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THE LOST KNOWLEDGE = ACCURATE POSITIONING OF PLANETS

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This paper deals with the corrections for the precession of the earth's spin axis prior to and during the Gupta Era. This very slow motion whose period is approximately 26,000 years can be deduced only by meticulous observations. Unfortunately, this tradition of applying correction based on observation was lost resulting in large errors in *pañcāṅgas*/ horoscopes made by astrologers. The consequence is illustrated by two examples.

IMPORTANCE OF GUPTA ERA IN THE INDIAN HISTORY

The Gupta Era is known for its fine art and architecture as well as for astronomy. Considering the beginning of the *Siddhāntic* Astronomy in the year 410 AD[1] all astronomical calculations were being carried out. The *Vikram Saṃvat* (Era) had its beginnings in the Chandragupta II's time (380 -415 AD); the epoch corresponds to BC 57. It is believed that the transition of the Gamma (First Point of Aries) from Aries to Pisces in BC 57 is reckoned as the important event. The correction was identified with '*ayanāṃśa*' in the *nirayaṇa* system used for the *nakṣatras*. The school of astronomy in Ujjain along the lines of one at the capital Pāṭaliputra[2] appears to have been started for these accurate observations and related calculations.

Calendar Reform Committee of India in 1957 officially started the new year at Caitra 1, 1879 Śaka Era, on March 22, 1957. Following the European methods ; tropical year system was adopted (more details about this year is given in subsequent sections).

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The objectives of this work are to:

1. Arrive at the correct value (the lost knowledge) for the positions of the planets amongst the *rāśis* (zodiac signs) for the two examples used in years 1939, and 1954 thereby a method for any other year and

2. Show that an exercise similar to this Committee's - was performed by the astronomers of the court of Emperor Chandragupta II (Vikramāditya) in the Year 410 AD when he had annexed the Śaka country[3-6] in the year 409 AD. The Śakas (Persians) preferred the commencement of new year from the spring equinox unlike the Hindus who used *Uttarāyana* (winter solstice) for the same. A similar calendar reformation was done in the Julian calendar back in 46 BC by Julius Caesar with the help of Sosigenes in Alexandria[7]. He had annexed Egypt to the Roman Empire.

Mapping of Planetary Positions in the Sky in the Indian Society

Astrology is an inevitable social evil. Even today many important events like weddings, oath taking ceremonies of politicians are fixed by astrologers based on planetary positions. However the observed positions of planets do not tally with the calculations made by astrologers; the tables they use have become irrelevant.

Among a large number of calendars prevalent in India, one *Śaka* which starts from 78 AD corresponds to the victory of King Śālivāhana of South India over the *Śaka* king of Malwa. The second one is called the *Vikram Śaka* with epoch at 57 BC. This calendar is extensively used in North India. The details of the two systems can be seen in[8-10] .

The epoch of 57 BC has unfortunately caused widespread confusion amongst historians. Thinking along the lines of the *Śaka* calendar, as mentioned earlier, many historians thought that there must have been a king called Vikramāditya in 57 BC in Ujjain to justify the name Vikram Era. Such a line of thinking was challenged and disproved by Sircar[4] .

The most convincing reason for the choice of 57 BC is that the reference point in the sky - Gamma (the first point of Aries), when the equinox moved from Aries to Pisces. Astrologers reckon this as the Era of Pisces (refer to the Table 1 for the names and the angular spans of these eras, and Fig 2 for understanding the precession of equinox). This shifting or the precession of the equinoxes has

