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Editor's Note

At the true start of the third millennium CE, we end this year, just like the last one, with a number of papers on Vedic astronomy, to keep up with the winter solstice spirit: the discussion of facts and their interpretations. We begin with a few important points raised by Kim Plofker from the point of view of a mathematician and historian of Indian astronomy. Incidentally, note also her interesting course on “History of Indian Mathematics” at Brown University that deals, among other items, with the Euro-/America-centric approach often seen in such studies. This is followed by comments of Narahari Achar on my paper in EJVS 5-2. I will answer, as far as it still is necessary after K. Plofker's general comments, when I have some leisure, in the new year. Finally, N. Achar contributes an interesting paper on the ṚV and the *Jyotiṣa Vedāṅga*. With best wishes for the New Year, Century and Millennium to all of our readers,

MW

How to interpret astronomical references in Vedic texts?

Kim Plofker

The exchange in EJVS 5, 2 (December 1999) between B. N. Achar and Michael Witzel on the subject of Vedic astronomy raises interesting points on both sides, and is conducted with admirable courtesy and attention to the texts. Achar again repeats the arguments (originally put forth by S. B. Dikshit) in favor of an astrochronological dating of the *Śatapatha Brāhmaṇa* (ŚB) to around 3000 BCE, and describes the use of modern “planetarium” software for easier inspection of celestial appearances at different dates and places. Witzel again repeats the criticisms of these arguments frequently made since Dikshit’s time (particularly, in recent years, by David Pingree), and adds some suggestions on the linguistic evidence as well as some ideas for partially reconciling the opposing viewpoints.

The central question, now as ever, is how to interpret astronomical references in Vedic texts: particularly, in the case discussed here, whether the ŚB states that the “*kṛttikās*” (Pleiades) have, in effect, a declination of zero and therefore refers to observations made approximately 5000 years ago, when the position of the earth’s axis due to precession put the Pleiades as seen from the earth on the celestial equator. There is simply no way to decide this question incontrovertibly from the textual evidence without making an assumption one way or the other about the intended meaning of the Sanskrit terms. If the expression translated as, e.g., “do not depart from the east” was really intended to mean “rise exactly at the accurately determined east point,” that is, on the celestial equator, then the Dikshit/Achar chronology is the most probable interpretation. If, on the other hand (as I believe), its significance was less astronomically rigorous, then that interpretation is unlikely.

Achar accepts the hypothesis of greater astronomical exactitude, and suggests an interpretation of an accompanying passage about the “*saptarṣis*” (Big Dipper) that is consistent with it. Unlike some defenders of this hypothesis, he has

carefully read and understood the arguments of its opponents, particularly Pingree. But I think Achar has neglected Pingree's discussions of the parallels with early first-millennium BCE Mesopotamian astral sciences (particularly omens), which lie at the heart of the hypothesis of Mesopotamian-Indian transmissions that provides an alternative explanation of the ŚB's statements.

Witzel (also without explicitly noting possible Mesopotamian connections) focuses primarily on the advantages of a looser interpretation of "rising in the east": it permits a chronology that fits better, historically and linguistically, with what we know of the ŚB. It is, in addition, perfectly consistent with everything else we know for certain about the practices of Vedic astronomy—which, unfortunately, is hardly anything at all. Witzel also suggests a possible combination of the two hypotheses, according to which the statement about the Pleiades in the east, like the name "Bear" for the "*saptarṣis*", could be a survival from an earlier era preserved in the ŚB without disrupting his chronology for the work itself. While this irenic proposal is not in itself unreasonable, I don't think either side will be truly convinced by its implication that a concern for precise astronomical determinations existed among the Indo-Europeans of the late fourth millennium, but had been lost except for a few vestigia by the late Vedic period.

