

THE SAPTARISHIS CALENDAR: 'THE INDIAN TROPICAL ZODIAC'!

Buddhike S.H. Indrasena

Kandy General Hospital (Teaching), Kandy 20000,
Sri Lanka.

Email: indrasenaharsha@gmail.com

Abstract: The Saptarishis Calendar of ancient India is based on precession of the equinoxes. It employs the tropical zodiac of the Greeks and the precessional rate of Hipparchus. The Saptarishis era has to be determined by naked eye observation of the sky. The line of reference goes through the stars Dubhe and Merak in the constellation of Ursa Major, touching both of them, and crosses the ecliptic in the sidereal Purvaphalguni Nakshatra¹ of Simha Rashi at a point close to the star 59 Leonis. The angular difference between this 'Saptarishis pointer' and the vernal equinox gives the tropical lunar mansion in which Saptarishis resides at a given point in time.

Keywords: India, the Saptarishis Calendar, Dubhe, Merak, 59 Leonis, precession of the equinoxes, tropical zodiac

1 INTRODUCTION

There are numerous references in ancient Indian literature to a kind of time keeping using the star group known as Saptarishis (the Seven Sages). Saptarishis has been identified as the brightest seven stars in the constellation Ursa Major (the Big Bear), constituting the asterism known as the Big Dipper (Figure 1).

The seven stars of Ursa Major take the shape of a cart or a bowl with a handle. The Sanskrit names of these stars can be recognized by following the description given in the *Brihat Samhita* of Varahamihira (Iyer, 1884: 80):

The east-most of the group is Bhagavan Marichi; the next to him is Vasishtha; the next

is Angirasa and the next two are Atri and Pulastya. The next in order are the Rishis Pulaha and Kritu. The chaste Arundati chastly attends her husband the Sage Vasishtha.

Details of the principal stars in Ursa Major are given in Table 1.

2 USES OF THE SAPTARISHIS CALENDAR

The Saptarishis Calendar is based on the discovery by the ancient Greek astronomers that in different periods of time the Seven Sages resided in different lunar mansions of the tropical zodiac. The lunar mansion in which Saptarishis resided was noted when significant events occurred. This must have been done by direct observation of the

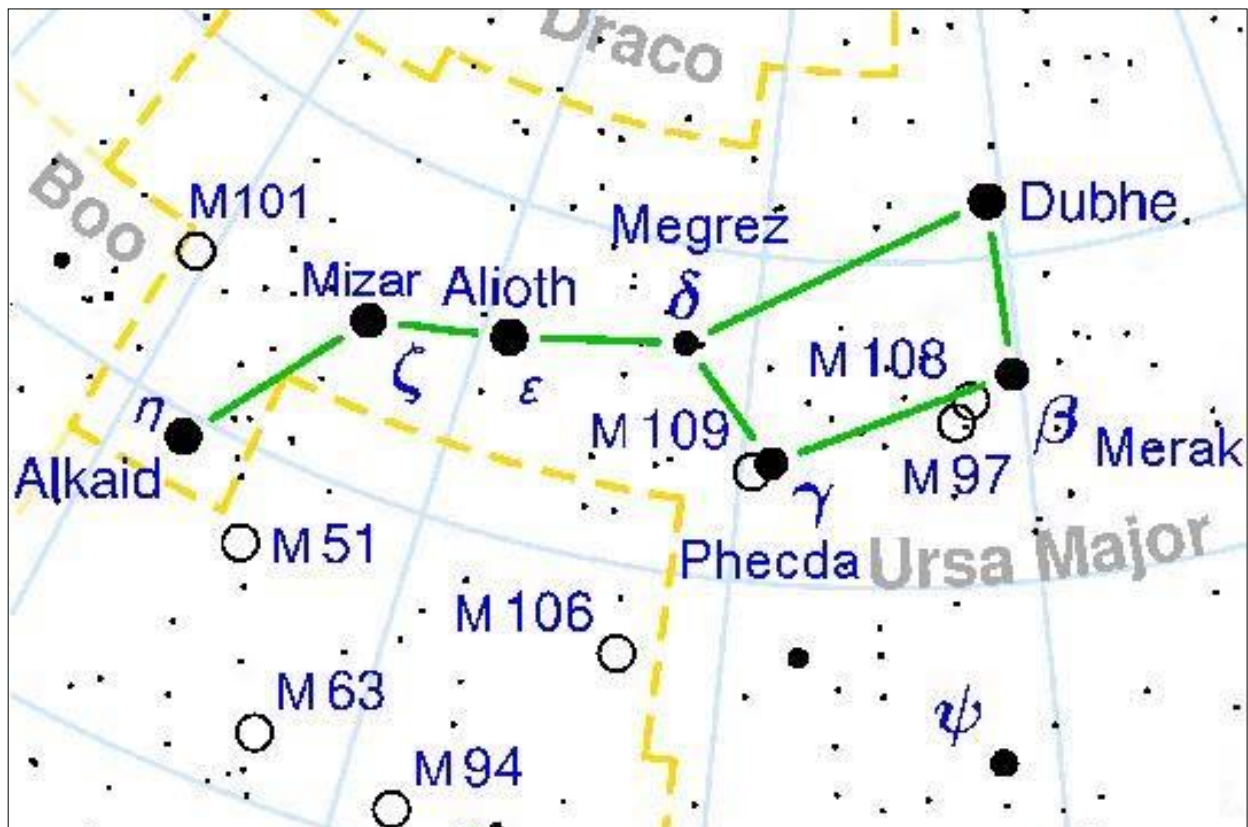


Figure 1: A map showing the brightest stars in the constellation of Ursa Major (http://en.wikipedia.org/wiki/Big_Dipper).

Table 1: The main stars in the constellation of Ursa Major.