Table 1. Zodiac signs and corresponding *nakṣatras*

Zodiac sign	Abbrev.	Angle, Zodiac Sign	Angle, *Nakṣatras* (Degrees) *Nakṣatras* (Asterisms)
Aries	Ari	0	0 1. Aśvinī
(*Meṣa*)			13.333 2. Bharaṇī
Taurus	Tau	30	26.666 3. Kṛttikâ
(*Vṛṣabha*)			39.999 4. Rohiṇī
Gemini	Gem	60	53.332 5. Mṛgaśīrṣa
(*Mithuna*)			66.665 6. Ârdrâ
Cancer	Cac	90	79.998 7. Punarvasu
(*Karkata*)			93.331 8. Puṣya
Leo	Leo	120	106.664 9. Âśleṣâ
(*Siṃha*)			119.997 10. Maghâ
			133.33 11. Pūrva Phâlguṇī
Virgo	Vir	150	146.663 12. Uttara Phâlguṇī
(*Kanyā*)			159.996 13. Hasta
Libra	Lib	180	173.329 14. Citrâ
(*Tulā*)			186.662 15. Svâtī
Scorpio	Sco	210	199.995 16. Viśâkha
(*Vṛścika*)			213.328 17. Anurâdhâ
Sagittarius	Sgr	240	226.661 18. Jyeṣṭhâ
(*Dhanu*)			239.994 19. Mūla
			253.327 20. Pūrv âṣâḍhâ
Capricorn	Cap	270	266.66 21. Uttar âṣâḍhâ
(*Makara*)			279.993 22. Śravaṇâ
Aquarius	Aqr	300	293.326 23. Dhaniṣṭhâ
(*Kumbha*)			306.659 24. Śaṭabhiṣaj
Pisces	Pis	330	319.992 25. Pūrva Bhâdrapada
(*Mīna*)			333.325 26. Uttara Bhâdrapada
			346.658 27. Revatī

a cycle of approximately 26,000 years. The change of seasons on the earth takes place due to the orientation of this earth's axis with respect to the sun. Even though the precession is an extremely slow process, it causes significant shifts in the weather pattern when taken over long span of time. The currently accepted value for the shift is 50.2 angular seconds per year[8] or for one degree shift — it approximately takes 72 years. The calendar reformation committee also has accepted the same value. The basic reason for the calendar reformation in Europe in the year 1582 by Pope Gregory was the same — the phenomenon of shifting of the equinoxes[10,11].

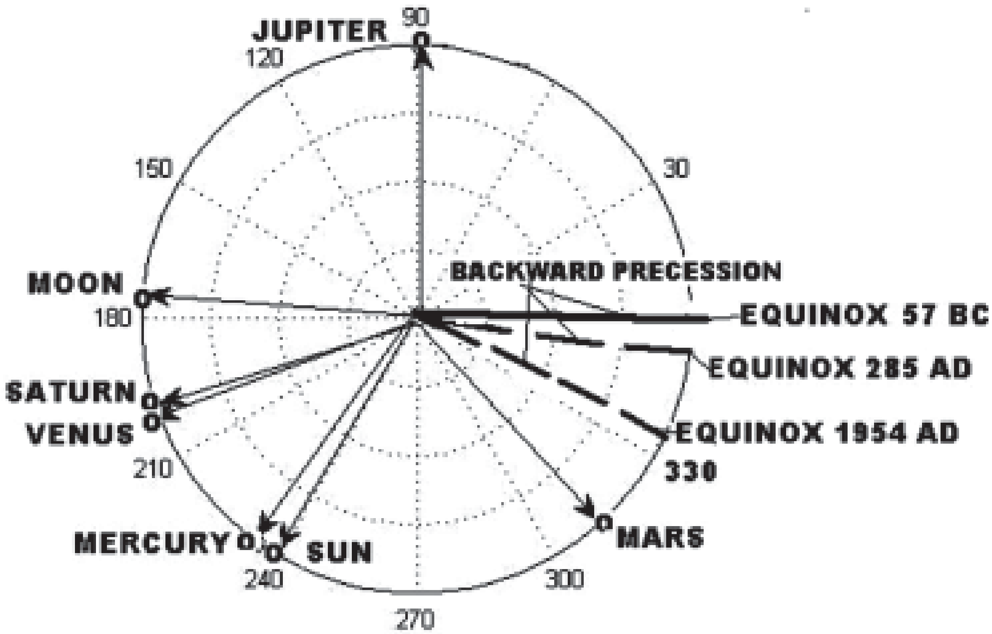

Fig. 1. Precession of equinox and planetary positions in Table 2

One of the reforms in the calendar in 1582 was that the time length of a year was made slightly shorter than the older year and this new year was called a Tropical Year, and such a definition of year is hardly taught in schools even these days in India even after its adoption by the Government of India in 1957.