In my view, the chief disadvantage of Achar's hypothesis is the absence of unambiguous and detailed attestations of an astronomy sufficiently developed to give rise to the precision he postulates. Where is the explicitly *quantitative* astronomy his conclusions appear to assume, where are the units of measurement, the standardized reference systems, the observational records, the descriptions of observational practices, the refinements of calendrical computation? If one reads all the astronomical references in Vedic texts "loosely", that is, without requiring them to conform to precise technical meanings, they form a consistent and reasonable (though sketchy) picture of a minimal astronomy concerned mostly with the regulation of a simple luni-solar liturgical calendar, and taking note of other celestial features such as

constellations and eclipses without attempting any predictive mathematical schemes concerning them—a picture very like the one we have of late second-millennium Mesopotamian or early first-millennium Greek astronomy. It does not challenge in any way the conservative chronology for the Vedic period maintained by most Indologists on the basis of linguistic and archaeological evidence.

The problem is, of course, that we have such a scanty textual record from this period that it is impossible to exclude all alternative interpretations beyond dispute. If the astronomical references are translated under the assumption that they reflect a highly developed astronomical system of great antiquity, they can support that assumption too. The best we can hope for is that disputants on both sides will continue to develop and explain their own reconstructions without mischaracterizing those of their opponents, and with the realization that the choice of one hypothesis over the other is ultimately determined by one's own assumptions about the probable nature of Vedic astronomy.

Comments on “The Pleiades and the Bears viewed from inside the Vedic texts”

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Witzel¹ has raised a number of issues directly related to my paper² in the same issue of EJVS. I offer the following comments, therefore, “quietly, peacefully and even justifiably.”

(i) Isolated sentences

Witzel is right when he comments editorially that one can not just quote an isolated sentence and build a theory on it. Nor should any one, on the basis of some theory, which ignores the cultural context, deny what the passage itself says.

(ii) Sky in Vedic and post-Vedic times

I also agree that the situation in 2900 BCE differs far more from the current situation in 2000 CE, than from the situation in 1000 BCE. However, contrary to his remark, in my paper³, the sky had been examined over a very long period of time from about 4500 BCE to 2000 CE, as could be seen from the comment there about the circumpolar nature of *saptarṣi maṇḍala*. It had been found that the azimuth of the Pleiades moves towards the north by almost 3° in 500 years. This is also in agreement with Witzel’s findings with the Voyager II program. This piece of information is important in establishing the limits to be discussed later.

¹ Witzel, M., “The Pleiades and the Bears viewed from inside the Vedic texts”, EJVS, 5-2, 1999.

² Achar, Narahari B. N., “On Exploring the Vedic Sky with Modern Computer Software”, EJVS, 5-2 1999.

³ Ibid.

(iii) Vedic east

Witzel has argued that the “Vedic east” in fact comprises a very large region spanning from the NE to SE, i.e., the azimuth ranging from 45° (= NE) to 135° (= SE), including 90° (=the true east). While it may be acceptable or even required under certain circumstances, it would be very difficult to accept such a large range in the present context. This can be easily seen as follows: the azimuth for the Sun at sunrise on the summer solstice day would be about 62°, and at sunrise on winter solstice day it would be about 118° at the latitude of Delhi. Both of these values are well within the ‘east’ marked off by Witzel, and thus the Sun would stay in the ‘east’ throughout the year! No *uttarAyana*, or *dakSiNAYana*. More appropriate limits for the true east can be estimated from the fact that the Vedic priests were required to establish the east-west line (*prāci*) at the time of Yajña. This could be done with no more sophisticated equipment than a stick and a piece of rope. A skillful priest could draw the east-west line within 1° of the true east-west line, if the conditions were right, but could do no worse than 3°. By far the average margin of error would have been 2°. A 5° deviation from such a line could be detected, and certainly an 8-13° deviation. Note also that there were professional star gazers: *nakṣatra darśa*, VS (XXX.10) Now allowing a 3° margin of error in establishing the true east-west line, (and remembering that a 3° range in azimuth for the Pleiades corresponds to about 500 years), Pleiades could be thought of as not deviating from the east for about 500 years on either side of 3000 BCE, i.e., from 3500 BCE to 2500 BCE.