Bayer Code	Common Name	Sanskrit Name	Magnitude (V_m)	Sidereall Longitude	Right Ascension	Declination (N)
α UMa	Dubhe	Kratu	1.79	20° 36' 02" Cancer	11h 03m 43s	61° 44' 49"
β UMa	Merak	Pulaha	2.37	24° 50' 12" Cancer	11h 01m 50s	56° 22' 43"
γ UMa	Phecda	Pulasthya	2.44	05° 52' 42" Leo	11h 53m 49s	53° 41' 29"
δ UMa	Megrez	Atri	3.31	06° 28' 01" Leo	12h 15m 24s	57° 01' 45"
ϵ UMa	Alioth	Angiras	1.77	14° 20' 06" Leo	12h 54m 00s	55° 57' 24"
θ UMa +	Alcor-	Vasishta +	4.01	21° 16' 29" Leo	13h 25m 12s	54° 59' 07"
ζ UMa	Mizar	Arundhati	2.27	21° 06' 04" Leo	13h 23m 54s	54° 55' 21"
η UMa	Alkaid	Marichi	1.86	02° 19' 53" Virgo	13h 47m 31s	49° 18' 40"

night sky and locating the Saptarishis pointer in relation to the tropical zodiac. This was not a method that could be done by simple calculation. It was like a 'clock' in the sky. To tell the time one had to look at the sky and note the position of the Saptarishis pointer. Since there is only slight, if any, movement of stars relative to each other, the sidereal zodiac or the stars themselves could not be used in this method. With respect to a star or sidereal Nakshatra, there is hardly any movement of Saptarishis.

Given below are some of the events that the ancient Indian astronomers noted using the Saptarishis Calendar.

- 1) "At the birth of king Parikshit they were in Magha and the Kali Yuga then began." (*Vishnu Purana* 2; see Dutt, 1896: 312).
- 2) "When Seven Rishis will be in Parvashadha, then Nanda will begin to reign and thenceforth the influence of Kali will increase." (*Vishnu Purana* 2; see Dutt, *ibid.*).
- 3) "During the reign of Yudhishtira 2526 years before the commencement of the Vikrama Saka the seven Rishis were at the constellation of Magha (Regulus)." (*Brihat Samhita*: Sloka 3, Chapter XIII; see Iyer, 1884: 80).

3 THE SAPTARISHIS POINTER

Ursa Major includes the seven bright stars shown in Figure 1. Since these span an angular distance of $>42^\circ$, it is impossible to fit all of them within one lunar mansion (which spans only $13^\circ 20'$). Instead, in order to locate the lunar mansion an imaginary line connecting two particular stars in Ursa Major is extended towards the ecliptic. This line of reference is described in the *Vishnu Purana* as follows:

When the first two stars of the seven Rishis rise in the heavens and some lunar asterism is seen at night at an equal distance then the seven Rishis remain stationary in that conjunction for a hundred years of man. (Dutt, 1896: 31).

The meaning of "equal distance" in this translation should be understood as the distance from the North Celestial Pole to Ursa Major and a similar distance from Ursa Major towards the ecliptic. Ursa Major lies approximately midway between the North Celestial Pole and the ecliptic. The point where the imaginary line crosses the ecliptic is the place where Saptarishis resides.

The first two stars that rise in Ursa Major are the two stars that form the pouring edge of the bowl (i.e. Dubhe and Merak). The Dubhe-Merak axis when extended towards the ecliptic goes parallel and close to the Zosma and Chort stars in the constellation of Leo that form a triangle with Denebola (Purvaphalguni Nakshatra). The point where this imaginary line cuts the ecliptic is not static because of the slight proper motion of the stars, which is significant over several centuries.

4 ZODIACAL CONSIDERATIONS

Does Saptarishis move? In accordance with the Saptarishis Calendar, yes it does. It moves at a rate of one conjunction in 100 years, and it moves through the whole zodiac in one cycle, "... the seven Rishis remain stationary in that conjunction for one hundred years of man." (*Vishnu Purana*; Indrasena, 2014). Is this true? The answer to this question is both yes and no, depending on how the zodiac is defined.

The zodiac consists of 12 Rashis (signs) and 27 or 28 Nakshatras (lunar mansions), and is stationary and star based in Vedic astronomy. By definition the first Rashi, Mesha (Aries), begins at a point which is approximately diametrically opposite to the location of the star Chitra (Spica). This starting point of Mesha is fixed. In Greek astronomy the zodiac is based on equinoctial and solstice points, with Aries starting from the point of the vernal equinox and Libra the autumnal equinox. This is known as the tropical zodiac. The astrological tropical zodiac is not astronomically correct (*ibid.*). Because of the precession of the equinoxes the vernal equinoctial point drifts backwards along the ecliptic at a rate of $50.3''$ per year. Therefore, the tropical zodiac is not stationary but moves backwards along the ecliptic among the background of stationary stars at a rate of 1° in 72 years.

4.1 The Sidereal Zodiac

Stars hardly move except for proper motion, which is only a few arc minutes over many centuries. Figure 2 and 3 show the arrangement of stars in CE 100 and CE 3000. The sidereal zodiac is also shown along the ecliptic. Simha (Leo) and Kanya (Virgo) Rashis (constellations) can be seen in these figures. The sidereal zodiac starts

