

Knowledge of Planets in the Third Millennium BC

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SUMMARY

Recent advances in archaeology, chronobiology, and the history of science have made it possible to decipher hitherto obscure passages related to planets in the Indian books of the third millennium BC. A brief summary of this knowledge is presented. It is argued that the period of Mercury was obtained near the end of the Vedic age in India. This was celebrated in terms of the famous myth of Vishnu striding across the heavens in three steps. Once the planetary model was in place, the gods of the planets were transferred into the inner psychological world.

1 INTRODUCTION

It is generally accepted that the knowledge of the shifting over time of the constellations with respect to seasons is very old (e.g. de Santillana & von Dechend 1969; Kramrisch 1981). There is also considerable indirect evidence that the astronomy of the mean motions of the Moon, where these motions are seen against a background of 27 or 28 constellations (nakṣatras), originated no later than the middle of the third millennium BC. But what about the planets? Since the planets move through the nakṣatras and Venus and Jupiter are brighter than any of the stars, observation of the nakṣatras presupposes that the planets have been noticed. An astronomy of the mean motions of the Sun and the Moon, against the background of nakṣatras, is described in the *Vedāṅga Jyotiṣa*, which dates back to about 1350 BC (Sastry 1985; Kak 1995). The *Vedāṅga Jyotiṣa* does not mention the planets, but this is because it is concerned only with the motions of the Sun and the Moon related to fixing the calendar.

In recent work (Kak 1994a, b) internal evidence in the organization of the Vedic books and references in later literature have been used to establish that the Vedic people had obtained the periods of the planets by 1900 BC. In another study, Frawley (1994) has provided literary evidence showing that the planets were known in the early Vedic literature. In this paper we present further evidence that supports the thesis that the knowledge of planetary periods is to be dated prior to 1900 BC, the *terminus ad quem* of the Rigvedic era (see e.g. Feuerstein, Kak & Frawley 1995). Since the bulk of the Rigvedic hymns are believed to date long before this epoch, we judge its astronomy as belonging to the third millennium BC.

The Rigveda (e.g. RV 1.105.10) describes the five planets as residing in the mid-heavens. The earliest explicit reference to the planets as a group occurs in the Atharvaveda (AV). Note that Atharvaveda is dated about the same era as the Rigveda. In AV 19.9 we have:

May Mitra, Varuṇa, the Sun, the destroyer, the portents from the earth and the atmosphere, and the planets moving in the sky (*divicarā grahāḥ*) bring well-being to us. (AV 19.9.7)

May the planets belonging to the Moon, the Sun, and Rāhu bring well-being. May the deadly comets and the Rudras of the keen brightness bring well-being. (AV 19.9.10)

Here Mitra, Varuṇa, and the Rudras are Vedic gods; Mitra and Varuṇa represent day and night and Rudra is the Vedic name for Shiva; Rāhu is the ascending node of the Moon; the term for planet is *graha*.

Elsewhere, there is mention of the 34 lights, which appear to be the 27 nakṣatras, the five planets, the Sun and the Moon. The Moon is the fastest-moving of the heavenly bodies, and so it is compared to the male who activates or fertilizes the other heavenly bodies with which it comes in contact. The Rigveda speaks of the five bulls of heaven, which appear to be the five planets. Being faster than the fixed stars, the planets were, in turn, compared to bulls.

Another equally old text, Taittirīya Saṃhitā 2.3.5, speaks of the 33 daughters of Prajāpati, the personification of time here, that are given in marriage to Soma, the Moon, viewed as king. These are the 27 nakṣatras, the five planets, and the Sun. The Sun as the bride, Sūryā, is described in the Rigveda and the Atharvaveda. This also suggests a knowledge of eclipses. A solar eclipse is described in the Rigvedic hymn 5.40. Sengupta (1947) has tried to date this eclipse, but the dating is based on several rather arbitrary assumptions. A theory of Vedic astronomy that assumes an early knowledge of eclipses was presented by Shamasastri (1938), but it has not been critically evaluated.

That astronomical phenomena were cast in terms of myths is now well known (e.g. Shamasastri 1938; de Santillana & von Dechend 1969). The rivalry between the families of Aṅgirasas and the Bhr̥gu, mythical figures in the Rigveda, represents the motions of Jupiter and Venus. This is clear in later accounts where Bṛhaspati (Jupiter), the priest of the gods because its motion is closest to the ecliptic, is an Aṅgiras and Kavi Uśanas or Śukra (Venus), a Bhr̥gu, is the priest of the Asuras (demons).

The idea of an eclipse was expressed by the notion of Rāhu seizing the heavenly body. The fact that *graha*, 'seize', is the name used for planets right from the time of Atharvaveda suggests that the waxing and waning of the two inferior planets, Mercury and Venus, as well as the change in the intensity of the others, was known.