(iv) Further comments on ‘*saptarṣis*’ and ‘*udyanti*’

Finally, Witzel adds these remarks: “The present tense of *ud i, udyanti*, however, which would point, in some scholars’ opinion, to c. 3000 BCE, is easily explained, when we actually look at the Big Dipper when it appears in the early evening even today; it moves towards the north pole, surpasses it and sets in the west (see sky maps in Witzel 1996). This observation solves N. Achar’s problem of the

Ursa Major “rising” in the North. It actually rises, when it gets dark, in the north (nowadays with its easternmost stars from below the horizon, for late Vedic times cf ŚB 13.8.1.9); Ursa Major then turns upwards, and is, after a few hours actually higher than the north pole (now situated at c. 30° in the southern Punjab/Delhi).. So why can the Vedic texts not speak of ‘*ud-yanti*’, especially so, as the north is also called *ut-tara* (‘situated on the side of *ud* ‘up’), and as the northern direction includes all regions from 45°=NE to 90°=E and 315°=NW(sic). Generally speaking, the use of the actual term ‘to rise’ (*ud i*) is not strange at all as the stars close to the north pole move ‘upwards’ towards the pole (thus northwards).” However, the actual current situation as seen at Delhi is a little more complex in that the Big Dipper when it appears in the sky in the early evening does not always appear near the horizon and move upwards as the night progresses. Some times, when it appears in the early evening, it is already high in the sky and actually moves downwards as the night progresses. Some time it is seen setting at the early evening and rising late in the night. For a short period in the year, it is not seen at all early in the evening, but rises only late in the night. (Of course, one member, alpha Ursa Majoris, which is circumpolar at Delhi, never rises or sets. But is seen at different parts of the sky in the early evening at different times of the year.) All this is caused by the fact that earth’s rotation takes only 23 hours and 56 minutes, where as the mean solar day is a full 24 hours. Therefore, a star, which rises at the true east at 8:00 p.m. tonight, will rise at 7:56 p. m. tomorrow. In a month’s time it would be rising two hours earlier, therefore would already be high in the sky at 8:00 p.m. Three months from now, it would be seen overhead at 8:00 p.m. Six months from now it would be seen setting at 8:00p.m., and so on. It would indeed be strange to use the term ‘to rise’, when the Big Dipper is already high in the sky when it first appears in the early evening after sun set, and actually moves downwards as the night progresses. This can be seen for example during the months of May and June. The Big Dipper is already almost overhead at 8:00 p.m., moves downwards and sets in the early morning hours. When it actually comes above the horizon in the daytime, it can not be

seen in the sky. By the time Sun sets, when it can be seen again, it is almost overhead. The situation in 3000 BCE has been described in⁴ and the problem of ‘to rise’ has been discussed. The statement in ŚB appears to be problematic, because, Sāyaṇa, who could not have observed the circumpolar nature of the Big Dipper 500 years ago and at the southern latitude he was located, associated ‘*udyanti*’ with both *saptarṣis* and *kṛttikās*. Everybody else just followed him. It is interesting to note that ṚV 1.24.10 makes no reference whatsoever to rising or setting of the *ṛkṣāḥ*.

Abbreviations

ṚV *Ṛgveda*

VS *Vājasaneyi Saṃhitā*

ŚB *Śatapatha Brāhmaṇa*

⁴ Ibid.