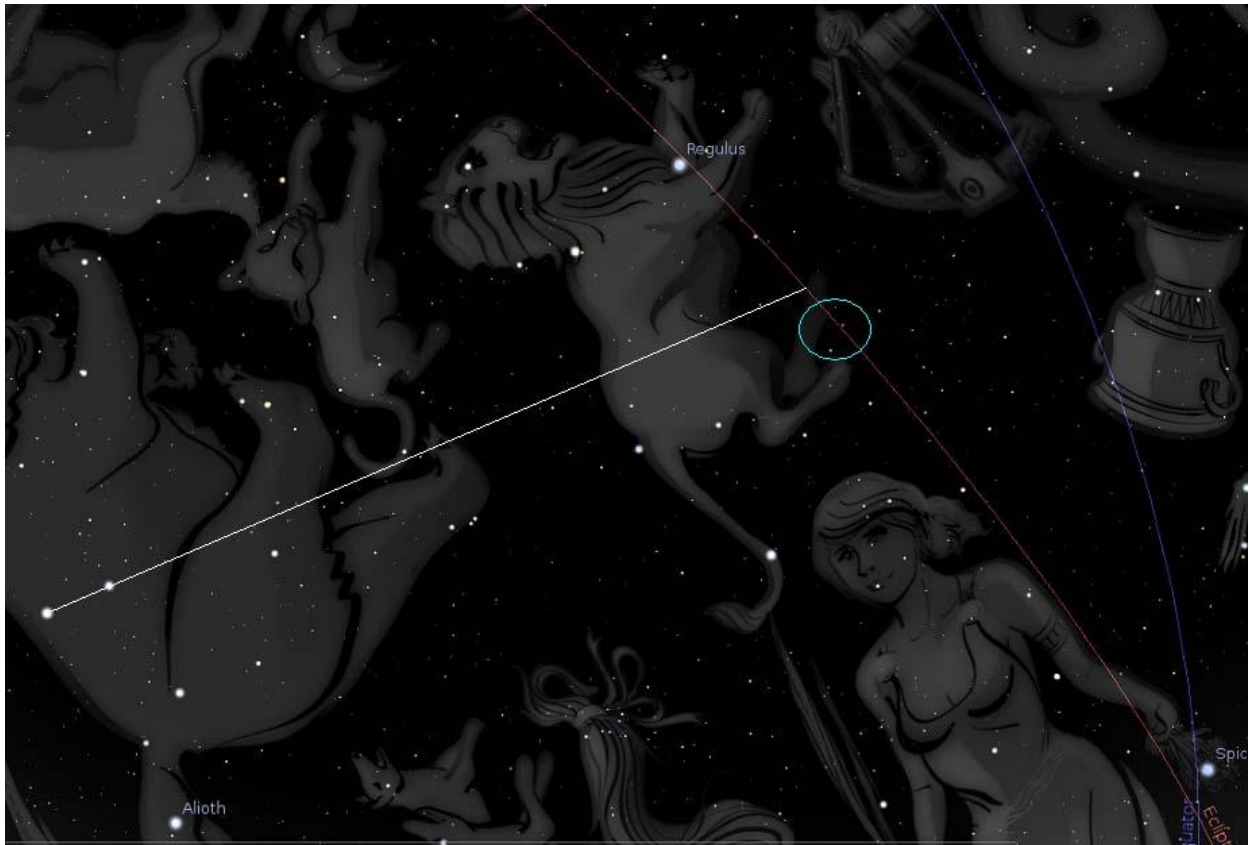


Figure 2: The location of the Saptarishis pointer (white line), the star cluster adjacent to the pointer (light blue circle), sidereal signs Simha and Kanya, and the autumnal equinox [the meeting points of the red (ecliptic) and blue (equator) lines] in CE 100.

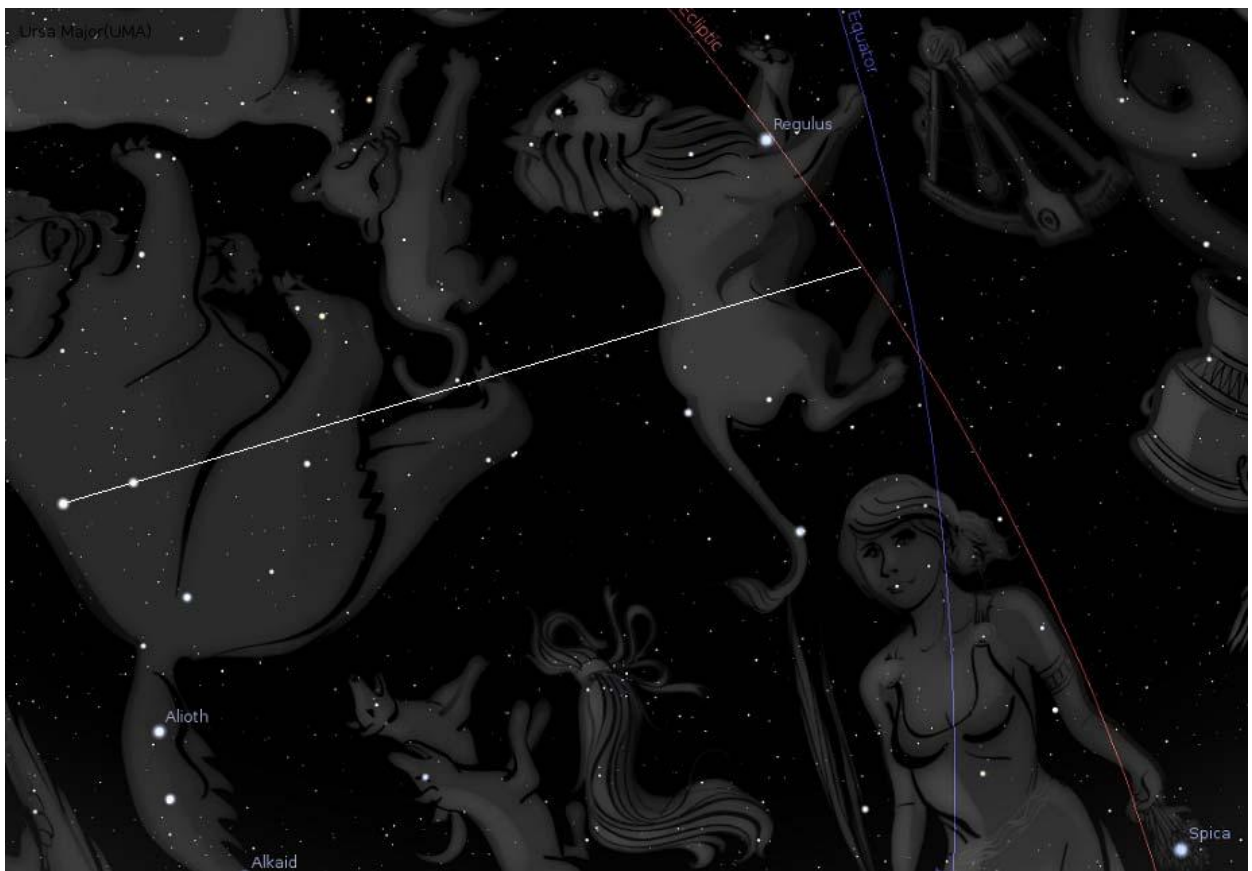


Figure 3: The location of the Saptarishis pointer (white line), sidereal zodiac and autumnal equinox [the meeting points of the red (ecliptic) and blue (equator) lines] in CE 3000.