This article should be seen as a companion to the previous paper by the author in this journal (Kak 1995). The paper begins by summarizing connections between astronomical and physiological phenomena that appear to have had a role in the development of the earliest astronomy. It is proposed that such connections might have provided the motivation to obtain planetary periods. The question of the period of Mercury, known in Indian astronomical literature as *Budha*, is then taken up. It is argued that, since Mercury is also called Vishnu, the famous Vedic myth of Vishnu covering the Universe in three steps represents three periods of the planet that equal the lunar year.

2 THE SIDEREAL CALENDAR

The Vedic books are in an esoteric idiom where the connections between the outer and the inner worlds are sketched out. The Vedic system of knowledge is based on the equivalences between stars (*adhidaivika*), living beings (*adhibhautika*), and man's cognitive structure (*adhyātmika*).

The stars in the sky were pictured as belonging to the figure of a cosmic man. This metaphor represents relationships in the Universe across scales. It appears that the actual connection between stars and living beings was based on the identity between basic biological rhythms and astronomical periods.

For example, fiddler crabs, in their natural habitat on the shore, burrow themselves during high-tide, emerging when the tide recedes in order to feed, mate, and challenge each other. When these crabs are removed to the laboratory and held in an incubator with constant conditions, they still run around in their containers during the time of each low tide. According to J.D.Palmer, "So accurate are their responses that the students working in the lab use the crab behavior patterns, rather than the tide tables of the Geodetic Survey, to plan their field trips to the crab's old home 30 miles across Cape Cod... How do crabs do it? It is not yet known." (Palmer 1976) Not only crabs but all living creatures have extremely precise inner cycles.

In humans the menstrual period has by tradition been taken to correspond to the Moon's motion; in fact, 'menses' means lunar month. New research supports this:

In a study of a number of women with variable onset of menstrual periods, artificial illumination of the bedroom through the 14th to 17th nights following the onset of menstruation resulted in the regularization of the period, with the period length coming very close to 29.5 days, the natural synodic month. That this period is a biologically significant one for the human species is further suggested by the fact that the average duration of pregnancy (from ovulation to birth) in the human is rather precisely nine 29.53 synodic months. *Encyclopaedia Britannica* (1994; Macropaedia article on Animal Behaviour, p. 761)

One should note the distinction between lunar and free-running circalunar cycles. A lunar cycle is in step with the motions of the Moon. The menstrual cycle is a free-running cycle with the same period as that of the Moon. One might assume that entrainment to the lunar cycle was triggered by moonlight. With the living under artificial lights of modern times, it is easy to see how the direct correlation with the Moon's motion has been lost.

It has been a surprise (e.g. Winfree 1987) that the fundamental circadian rhythm inside us is not the 24-hr one related to the motion of the Sun, but rather the 24 hr 50 min one according to the period of the Moon, since each moon-rise is 50 min. later than the preceding one. We share this approximately 24-hr-50-min clock with monkeys and other non-humans.

This 24-hr-50-min clock was discovered by the moderns only about 30 years ago, in experiments on a blind squirrel monkey. The activities of this monkey were recorded night and day for a period of three years, and it was discovered that her rhythms drifted later each day by an average of about 46 min. Was the deficit of 4 min from the moon-rise period due to the reference of the motion with respect to the stars, we do not know. The monkey kept her own time, unaffected by the activities around her.

That this connection might have been known in the ancient world is suggested by the fact that the Moon (Soma) is called the “lord of speech” (Vācaspati) in the Rigveda (RV 9.26.4; 9.101.5). It is taken to awaken eager thoughts (RV 6.47.3). Many references connect the Moon with the mind. This is stated most directly in the Śatapatha Brāhmaṇa 8.1.2.7 as the slogan: “the mind is the Moon.”

It is reasonable to assume that, with their emphasis on time-bound rituals and the calendar, the Vedic Indians of the third millennium BC knew many biological periods. Having seen rhythms that matched closely the principal astronomical periods, they must have further assumed that there were less-obvious cycles that were matched to the motions of the other heavenly bodies. This is likely to have been a motivation for determining the planetary periods.

The gestation periods for mammals also have intriguing relationships to astronomical numbers. Perhaps such connections were the basis for marking out certain animals as special symbols. The averages of some of the gestation periods are as follows.

ass	365 days
sacred baboon	183 days
cow	284 days
dog	61 days

It is no wonder, then, that the ass is used as a symbol for the year in Śatapatha Brāhmaṇa, an ancient Indian text from a period somewhat later than the early Vedic age. Likewise, the fact that the gestation period for the sacred baboon is exactly half of the solar year is likely to have played a role in the special significance attached to it by the Egyptians. The fact that the gestation periods for the human and the cow are about the same may be another reason for the sacredness assigned to the cow. In other words, knowledge of biological periods appears to have played a role in the choice of some as sacred symbols.