Searching for *nakṣatras* in the *Ṛgveda*

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I. The Problem

Nakṣatras, variously translated as asterisms or lunar mansions, with an enduring list of 27 (some times 28) in number have been the hallmark of Indian astronomy since antiquity and continue to be in use even today^[1-5]. The word *nakṣatra* has been used in the Vedic literature in the sense of (i) stars in general, (ii) asterisms, i.e., groups of stars 27 (28) in number, situated more or less along the ecliptic, (iii) arc divisions of the ecliptic. We shall not be concerned with case (i), which is very general, nor with case (ii), which is an abstract astronomical concept, definitely in use since the time of *Vedāṅga Jyotiṣa* (VJ). It is true that even in *Ṛgveda*, the word *nakṣatra* has been used some times in the sense of a star in general, and the sun itself is referred to as a *nakṣatra*^[2-4]. However, in this paper, we shall be mainly concerned with case (iii), which represents the predominant sense of the word *nakṣatra*, the one referring to asterisms which mark the path of the sun and the moon along the ecliptic^[5]. As has been noted by Dikshit^[1] and others, the *Ṛk Saṃhitā* does not explicitly mention the names of all the 27 *nakṣatras*, but mentions only a few by name. Complete lists of 27/28 *nakṣatras* have been available in the Vedic literature, in the *Saṃhitā* texts including AV, TS, KS, MS, in the *Brāhmaṇa* texts, TB, SB, PB, KB, and in the *Āraṇyaka* and *Sūtra* texts. But, a comparable list explicitly containing the names of all the *nakṣatras* is not available in *ṚV*. Although scholars such as Ludwig, Zimmer^[6] and Tilak^[7], find indirect evidence for the knowledge of all the 27 (28) *nakṣatras* in *ṚV*^[8], there are some scholars who believe that all the *nakṣatras* were not known at the time of *ṚV*^[9]. However, one would then be at a loss to explain the sudden appearance of a complete list such as that found in AV or TS, and the recognition of

nakṣatravidyā as a branch of study, (CU VII. i. 2. 4; TB III. 4. 4. 1) and of “*nakṣatradarśa*” as a professional (VS XXX.10). Is there direct and incontrovertible evidence to demonstrate that all the *nakṣatras* are, in fact, known in RV?

II. The List of *nakṣatras*

Several comparative studies of the lists of 27/28 *nakṣatras* found in various Vedic texts, and attempts to identify the *nakṣatras* with names of stars in modern star catalogues have been made ^[10]. It is known that by the time of VJ, the concept of *nakṣatra* had developed into a purely astronomical abstract concept of designating 1/27 part of the ecliptic. As already explained earlier, we are concerned here with the case where *nakṣatras* refer to bright stars along the ecliptic marking the paths of the sun and the moon. Each *nakṣatra* is also associated with a presiding deity. A list of 27 *nakṣatras* and the associated deities taken from TS is given in table 1.

Table 1 The list of *nakṣatras* and their presiding deities from TS

No.	Name	Presiding deity
1	Krittikā	Agni
2	Rohiṇī	Prajāpati
3	Mṛgaśīrṣa	Soma
4	Ārdrā	Rudra
5	Punarvasū	Aditi
6	Tiṣya	Bṛhaspati
7	Āśreṣā	Sarpa
8	Maghā	Pitṛ
9	Phalgunī	Aryamā
10	Phalgunī	Bhaga
11	Hasta	Savitā
12	Citrā	Indra

13	Svātī	Vāyu
14	Viśākhe	Indrāgni
15	Anūrādhā	Mitra
16	Rohiṇī	Indra
17	Vicṛtau	Pitṛ
18	Āṣāḍhā	Āpaḥ
19	Āṣāḍhā	Viśvedeva
20	Śroṇā	Viṣṇu
21	Śraviṣṭhā	Vasu
22	Śatabhiṣaj	Indra
23	Proṣṭhapada	Ajaekapāt
24	Proṣṭhapada	Ahirbudhniya
25	Revatī	Pūṣā
26	Aśvayujau	Aśvin
27	Apabharaṇī	Yama

(a) The number of *nakṣatras*: is it 27 or 28?