Table 2: The approximate Saptarishis era at the beginning of each millennium.

Year	Tropical Longitude of the Saptarishis Pointer (° ' ")	Tropical Lunar Mansion of the Saptarishis Pointer	Sidereal Longitude of the Saptarishis Pointer (° ' ")
10000 BCE	27 19 59 Pisces	Revati	17 25 01 Simha
9000 BCE	11 55 14 Aries	Ashwini	18 23 32 Simha
8000 BCE	26 08 30 Aries	Bharani	19 00 48 Simha
7000 BCE	10 06 27 Taurus	Rohini	19 22 53 Simha
6000 BCE	23 54 35 Taurus	Margasir	19 34 38 Simha
5000 BCE	07 37 07 Gemini	Ardra	19 39 42 Simha
4000 BCE	21 17 55 Gemini	Punarvasu	19 41 24 Simha
3000 BCE	04 58 17 Cancer	Pushya	19 40 34 Simha
2000 BCE	18 40 10 Cancer	Ashlesa	19 38 43 Simha
1000 BCE	02 25 24 Leo	Magha	19 37 22 Simha
CE 01	16 14 06 Leo	Purvaphalguni	19 36 23 Simha
CE 1000	00 04 50 Virgo	Uttaraphalguni	19 35 00 Simha
CE 2000	14 00 18 Virgo	Hasta	19 34 11 Simha
CE 3000	28 00 04 Virgo	Chaitra	19 34 18 Simha
CE 4000	12 03 05 Libra	Swati	19 34 24 Simha
CE 5000	26 09 42 Libra	Vishakha	19 35 00 Simha
CE 6000	10 21 12 Scorpius	Anuradha	19 37 36 Simha
CE 7000	24 38 02 Scorpius	Jyeshtha	19 42 55 Simha
CE 8000	09 01 39 Scorpius	Moola	19 52 43 Simha
CE 9000	23 34 09 Scorpius	Purvashadha	20 09 32 Simha
CE 10000	08 18 30 Scorpius	Uttarashadha	20 36 41 Simha

with reference to a star. Commonly a point diametrically opposite to Spica is taken as the starting point of Aries by Indian astrologers (Lahiri Ayanamsha). In the West, the Fargan-Bradely Ayanamsha is commonly used, but I prefer the Dulakara Ayanamsha (Indrasena, 2015), which is obtained by eliminating the refraction error imparted by the atmosphere in the location of Spica. It should be understood that throughout this research paper the Dulakara Ayanamsha has been used, and the zodiac has been fixed at CE 232.²

It can be seen that there is hardly any change in star positions with respect to each other between CE 100 and CE 3000. The stars are also more or less stationary with respect to the sidereal zodiac. The Saptarishis pointer, which is the Dubhe-Merak axis, cuts the ecliptic in sidereal Simha (Leo) close to the star 59 Leonis in both CE 100 and CE 3000. There is only 2 arc minutes movement of the pointer along the ecliptic over 2,900 years because of the proper motion of Dubhe and Merak (see Table 2). Therefore, over 2,900 years Saptarishis has hardly moved with respect to the sidereal zodiac.

4.2 The Tropical Zodiac

What is the situation with respect to the tropical zodiac? In Figures 2 and 3, the starting point of tropical Libra can be identified as the point of interception of the ecliptic and the celestial equator. Tropical Aries starts from the point of the vernal equinox. In CE 100, the Saptarishis pointer cuts the ecliptic at tropical Leo but in CE 3000 it will happen in tropical Libra because the starting point of tropical Libra has progressed backwards by about 40° along the ecliptic towards sidereal Leo. Clearly there is movement of Saptarishis along the tropical zodiac although

there is hardly any absolute movement against the stationary stars. This movement is due to the precession of the equinoxes. The rate is approximately 1.5° in 100 years.

5 DISCUSSION

5.1 The Indian Tropical Zodiac

A Nakshatra-based zodiac is unique to Indian astronomy. Indian astrology uses both signs and lunar mansions, whereas Western astrology hardly uses lunar mansions. The first lunar mansion is Ashwini and starts at Aries zero. As noted previously, one lunar mansion spans 13° 20'; these mansions are distributed equally along the zodiac. Since tropical Aries starts at the vernal equinox, the vernal equinox also is the starting point of tropical Ashwini. A tropical lunar mansion-based zodiac starting from the vernal equinox is the basis of the Saptarishis Calendar.

5.2 What Others Say About the Saptarishis Calendar

The Saptarishis Calendar is an ill-understood phenomenon thus far, and as a result it has been dismissed by saying it is non-astronomical (Dikshit, 1969). It is considered more as a convention rather than a true phenomenon (see Ravilochanan, 2007). This misunderstanding is such that the Saptarishis era is calculated by adding or subtracting 100 years serially from a known point. But it is clear from the above description that the Saptarishis Calendar is astronomical and is real. It cannot be calculated by adding 100 years serially but must be identified by observing the pointer in the night sky.

The only research paper available thus far that describes the astronomical basis of the Saptarishis Calendar is the one by Sule et al. (2006).

They noted that the Saptarishis pointer actually migrated from one star or star cluster to another star or cluster. However, they placed major emphasis on the North Celestial Pole and always had the pointer starting from the Pole. Rather than focussing on the alignment of the first two stars in Ursa Major that rise, Sule et al. used a line that went through the North Celestial Pole. In a computer programme it is possible to do so, but in practice it is not always possible to locate the Pole by looking at the sky. Nowadays, the North Celestial Pole is within 1° of Polaris, but Polaris was not always at the Pole. Because of precession, different stars marked the position of the Pole at different times in the past. In 3000 BCE it was Thuban that was close to the North Celestial Pole. In ~ 320 BCE there was no star visible to the naked eye near the Pole, and by CE 3000 Polaris will cease to serve as the Pole Star. Figure 4 shows how the location of the North Celestial Pole changes among the background stars in the course of one precessional cycle.