The importance that the Moon has on the inner biological clock of humans might have played a role in the adoption of the luni-solar calendar in India. Its use can be seen at least as early as the third millennium BC. The evidence for this comes from the mention in the right context of several astronomical terms in the Rigveda, which are defined precisely in the later Vedāṅga Jyotiṣa.

3 THE NAMES OF THE PLANETS

Although it is certain that the planets had been studied by the Rigvedic people, we do not find a single place in the texts where the names are listed together. The list below brings together some of the names, together with the ascribed colours, used in a variety of places including the later Purāṇic literature.

MERCURY. Budha, Saumya, Rauhiṇeya, Tuṅga (*yellow*)

VENUS. Uśanas, Śukra, Kavi, Bhṛgu (*white*)

MARS. Aṅgāraka, Bhūmija, Lohitāṅga, Bhauma, Maṅgala, Kumāra, Skanda (*red*)

JUPITER. Bṛhaspati, Guru, Āngiras (*yellow*)

SATURN. Śanaīścara, Sauri, Manda, Paṅgu, Pātaṅgi (*black*).

There is one other name that is not well attested, namely Vena for Venus. Mercury is viewed as the son of the Moon by Tārā, the wife of Jupiter, or the nakṣatra Rohiṇi (Aldebaran); Venus, as the son of Bhṛgu and the priest of the demons; Mars, as the son of the Earth or Shiva; Jupiter, as the son of Āngiras and the priest of the gods; and Saturn is seen as being born to Revatī and Balarāma or to Chāyā and the Sun. Saturn is described as the lord of the planets, lord of seven lights or satellites, and the slow-goer. Since the Indian calendar was reckoned according to the constellation at the vernal equinox, one may assume that the name son of Aldebaran implies that Mercury was first noted during the era of 3400–2210 BC when the vernal equinox was in the Pleiades.

Jaiminigr̥hyasūtra (Caland 1984, p. 60) gives the following equations between the planets and the Vedic gods: the Sun is Shiva; the Moon is Umā (Shiva's wife); Mars is Skanda, the son of Shiva; Mercury is Vishnu; Jupiter is Brahman (symbolizing the entire Universe); Venus is Indra; and Saturn is Yama, the 'dual' god (death). The colours assigned to the planets are from the same source.

One may speculate that the identification of Saturn with Yama arises out of the fact that the synodic period of Saturn is the 'dual' to the lunar year: 378 days of Saturn and 354 days of the lunar year with the centre at the 366-day solar year.

There are parallels between the Indian myths and those from Babylon, Greece, and other cultures but these will not be taken up in this article. Further discussion of this question can be found elsewhere (de Santillana & von Dechend 1969).

4 ON THE IDENTIFICATION OF MERCURY WITH VISHNU

Mercury's identification with the god Vishnu, an important figure in the Rigveda, is of particular significance. Vishnu is the younger brother of Indra in the Rigvedic era, and Indra is sometimes identified with the Sun. The most essential feature of Vishnu is the three steps by which he measures out the Universe (e.g. RV I.154). Two of these steps are visible to men, but the third and highest step is beyond the flight of birds and mortals (RV I.155, 7.99). In later mythology it is explained that Vishnu did this remarkable act in the incarnation as Vāmana, the pygmy. This agrees with the identification with the small Mercury.

Now what do these steps mean? According to late tradition, Vishnu is a solar deity and so these three steps represent the sunrise, the highest ascent, and the sunset. Another equally old interpretation is that the three steps represent the course of the Sun through the three divisions of the Universe: heavens, Earth, and the netherworld.

Both of these interpretations, however, appear unsatisfactory. Neither of these interpretations squares with the special significance attached to the third step. Nor do they explain the putative identity of Mercury with Vishnu.

An explanation becomes obvious when we examine details of the ancient Vedic altar ritual (Kak 1992, 1993a, b, 1994a, b). The Universe was

represented in time symbolically by the number 360. The year was divided into two halves: 183 days for the northern course of the Sun and 183 days for the southern course of the Sun. The symbolic year of 360 days was divided further into three parts:

sky	261 days
space	78 days
earth	21 days.

It was proposed earlier that the sky number of 261 was chosen as the mean of the numbers 183 and 339, where the latter number is the number of 'sun-steps' across the sky on an average day (e.g. Kak 1994b). Such a division was mapped into various kinds of altars, which we shall not describe here but whose details may be found in Sen & Bag (1983).

Since Vishnu is Mercury, it is natural to suppose that the three steps of Vishnu are nothing but the three revolutions of Mercury in a cycle of 261 sky days. With this supposition, the period of Mercury will be 87 days. This is precisely the value indicated by the Rigvedic astronomical code (Kak 1994b). Furthermore, the synodic period of Mercury is taken to be 118 days in the Rigvedic code, and three such periods equal the 354 lunar days or 360 tithis. It appears that this dual relationship led to the great importance given to the myth of the three steps of Vishnu. Of course the figures for the periods are only approximate, but, as expected, at the first determination of these numbers an attempt was made to connect them with the basic numbers of 261 and 354.