Some scholars have argued that originally the number of *nakṣatras* was 27 and that it became 28 later when a *nakṣatra*, Abhijit, was added in between Uttarāṣāḍha and Śroṇa. Other scholars have argued that in the original list the number of *nakṣatras* was 28, and that it became 27 when Abhijit was dropped. In the Vedic Saṃhitās, 28 *nakṣatras* are mentioned in AV(XIX.8.2) and MS(XI.13.20), but a majority of other Saṃhitā texts give only 27: TS(IV.4.10), KS(XXXIX.13), and VS(IX.7). Among the Brāhmaṇa texts, TB(1.5.1) gives only 27, but, TB(1.5.2.3) mentions Abhijit, and TB(3.1.1.6) gives 28. On the other hand, ŚB(X.5.4.5) specifically mentions 27 *nakṣatras* and 27 *upanakṣatras*, while PB(23.23) and KB(5.1) also give only 27. Thus there appears to be a preponderance of the number 27, and it is not easy to decide which of the two, if either, is earlier. In fact, both numbers may have co-evolved, with 27 specifically for astronomical purposes as in VJ, and 28 specifically for ritual purposes as in *nakṣatreṣṭhi*. This is

seen for example, when the same text, TB, gives 27 in one section, (1.5.1) and in the very next, (1.5.2.3) mentions Abhijit. Furthermore, as Sen ^[2] has remarked, no “*nakṣatra*-space” is allotted for Abhijit. On the other hand, the legends of fall of Abhijit point to its removal from the list. In view of all these, we will regard 27 as the number.

(b) Variant names of *nakṣatras*

It has been noted that all the lists of *nakṣatras* in Vedic texts mentioned above begin with Krittikā and a comparison of the names of the *nakṣatras* from the Saṃhitā texts TS, KS, MS, and AV together with the list from VJ has been given by Sen ^[2]. Although most of the names are the same, there are some variations. The most notable variations are seen for the stars given in table 2. There are other minor differences such as a short-vowel ending in one list, but a long-vowel ending in others for the name of the same *nakṣatra*. Moreover, the pairs of *nakṣatras*, (9,10), (18,19), and (23, 24) in table 1., are distinguished in other lists by the addition of the prefixes *pūrva-*, and *uttara-*. It should be noted that although the names appear to be different, the presiding deity is the same. It follows, therefore, that the same *nakṣatra*, presided by the same deity may have alternate names. These differences in names of *nakṣatras* should not therefore be construed as some “basic instability in their tradition”^[9].

Table 2. Variant names of *nakṣatras* in Saṃhitā texts

<i>nakṣatra</i> no.	TS	MS	KSAV	deity
3	Mṛgaśīrṣa	Invagā	Invakāmṛgaśīrṣa	Soma
4	Ārdṛā	Bāhu	Bāhuārdṛā	Rudra
6	Tiṣya	Tiṣya	Tiṣyapuṣya	Bṛhaspati
13	Svātī	Niṣtya	Niṣtyasvātī	Vāyu
16	Rohiṇī	Jyeṣṭhā	Jyeṣṭhājyeṣṭhā	Indra
17	Vicṛtau	Mūla	Mūlamūla	Pitṛ
21	Śroṇā	Śroṇā	Aśvatthaśravaṇa	Viṣṇu

28	Apabharani	Bharani	Apabharani ibharanyaḥ	Yama
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(c) Variant deities of *nakṣatras*

In general, each *nakṣatra* is presided by a deity, and the deity remains the same across the lists even though the names of *nakṣatras* might be different. However, there are two *nakṣatras* for which the names are the same across the lists, but the deities are apparently different. This is shown in table 3a.