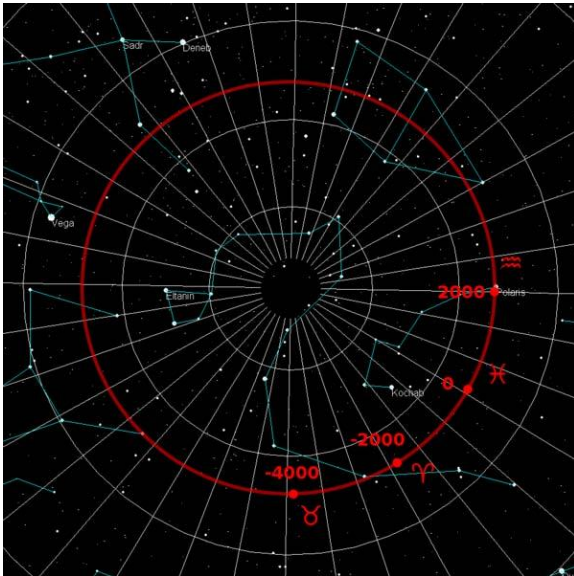


Figure 4: A plot (the red circle) showing how the position of the North Celestial Pole changes with time.

Since the North Celestial Pole cannot always be identified by a star it is not practical to draw imaginary lines that go through the Pole. Furthermore, when emphasis is placed on the Pole rather than Ursa Major, it can be seen that the line can miss the stars Dubhe and Merak altogether. For example, although in CE 2000 the line passes through these two critical stars (Figure 5), in 2000 BCE the line from the North Celestial Pole (very near the star Thuban) missed both Dubhe and Merak but went in between them, violating the principle given in the *Vishnu Purana* (see Figure 6). When the North Celestial Pole is devoid of a star and no stars in Ursa Major are used, it is virtually impossible to trace lines accurately to the ecliptic. Although this can be done with the help of a computer, without a computer it is a challenge.

All in all it can be said that the Saptarishis Calendar is an ill-understood phenomenon. This is because it is tempting to move the Saptarishis pointer along the ecliptic. Rather than moving the pointer from one star to another what actually happens is that the tropical zodiac—which is not dependent on the stars—moves against the star-based Saptarishis pointer.

5.3 The Rate of Motion of Saptarishis

Since the Saptarishis Calendar is a direct projection of the precession of the equinoxes the position of Saptarishis should change at the precessional rate. The major drawback in understanding the true nature of the Saptarishis Calendar and the rate of change is the ambiguity of the descriptions and translations of the verses that mention the rate of movement of Saptarishis.

There are different versions presented in the *Vishnu Purana* and in the *Brihat Samhita*. In the *Vishnu Purana* there is no reference to lunar mansions: "... seven Rishis continue stationary in that conjunction for a hundred years of man." (Dutt, 1896: 312). In contrast, the *Brihat Samhita* states that "The Sages in their course remain for a period of 100 years in each lunar mansion." (Sloka 4, Chapter XIII; Iyer, 1984: 80). The meaning of the term "conjunction" in the *Vishnu Purana* quotation is often misinterpreted as Nakshatra (lunar mansion) but it should not be. 'Conjunction' can be understood better as the meeting point of the Saptarishis pointer with the ecliptic. In other words, the Seven Sages remain at a particular point for nearly 100 years, and this is exactly the case when the *Vishnu Purana* verse is looked into closely. The verse says "Whichever Nakshatra out of Ashwini etc. this line meets; it will remain in the same for 100 human years." The verse is actually referring to the point where the lines meet in a lunar mansion rather than the whole of the lunar mansion. This has been wrongly interpreted as the whole lunar mansion instead of one point. This point has to span either 1° , as per the Greek tradition, or 1.5° , as per the Vedic tradition, if it lasts for 100 years. Since it was the Greeks who popularized the tropical zodiac, the span of the 'conjunction' has to be taken as 1° rather than the whole lunar mansion.

The afore-mentioned quotation in the *Brihat Samhita* must be interpreted cautiously because at the beginning Varahamihira says that what he was writing about Seven Sages was merely what was known to Vriddha Garga: "I shall describe according to the theory of Sage Vriddha Garga ..." (Slokas 1/2, Chapter XIII; Iyer, 1884: 80). It is not clear who Vriddha Garga was. Although it is tempting to assume that he was an ancient Indian writer, his name does not appear in any Indian books, so perhaps he was not an Indian sage. Since Varahamihira and

later Indian astronomers followed the zodiac of Ptolemy, relating the signs to solstices and equinoxes, it is possible that Vriddha Garga was none other than Ptolemy.

Since Varahamihira does not take responsibility for what he says in the *Brihat Samhita* about the Seven Sages it is clear that either he had doubts about it or it was not well understood by him. Therefore Varahamihira's account of the Seven Sages residing in one Nakshatra for 100 years must be treated with caution.

It is impossible for the Saptarishis pointer to traverse one lunar mansion in 100 years. A lunar mansion spans $13^{\circ} 20'$, and since Saptarishis moves along the tropical zodiac at the rate of the precession of the equinoxes, in 100 years it is impossible to move more than 1.38° at the current rate of precession. As per the Vedic tradition the rate of precession is $54''$ per year; in 100 years this will be 1.5° . As per the Greek tradition of Hipparchus the rate of precession is not less than 1° in 100 years. The rate of change of the Seven Sages as given in ancient Indian texts is closer to the rate of precession as discovered by Hipparchus. Therefore, it seems that the Saptarishis Calendar is the application of the rate of precession found by Hipparchus, and the meaning of the term 'conjunction' in the *Vishnu Purana* or Nakshatra in the *Brihat Samhita* is simply a span of 1° along the ecliptic.

