनालु मो।।

अमावास्य-पौर्णमिलु

ई अमावास्य मनकु चाल चेड्डरोजु. अरववाळ्ळकि चाल पवित्रमैनरोजु. सूर्युनि गमनंमीद आधारपड्ड कालप्रमाणं मीद विश्वासमुन्न तमिळुलु मात्रं अमावास्यनि पुण्यदिनंगा भाविस्तारु. मंचिकैना चेडुकैना मनदि चांद्रमानं अंटे चंद्रुडि गमनं मीद आधारपड्डपंचांगं काबट्टि मन नम्मकालु वेरुगा उंडडंलो आश्चर्यं लेदु.

1. अमावास्यरोजु मरणिस्ते नरकानिकि पोताडनि नम्मकं.
2. अमावास्यरोजु पुडिते दोंगलवुतारनि नम्मकं.
3. अमावास्यरोजु क्षवरं चेसुकोरादु अनि नम्मकं.

4. अमावास्यरोजु ऑंटरिगा दूरप्रयाणालु चेय्यकूडदनि नम्मकं.
5. अमावास्य मुंदु अत्तिंटिकि पोकूडदु.
6. पौर्णमिरोजु क्षवरं चेसुकुंटे अंदमैन तलकट्टु वस्तुंदनि नम्मकं.
7. पौर्णमिरोजु पुट्टिंटिनुंचि बयटकु वॆळ्ळ कूडदनि नम्मकं.
8. पौर्णमिरोजु पुट्टिनवारिकि अष्टैश्वर्यालु प्राप्तिस्तायनि नम्मकं.
9. अमावास्य पौर्णमिरोजु चॆट्लॆक्करादु.

वान

ग्रहाल्निबट्टि, आया राशुल्लो सूर्युडु संचरिंचडान्निबट्टि, चंद्रपरिवेषंबट्टि, इंद्रधनुस्सु, आकाशंरंगुनुबट्टि उरुमुलु, मॆरुपुल्निबट्टि, वानराकड निर्णयिंचारु. सूर्युडु, बुधुडु, चंद्रुडु कलिस्ते वान वस्तुंदंटारु.

1. वानराकड प्राणं पोकड तॊलियदनि नम्मकं.
2. तल्लि मुखं चूडनि बिड्ड वानमुखं चूडनिपैरु लेदनि नम्मकं.
3. आरुद्रवान अदरुवान अनि नम्मकं.
4. आरुद्रलो वान कुरिस्ते दारिद्र्यमुंडदनि नम्मकं. आरुद्रलो पडेवान अदरगॊड्तुंदनि अनुभवज्ञु लंटारु. ई वानतीव्रतनुबट्टि बागुपडिना, नष्टपोयिना अनि नम्मुतारु. सहजंगा ई वान रैतुलकि दारिद्र्यं लेकुंडा चेस्तुंदनि नम्मकं.
5. चंद्रुडिकि दूरंगा गुडिकडिते दग्गर्लो वान कुरुस्तुंदनि नम्मकं.
6. आकाशं ऎर्रबडिते वान वस्तुंदनि नम्मकं.
7. पॊद्दुन्नेवच्चिन वान पॊद्दुगूकिवच्चिन चुट्टं पोरु अने नम्मकमुंदि.
8. ऎसट्लोबिय्यं तिंटे पॆंड्लिनाडु वानवस्तुंदनि नम्मकं.

कार्तॆलु

1. भरणि ऎंडलकि बंडलुकूड पगिलिपोतायि.
2. भरणि कृत्तिकलो कुरिसे वान पंटलकु मंचिदि.
3. मृगशिर कुरिस्ते बंगारं पंडुतुंदि.
4. पूर्वाषाढ वानलकि दिब्बलु कूड करिगिपोतायि.
5. आश्लेषलो वानकुरिस्ते अरिकालु तेमंते. उरुमुलु मॆरुपुलु दंडिगावुन्ना गालिकि मब्बुलेचिपोतुंदि. नालुगु चिनुकुलु पडि वच्चिनंत त्वरगा आगिपोतुंदि.
6. वैशाख वर्षं व्याधुलकि मूलं.
7. अश्वनिलो स्वल्पंगा वान कुरुस्तुंदि.

8. रेवतिकार्तेलो वानपडिते अन्नि पंटलकु मेलु अनि रैतुल नम्मकं.

ई विधंगा जानपद नम्मकाल्लो खगोळ विज्ञानानिकि संबंधिंचि नवि ऎन्नो उन्नायि (कन्पिस्तुन्नायि).

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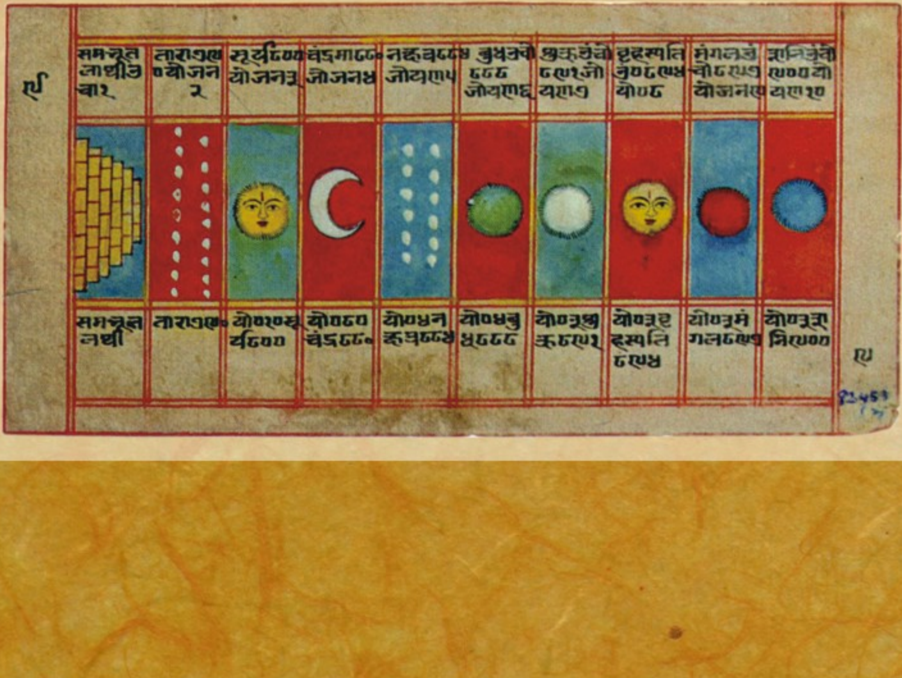

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