Table 3a. Variant deities of Citrā and Śatabhiṣaj

<i>nakṣatra</i>	TS(IV. 4. 10)	TB(1.5.1)	TB(3.1.1)	TB(3.1.4)
12. Citrā	Indra	Indra	Tvaṣṭā	Tvaṣṭā
22. Śatabhiṣaj	Indra	Indra	Varuṇa	Varuṇa

In his commentary on TB(1.5.1), Sāyaṇa observes: “*pūrvaṃ citrānakṣatrasvāmī yo’yamindraḥ uktaḥ soyaṃ tvaṣṭā paramaiśvarya yogādindra ucyate*”. explaining that because of the supremacy of divine faculties, Tvaṣṭā is referred to as Indra. In a similar vein, for the second *nakṣatra*, Sāyaṇa says, “*atra tu indra śabdena paramaiśvarya yogād varuṇo gṛhyate.*” In other words, here Indra denotes Varuṇa. There is one *nakṣatra*, # 17, which is denoted by apparently different names in different lists, and is also associated with apparently different deities as indicated in table 3b.

Table 3b. Names and deities of *nakṣatra* # 17 in different lists

List	TS(IV. 4. 10)	TB(1.5.1)	TB(3.1.1) TB(3.1.4)
Name	Vicṛtau	Mūlavarhani	Mūla Mūla
Deity	Pitṛ	Nirṛti Nirṛti	Prajāpati

In commenting on TS(IV.4.10), Sāyaṇa observes, “*pitṛ śabdo’tra mūlavācī*” and later, “*atra prajāpati śabdena nirṛtir vivakṣyate*”, explaining that Nirṛti is the deity associated with *nakṣatra* #17, Mūla. In summary then, Vedic texts give a list of 27 *nakṣatras*, each *nakṣatra* has a unique *abhimāni devatā*, presiding deity. Even

though the names in different lists appear to be different, they refer to the same *nakṣatra*, for, the deity is the determining factor. The problem is to find a comparable list of *nakṣatras* in RV.

III. The Clue

The clue comes from VJ^[11], which regards the *nakṣatras* as divisions of the ecliptic. However, each division gets its name from a prominent asterism near by (referred to as Yogatāra in later works), and is presided by the same deity as the one for the asterism. Thus, one finds the deities of the 27 *nakṣatras* as

*agnih̄ prajāpatiḥ somo rudro'ditir bṛhaspatiḥ sarpas̄ca pitaraścaiva bhagaścaiva
aryamāpica savitā tvaṣṭāṭha vāyuścendrāgnī mitra eva ca indro nirṛtir āpo vai
viśvedeva stathai vaca viṣṇur vasavo varuṇo'ja ekapāt tathai vaca ahirbudhnya
stathā pūṣā aśvinau yama eva ca*

RJ(25-27)

This agrees essentially with the list of deities discussed earlier. There is also a list of *nakṣatras* indicated symbolically as follows:

*jau drā gaḥ khe śve'hi ro ṣā cin mū ṣaṇyaḥ sūmā dhānaḥ re mṛghā svāpo jaḥ kṛṣyo
ha jye ṣṭhā ityṛkṣā liṅgaiḥ*

RJ(14)

This *śloka* arises in connection with the procedure for determining the *nakṣatra* at any *parva*. The *nakṣatras* are indicated here symbolically by means of syllables, which are either the beginning or the ending syllables of their names, or names of the presiding deities, according to:

1) *jau* for Āśvayujau, 2) *drā* for Ārdrā, 3) *gaḥ* for Bhagaḥ (deity of Pūrvaphālguṇi), 4) *khe* for Viśāke, 5) *śve* for Viśvedevāḥ (deity for Uttarāṣḍhā), 6) *hiḥ* for Ahirbudhnyaḥ (deity for Uttara Proṣṭhapadā), 7) *ro* for Rohiṇī, 8) *ṣā* for Āśreṣā, 9) *cit* for Citrā, 10) *mū* for Mūlā, 11) *ṣa* for Śatabhiṣaj, 12) *ṇyaḥ* for Bharanyaḥ, 13) *sū* for Punarvasū, 14) *mā* for Aryamā (deity for Uttara Phālguṇi),

dhāḥ for Anūrādhāḥ, 16) *ṇaḥ* for Śravaṇaḥ, 17) *re* for Revatī, 18) *mṛ* for Mṛgaśīrṣā, 19) *ghāḥ* for Maghāḥ, 20) *svā* for Svātī, 21) *paḥ* for Āpaḥ (deity for Pūrvāṣādhā), 22) *jaḥ* for Aja-ekapāt (deity for Pūrvapros̥thapadā), 23) *kṛ* for Kṛttikāḥ, 24) *ṣyaḥ* for Puṣyaḥ, 25) *ha* for Hastā, 26) *jye* for Jyeṣṭhā and finally 27) *ṣṭhāḥ* for Śraviṣṭhā.