5.4 Origin of the Saptarishis Calendar

It is unlikely that the Saptarishis Calendar was in use in India earlier than the time of Ptolemy (i.e. the second century CE). The earliest text that mentions his calendar is the *Vishnu Purana*; the earliest possible date for its composition is the first century BCE and the latest is the fourth century CE. Vriddha Garga is said to have lived in the third century CE, and Varahamihira lived in the sixth century CE. Saptarishis is mentioned in the *Matsya Purana* (CE 250–500), the *Vayu Purana* and the *Bhagavata Purana* (CE 500–1000) (see Sule et al., 2006), all of which post-date the Hipparchus-Ptolemaic era. Hipparchus discovered that the rate of precession was 1° in not less than 100 years, while Ptolemy popularized the tropical zodiac. It is clear that what was known as the Seven Sages' movement by the ancient Indian seers was nothing more than the adoption in India of the tropical zodiac of Ptolemy and the rate of precession of Hipparchus.

Ironically, though, by this time Indian astronomers were aware that the actual rate of precession was $54''$ per year, as mentioned in the *Surya Siddhanta* (Indrasena, 2015: 87). This is equivalent to 1° in 66.7 years, a more realistic value than Hipparchus' figure. This must have been the reason why Varahamihira was so cautious about the movement of Saptarishis when he

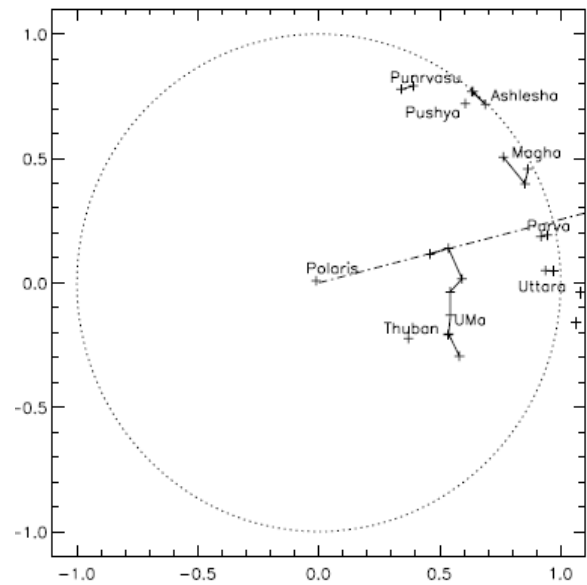


Figure 5: In CE 2000 the Saptarishis pointer passed through the two Ursa Major stars (after Sule et al., 2006).

said it traverses one lunar mansion in 100 years and placed the responsibility for this claim on Vriddha Garga.

That the Saptarishis Calendar came to India from Greece is also supported by the fact that this calendar was widely used only in the northern parts of India (i.e. in Kashmir and Nepal). In Kashmir it is still in use today whereas the rest of India emphasizes the Kali era.

In Kashmir, Varahamihira's teachings are still very popular and it is clear from his writings that he supported the Saayana (tropical) zodiac of the ancient Greeks.

5.5 The Sky Clock

The ancient Indian astronomers did not pay much attention to the exact rate of change of the Saptarishis pointer. This was because they relied

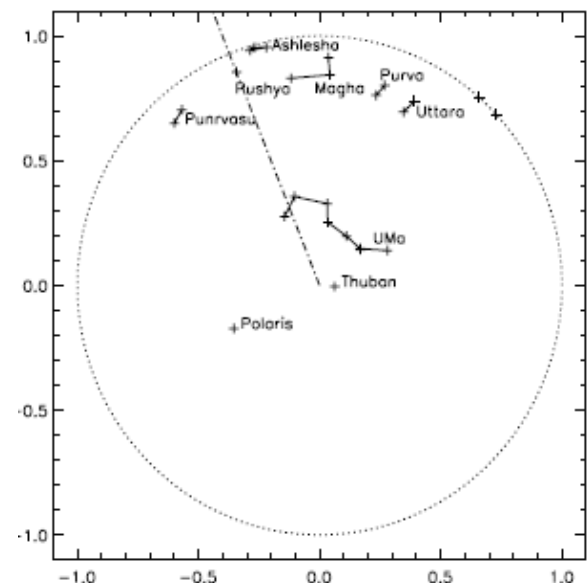


Figure 6: In 2150 BCE the Saptarishis pointer passed between the two 'marker' stars in Ursa Major (Sule et al., 2006).

Table 3: The approximate Saptarishis era by lunar mansion.

Tropical Lunar Mansion	Tropical Longitude (° ')	Year of Commencement	Sidereal Longitude of the Saptarishis Pointer (° ')
Asvini	00 00	9821 BCE	17 37 22 Simha
Bharani	13 20	8903 BCE	18 27 58 Simha
Krittika	26 40	7964 BCE	19 01 50 Simha
Rohini	40 00	7009 BCE	19 22 44 Simha
Mrigasira	53 20	6043 BCE	19 34 17 Simha
Ardra	66 40	5291 BCE	19 38 48 Simha
Punarvasu	80 00	5071 BCE	19 39 35 Simha
Pushya	93 20	3120 BCE	19 40 25 Simha
Ashlesa	106 40	2147 BCE	19 39 03 Simha
Magha	120 00	1177 BCE	19 37 42 Simha
Purvaphalguni	133 20	210 BCE	19 36 18 Simha
Uttaraphalguni	146 40	CE 753	19 35 05 Simha
Hasta	160 00	CE 1711	19 34 46 Simha
Chaitra	173 20	CE 2667	19 34 11 Simha
Swati	186 40	CE 3617	19 34 04 Simha
Vishakha	200 00	CE 4563	19 34 55 Simha
Anurdha	213 20	CE 5506	19 36 03 Simha
Dhanishta	226 40	CE 6442	19 39 31 Simha
Mula	240 00	CE 7373	19 45 56 Simha
Purvashadha	253 20	CE 8297	19 56 51 Simha
Uttarashadha	266 40	CE 9211	20 14 16 Simha
Shravana	280 00	CE 10113	20 40 35 Simha

on observing the Seven Sages rather than using any method of calculation that depended upon their specific rate of movement. Therefore, they did not need to know the exact rate: whether it was 1° per century or one Nakshatra per century was immaterial just so long as the pointer was observed and recorded at the time of a specific event. Even today if somebody wants to find out where Saptarishis is, this must be done by direct observation rather than by calculation. Anybody looking at the sky will see that Saptarishis is now in Hasta of the tropical zodiac. It can be said that when Jawaharlal Nehru was the President of India the Seven Sages were in Hasta, whereas when Parikshit was the ruler it was in Magha. This conclusion cannot be arrived at by any method of direct calculation.