The explicit name of Budha for Mercury appears in a text called *Pañcavimśa Brāhmaṇa* (PB) (see Caland 1982, pp 620–621), which is dated definitely after 1900 BC since it has an account of a journey to the source of Sarasvatī from the place where the river is lost in the desert (PB 25.10). PB 24.18 speaks of Budha in connection with a 61-day rite. Three such rites imply a total of 183 days, which equals the days exclusively devoted to the heavens. This appears to be the analogue, in the field of ritual, of the three steps of Vishnu covering the heavens.

5 FROM MYTH TO SCIENCE

We have presented evidence showing that an understanding of the motions of the planets arose at some time during the unfolding of the Rigvedic period. For example, Venus is described in early Vedic mythology in terms of the twin *Aśvins*, the morning and evening stars, just as Homer later describes it as the pair *Hesperus* and *Phosphorus*. This parallel indicates an early Indo-European basis to this myth.

The main characters in the planetary myths are Jupiter and Venus, as is to be expected for the two brightest planets. Venus, in its earlier incarnation as the *Aśvin* twins, was seen as being born to the Sun. Mercury as Vishnu is *Upendra*, the younger brother of the *Indra*, here a personification of the Sun. But once Mercury was fitted into the planetary scheme, its association with Vishnu was forgotten. Later accounts describe the planets in relation to each other. Our arguments showing that the period of Mercury was obtained in the third millennium BC imply that, as the determination of the period of

Mercury is the hardest amongst the classical planets, the periods of the other planets had by then already been obtained.

The literature that followed the Rigvedic age was at first concerned more with the ritual related to the earlier astronomy of the Vedic age. Once the planetary system fell into place, the gods became supernumeraries. Now the focus shifted to their duals taken to inhabit the inner universe. Thus by the time of the Śatapatha Brāhmaṇa (second millennium BC), the original stars of Ursa Major were identified with the cognitive centres in the brain, as in ŚB 8·1 or in more detail in Brhadāraṇyaka Upaniṣad 2.2.4 (e.g. Eggeling 1988; Müller 1962). Evidently this could have only occurred much later than the explication of the planetary motions that took place in the third millennium BC.

REFERENCES

- Caland, W., 1982. *Pañcaviṃśa Brāhmaṇa*. The Asiatic Society, Calcutta.
 Caland, W., 1984. *The Jaiminigrhyasūtra*. Motilal Banarsidass, Delhi.
 de Santillana, G. & von Dechend, H., 1969. *Hamlet's Mill: An essay on myth and the frame of time*. Gambit, Boston.
 Eggeling, J. (tr.), 1988. *The Śatapatha Brāhmaṇa*. Motilal Banarsidass, Delhi.
 Feuerstein, G., Kak, S.C. & Frawley, D., 1995. *In Search of the Cradle of Civilization*. Quest Books, Wheaton.
 Frawley, D., 1994. *Indian Journal of History of Science*, **29**, 495–506.
 Kak, S.C., 1992. *Mankind Quarterly*, **33**, 43–55.
 Kak, S.C., 1993a. *Vistas in Astronomy*, **36**, 117–140.
 Kak, S.C., 1993b. *Indian Journal of History of Science*, **28**, 15–34.
 Kak, S.C., 1993c. *Indian Journal of History of Science*, **28**, 71–79.
 Kak, S.C., 1994a. *Current Science*, **66**, 323–326.
 Kak, S.C., 1994b. *The Astronomical Code of the Rigveda*. Aditya, New Delhi.
 Kak, S.C., 1995. *Q. J. R. astr. Soc.*, **36**, 385–396.
 Kramrisch, S., 1981. *The Presence of Śiva*. Princeton University Press, Princeton.
 Müller, F.Max (tr.), 1962. *The Upaniṣads*. Dover, New York.
 Palmer, J.D., 1976. *An Introduction to Biological Rhythms*. Academic Press, New York.
 Sastry, T.S., 1985. *Vedāṅga Jyotiṣa of Lagadha*. Indian National Science Academy, New Delhi.
 Sen, S.N. & Bag, A.K., 1983. *The Sulbasūtras*. Indian National Science Academy, New Delhi.
 Sengupta, P.C., 1947. *Ancient Indian Chronology*. University of Calcutta, Calcutta.
 Shamasastri, R., 1938. *Drapsa: The Vedic Cycle of Eclipses*. Sree Panchacharya Electric Press, Mysore.
 Winfree, A.T., 1987. *The Timing of Biological Clocks*. Scientific American Books, New York.