The list begins with Aśvinī and follows with every sixth *nakṣatra* from it as given in a traditional list of *nakṣatras* such as the one in table 1. What is notable about this list is that there are several *nakṣatras* which are denoted by the beginning or the ending syllables of the names of the deities, rather than that of the *nakṣatras* (3, 5, 7, 14, 21, and 22 in the above list). Again, there is another *śloka* for determining the name of the *nakṣatra* which occurs at the beginning of each of the *ayanās* in the five year *yuga* of VJ:

vasus tvaṣṭā bhavojaśca mitras sarpośvinau jalaṃ dhātā kaścāyanādyās syuḥ

RJ (9)

The *nakṣatras* at the beginning of the *ayanās* in the five year *yuga*, are Śraviṣṭhā, Citrā, Ārdrā, Pūrvapros̥thapadā, Anūrādhā, Āśreṣā, Aśvinī, Pūrvāṣādhā, Uttaraphālguni, and Rohiṇī, respectively. They are all indicated by the names of the deities presiding over them. It follows therefore that *nakṣatras* are equally well enumerated by the names of the presiding deities. This is the clue that helps in searching for *nakṣatras* in ṚV.

IV. The finding

Since the *nakṣatras* may be indicated by the names of deities, all that one has to do is to search in ṚV for a list of some 27 names of deities that would correspond to the *nakṣatras*. It is to be expected that the most likely place to find such a list would be the fifth *maṇḍala*, which is the book of the Atri family, for Atri is reputed to be one of the premier astronomers. One does not have to try very hard, for the famous “*svasti no mimīta*” *sūkta*, ṚV(V. 51), which is recited at rituals for peace (“*śānti karmāṇi*”) contains such a list! This *sūkta*, ṚV(V. 51), has Svastyātreya for its ṛṣi, contains fifteen ṛks, composed in *gāyatri*, *uṣṇi*, *triṣṭubh* and *anuṣṭubh* meters.

Its “*viniyoga*”s are elaborated in the *Āśvslāyana sūtra*. It begins with an invitation to Agni for partaking of the soma drink and asks him to bring all the deities who protect us for partaking of soma. “*agne sutasya pītaye viśvairūmebhir āgahi*” It mentions, Indra, Indrāgni, Soma, Rudra, Vāyu, Viśvedevāḥ, Mitra, Varuṇa, Vasu, Ādityāḥ, Aśvin, Bhaga, Aditi, Pūṣan, Bṛhaspati, Ṛbhus, and deities of “*sarvegaṇāḥ*”. The last category includes deities belonging to *rudraḡaṇa* and *āditya ḡaṇa* and hence would include Sarpa, Nirṛti, Ajaekapāt, Ahirbudhnya, Dhātṛ, Aryamā, Tvaṣṭā, and Viṣnu among others. In short, *sūkta* ṚV(V.51) includes the presiding deities of all the *nakṣatras*. There is no doubt that *nakṣatras* are meant, for the last ṛk of the *sūkta* says, “*svasti paṅṭhām anucarema sūryā candramasāviva*” (V.51.15), referring to the path of the sun and the moon, the ecliptic. The *sūkta* also mentions one *nakṣatra* by name, “*svasti paṭhye revatī*” (V. 51. 14). It should be mentioned that the *sūkta* does contain names of deities such as Dyāvapṛṭhvī, and Mitrāvaruṇau, which are not directly connected with the *nakṣatra* system. But, then the *sūkta* is not limited to just deities of *nakṣatras*. In view of these facts, (i) that *nakṣatras* can be enumerated in terms of the presiding deities, (ii) that *sūkta* ṚV(V.51) contains such a list of deities, (iii) that the *sūkta* specifically refers to the path of the sun and the moon, and (iv) that it mentions one *nakṣatra*, Revatī by name, one is compelled to conclude that all the *nakṣatras* are known in ṚV. It might also be noted that partial lists of deities presiding over the *nakṣatras* are scattered throughout ṚV.