5.6 The Saptarishis Era

The placement of the Saptarishis pointer against the tropical and sidereal zodiac is given in Tables 2 and 3. In the sidereal scale the pointer can be seen always to be in the Purvaphalguni Nakshatra (between 13° 20' 00" and 26° 40' 00") of Simha (Leo) Rashi (sign) between 10000 BCE and CE 10000. It is not easy to determine the exact point where the Saptarishis pointer crosses the ecliptic, but it is somewhere near the star cluster that is located between the two hind feet of the lion (i.e. within the light blue circle included in Figure 2). Out of the three stars, 56 Leonis, 59 Leonis and χ Leonis, 59 Leonis is the closest to the ecliptic, and its radial velocity also is closest to the radial velocity of Dubhe and Merak. Therefore, for practical purposes 59 Leonis is used as the reference point on the ecliptic in this research paper, although

this is not the precise point. The sidereal longitude of 59 Leonis has been given using the Dulakara Ayanamsha, and the zodiac fixed as at CE 232. A slight change in the sidereal longitude is due to the proper motion of Dubhe and Merak (which have radial velocities of -9.40 ± 0.30 and -13.10 ± 0.01 km/s respectively; see Gontcharov, 2006). The proper motion of 59 Leonis (its radial velocity is -11.70 ± 1.30 km/s; *ibid.*) is very similar to those of the other two stars.

Although against the sidereal zodiac the Saptarishis pointer is always in Purvaphalguni Nakshatra, the pointer migrates rapidly along the tropical zodiac at a rate of about 950 years per lunar mansion as a result of precession of the equinoxes (see Tables 2 and 3). It is obvious that this migration of the Saptarishis pointer along the tropical zodiac is the principle behind the Saptarishis Calendar.

5.7 Use of the Saptarishis Calendar for Dating Historical Events

The Saptarishis Calendar can be used to date important events in history, as the following examples demonstrate.

5.7.1 The Mahabharata War and the Yudhishtira-Parikshit Era

The most famous statement regarding use of the Saptarishis Calendar is that Emperor Yudhishtira, who led the Pandava side to victory in the Kurukshetra War, ruled when Saptarishis was in Magha (Sloka 3, chapter XIII, *Brihat Samhita*). In the *Vishnu Purana*, it is said that at the birth of King Parikshit, the successor to Yudhishtira, Saptarishis was in Magha. According to Table 3,

the Saptarishis pointer was in Magha between 1177 and 210 BCE.

It has been estimated by Witzel (1995) that the Kuru Kingdom existed between 1200 and 800 BCE. Pargiter (1922: 180–182) arrived at an approximate date of 950 BCE for the Bharata battle, and from a combination of archaeological and literary evidence Lal (2012) came up with a figure of 900 BCE.

Elsewhere the author of this paper has concluded that the onset of Kali Yuga was in 951 BCE (Indrasena, 2015: 89). It is said in the *Mahabharata* that Kali Yuga commenced soon after Krishna's departure but actually it had already begun astronomically by the time of Krishna's death. Professor Narahari Achar (2010) has established that Krishna's demise occurred 36 years after the Mahabharata War. Accordingly, the year of the War can be dated to a couple of years later than 987 BCE.

5.7.2 Chronology of the Nanda Dynasty

The *Vishnu Purana* states that when Saptarishis was in Parvashadha, the Nanda Dynasty began. This statement cannot be explained by the principles outlined in this paper because Saptarishis cannot be expected to be in Purvashadha lunar mansion in the tropical zodiac until CE 8300. It is possible that this verse actually refers to Purvaphalguni rather than Purvashadha when it says 'Parvashadha'. If this is the case then the relevant time period would be after 210 BCE. Historians say that the Nandas were in power in the fourth century BCE, which approximately tallies with the Saptarishis era as outlined in Tables 2 and 3.

5.7.3 The Duration from Parikshit to Nanda

According to the *Vishnu Purana* (4th Amsa, 24th Adhyaya, 104th Sloka), 1,015 years elapsed from the birth of King Parikshit to the installation of King Nanda (Wilson, 1840). According to Wilson (ibid.) three copies of the *Vayu Purana* and five copies of the *Matsya Purana* give this interval as 1,050 years, and one copy of the *Matsya Purana* mentions 1,500 years. Meanwhile, the *Bhagavata Purana* gives 1,115 years.

As indicated above, King Parikshit must have been ruling around 950 BCE, and since the start of the Nanda Dynasty is dated to 345 BCE by historians (e.g. see Panda, 2007: 28), there is a gap of about 600 years between these two figures. This figure is much less than the gap mentioned in the *Puranas*, which is variously mentioned as from 1,015 years, to 1,500 years.

It has to be understood that when the *Vishnu Purana* says that the gap between Kings Parikshit and Nanda was 1,015 years, this is in terms of 'Saptarishis Years', since this gap has been given in the paragraph where the ages of Kings

Parikshit and Nanda are given in relation to the Saptarishis Calendar. Since the Saptarishis pointer moved at a rate of 1° in 100 years, the duration of one 'Saptarishis year' was 0.01° . When King Parikshit ruled it was Magha and when Nanda ruled it was Purvaphalguni. The difference is one lunar mansion of 13.33° . With the rate of precession of $\leq 1^\circ$ in 100 years this amounts to not more than 1,333 years. This is compatible with the gap given in the *Puranas* which ranges between 1,015 and 1,500 years.

5.7.4 The Saka Era in the *Brihat Samhita*

Another perplexing question that baffles scholars the world over is Varahamihira's claim in the *Brihat Samhita* that the year of King Yudhisthira's reign can be obtained by adding 2,526 years to the Saka era:

The Seven Sages were in the lunar mansion Magha when king Yudhisthira was ruling over the earth, the period of that king being 2526 years before the commencement of the Saka era. (Sloka 3, Chapter XIII; Iyer, 1884: 156).

This quotation should also be understood in the same context as above because the figure 2,526 is in 'Saptarishis years'. This gap is approximately equivalent to two Saptarishis Nakshatras. Since by the time of Yudhisthira it was Magha, the Saka era that Varahamihira mentions in the *Brihat Samhita* must have been when the Seven Sages were in Uttaraphalguni. As seen in Table 3, the Saptarishis entered Uttaraphalguni in about CE 700. Therefore, the Saka era mentioned in the *Brihat Samhita* is clearly different from the commonly-known Saka era that is said to have begun in CE 78.

A Saka era that began in CE 638 is currently in use in Southeast Asia (see Eade, 1995; Irwin, 1909). It is known as Chula Sakarat, meaning 'small Saka'.³ At present, the Chulasakarat Calendar is used in Thailand and in other Southeast Asian countries, and the Shalivahana era that began in CE 78 is known as the Mahasakaraja era in these countries. The Chula Sakarat Calendar is a variation of the Hindu Calendar, which also incorporates the Metonic cycle of the Greeks.

Accordingly, it is clear that the Saka era that is mentioned in the *Brihat Samhita* refers to the Chula Saka era that is still in use in Thailand and certain other Southeast Asian countries. Since the Chula Saka Calendar is a combination of both Vedic and ancient Greek astronomy it can be concluded beyond any reasonable doubt that the Saptarishis Calendar was based on both Vedic and Greek astronomy.

6 CONCLUSION

The Saptarishis Calendar is a reality: it is not just a convention but is an astronomically-explainable

phenomenon. It followed the precessional rate and tropical zodiac of the ancient Greeks. Saptarishis (the Seven Sages) moves forwards from one lunar mansion to the next, covering all 27/28 lunar mansions in one precessional cycle. The axis of the Saptarishis pointer always passes through the stars Dubhe and Merak in Ursa Major, and crosses the ecliptic at a point that can be identified using the tropical zodiac. The pointer does not move with time but the tropical zodiac does in a backward direction against the Saptarishis pointer, which paved the way for the time-keeping system known as the Saptarishis Calendar in ancient India.

7 NOTES

1. A Nakshatra is a lunar mansion.
2. This date was chosen because the Dulakara Ayanamsha assumes that the year CE 232 is the Ayanamsha year zero, when the tropical and the sidereal zodiacs coincided exactly.
3. In the Pali language the meaning of 'Chula' is 'small'.

8 REFERENCES

- Achar, B.N.N., 2011. Revised chronology of the Vedic people In Singh, B.R (ed.). *Origin of Indian Civilization*. New Delhi, D.K. Printworld. Pp. 69–96.
- Dikshit, S.B., 1969. *Bharatiya Jyotisha Shastra [History of Indian Astronomy]. Part I. History of Astronomy during the Vedic and Vedanga Periods*. Delhi, Government of India Press (English translator: R.V. Vaidya).
- Dutt, M.N. (trans.), 1896. *A Prose English Translation of Vishnu Purana*. Calcutta, Elysium Press.
- Eade, J.C., 1995. *The Calendrical Systems of Mainland South-East Asia*. (Handbook of Oriental Studies. South-East Asia, 9). Leiden, Brill.
- Gontcharov, G.A., 2006. Pulkovo compilation of radial velocities for 35 495 Hipparcos stars in a common system. *Astronomy Letters*, 32, 759–771.
- Indrasena, B.S.H., 2015. *Vedic Astronomy and Astro-*

- ogy through Science, Wisdom and Commonsense*. CreateSpace Independent Publishing Platform.
- Irwin, Sir Alfred Macdonald Bulteel, 1909. *The Burmese and Arakanese Calendars*. Rangoon: Hanthawaddy Printing Works.
- Iyer, N.C. (translator), 1884. *The Brihat Samhita of Varahamihira*. Madura, Souts Indian Press.
- Lal, B.B., 2012. Mahābhārata historicity. Paper presented in New Delhi at an International Seminar on Mahabharata organized by the Draupadi Trust. At <http://www.slideshare.net/sfih108/mahabharata-historicity-prof-b-b-lal> [accessed 20 November 2014].
- Panda, H., 2007. *Professor H.C. Raychaudhuri, as a Historian*. New Delhi, Northern Book Centre.
- Pargiter, F.E., 1922. *Ancient Indian Historical Tradition*. London. Oxford University Press.
- Ravilochanan, 2007. Origin of Saptarishis cycle and its implications. At: <http://ravilochanan.blogspot.in/2007/01/origin-of-saptarshi-cycle-and-its.html> [accessed 20 November 2014].
- Sule, A., Vahia, M., Joglekar, H., and Bhujle, S., 2006. Saptarshi's visit to different Nakshatras: subtle effect of Earth's precession. At <http://www.tifr.res.in/~vahia/saptarshi.pdf> [accessed 20 November 2014].
- Wilson, H.H., 1840. *The Vishnu Purana. A System of Hindu Mythology and Tradition*. London, Oriental Translation Fund.
- Witzel, M., 1995. Early Sanskritization. Origins and development of the Kuru State. *Electronic Journal of Vedic Studies*, 1(4), 1–26.



Dr Buddhike S.H. Indrasena, has medical degrees from the University of Sri Lanka, and is a Consulting Surgeon at the Kandy General Hospital in Sri Lanka. His non-medical research interests primarily are in classical Indian and Sri Lankan astronomy and astrology, and especially Vedic astronomy.