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List of Abbreviations

AV	<i>Atharvaveda</i>
CU	<i>Chāndogya Upaniṣat</i>

KB	<i>Kauṣītakī Brāhmaṇa</i>
KS	<i>Kāṭhaka Saṃhitā</i>
MS	<i>Maitrāyaṇī Saṃhitā</i>
PB	<i>Pañcaviṃśa Brāhmaṇa</i>
ṚV	<i>Ṛgveda</i>
SB	<i>Śatapatha Brāhmaṇa</i>
TB	<i>Taittirīya Brāhmaṇa</i>
TS	<i>Taittirīya Saṃhitā</i>
VJ	<i>Vedāṅga Jyotiṣa</i>
RJ	<i>Ṛgjyotiṣa</i>

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- [3] Macdonell, A. A. and Keith, A. B., *Vedic Index of Names and Subjects*, Motilal Banarsidass, (New Delhi, 1958), vol. I, pp. 409-431
- [4] Jaggi, O. P., *Indian Astronomy and Mathematics*, Atma Ram and Sons, (Delhi, 1993).
- [5] References to and views of scholars such as Colebrooke, Whitney, Weber, Burgess, Hommel, Thibaut and Mueller can be found in references [2] and [3].
- [6] References to Ludwig and Zimmer can be found in [3].
- [7] Tilak, B. G., *The Orion*, Cosmo Publications, (New Delhi, 1984) p. 158.

- [8] “*catustrimśad vājino devabandhor vankrīr aśvasya svadhitiḥ sameti*”. “The four and thirty ribs of the swift charger, kin to the gods, the slayer’s hatchet pierces” ṚV (I 162. 18). As the sacrificial horse is the symbol of the heavens, thirty four ribs represent the sun, the moon, the five planets and 27 *nakṣatras*. Furthermore, “*catustrimśatā purudhā vi caṣṭe sarūpeṇa jyotiṣā vivratena*” “ With four and thirty lights he looks around him, lights of one color though their ways are divers” ṚV (X. 55. 3). Translations are mostly taken from Griffiths.
- [9] Pingree, D., “History of Mathematical Astronomy of India”, in *Dictionary of Scientific Biography*, XV, (New York, 1978) pp. 533-633.
- [10] Saha, M. N. and Lahiri, A. C., *Report of the Calendar Reform Committee, Council of Scientific and Industrial Research*, New Delhi, (1955). This is the authorized report from the Government of India. However, a recent effort by Western scholars see : Pingree, D. and Morissey, P., “On the identification of the s of the Indian *nakṣatras*”, *Journal for the History of Astronomy*, xx, 99-119, 1989, which completely ignores the list in the Calendar Reform Committee Report. Most recent effort is based on computer simulations using planetarium software: Narahari Achar, B. N., *On the Identification of Vedic Nakṣatras* (To be published)
- [11] Sastry, T. S. Kuppanna., *Vedāṅga Jyotiṣa of Lagadha*, Indian National Science Academy, (New Delhi, 1985).
- [12] The fact that the *nakṣatras* are actually represented by their deities has also been noted in a little known book in Kannada, by Shenoi, B. P. V., *Brāhmī lipi mattu sindhū saṁskṛti, śrī lalitā prācyā saṁśodhanālaya*, (Mangalore, 1977). The author is grateful to Dr. Nayak for bringing this book to his notice.