The Gupta Era astronomers had used the prevalent asterisms named after the 27 stars when they fixed the first year of the *Vikram* Era in 57 BC. Whether they used the constellations is debatable since the concept of zodiacal constellations were introduced by Greeks. However, one can almost be sure that they knew about the transition of equinox from Aries to Pisces in 57 BC otherwise the reason for selecting 57 BC as the year 1 of the *Vikram Samvat* does not have an explanation in the view of the author ; they were making this decision in the Year 410 AD where the new year day was changed to the equinox day from the *Uttarāyan*a (winter solstice). The decision normally would have been to adopt 410 AD itself as the year 1, just like the adoption in the case of the *Śakas* where 78 AD was the year 1. However, the Persians (*Śakas*) who were already using the vernal equinox as a new year day for a long time. The corresponding month based on the luni – solar calendar already in use in India - would have been Caitra. Thus, Caitra became the first month.

On the other hand, 57 BC was used as a reference point because of the important event - transition of equinox from Aries to Pisces.

However, after the end of the Gupta Empire — India went through upheavals in its history[5,6] . One of the possibilities is that the knowledge of the Gupta era astronomers was not communicated to later astronomers. A very small number of astronomers carried on the tradition. It is important to note that the skills for applying such small corrections were known – Āryabhaṭa cites several texts which were in existence before him and are not available to us today.

After India's independence in 1947, Government of India set up a committee for calendar reformation under the leadership of eminent scientist M N Saha. They compiled more than 300 calendars in use all over India; each of them drifted away from the actual events of equinox or solstice in the sky owing to the non-application of precession corrections in the sky amongst the zodiac signs. The Committee's positioning of planets can be seen in Table 1 where they have selected the zero reference point Aries to be the same as that of the zero of Aśvinī. However, it should be noted that the zero of Aśvinī was chosen on the equinox day of 285 AD when it was at 180 degree away from Citrā (Spica). This has been used in converting the positions of planets to the format useful for astrologers. The result is that there has been utter confusion in horoscope making in recent years. This fact is extensively discussed by Kaul[12]. The procedure for accessing of this reference is given in Fig. 2.

The horoscopes made by Indian astrologers differ from those by European counterparts in that a correction called an '*ayanāṃśa*' is applied to the moving or shifting European zodiac sign values. But, unfortunately different horoscope makers who claim that they follow the *Sūrya Sidhānta* (Lahiri, Raman, Cyril Fagan), and *Grahalāghava* - apply different amounts of corrections - which is highly irrational as explained by Kaul. The Indian or the Hindu horoscope makers use what is called the *Nirayana* system where they attempt to back calculate to match with the static zodiac signs but unsuccessfully because their *ayanamṣa* values do not go far back to 57 BC when the transition of equinox took place from Aries to Pisces.

The reference 12 can be accessed by taking the following steps:	WEBSITE http://groups.yahoo.com/ group/hinducivilization/
STEP 1 : Go the website http://groups.yahoo.com/ group/hinducivilization/	Home
	Messages
	Post
STEP 2 : After going to the website, click on ' Files ' which appears on the left column at this site. The appearance is shown in the right column here.	Files ←
	Photos
	Links
	Database
	Polls
STEP 3 : Go through the alphabetical list of files, and download the file called – 'Rashi5.doc' .	Calendar
	Promote

Fig. 2. Steps to access reference 12 by Kaul

ILLUSTRATIVE EXAMPLES

In order to explain the objective of this work, two examples are used. Tables 2, and 3 show the details of the calculations used by Shakuntala Devi[13], the famous mathematician, and the author of this book.

In Table 2, we choose a specific time which happens to be the time of birth of an individual and available as an authentic record. The person was born at Calcutta (Latitude 22.30^o N, Longitude 88.20^o E). The signs of the zodiac and the values of angles using the Table 1, according to the European system, are given in columns 2 and 3. The planetary positions in their respective signs are given in column 4. The total value of the angles for each of the planets starting from the equinox position is shown in column 5. The *ayanāṃśa* used by Devi is

Table 2. Horoscope of Seema Born at Calcutta on December 19, 1954 at 18:00 Hours

Planet	Sign European	Angle-Sign	Planetary Position	Angle European	*Ayanāṃśa* (Devi)	Angle (Devi)	Sign (Devi)	*Ayanāṃśa* (*Vikram*)	Angle (*Vikram*)	Sign (*Vikram*)
1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**
Sun	Sagittarius	240.0	27.1	267.1	23.3	243.8	Sagittarius	28.0	239.0	Scorpio*
Moon	Libra	180.0	23.6	203.6	23.3	180.3	Libra	28.0	175.5	Virgo*
Mercury	Sagittarius	240.0	23.4	263.4	23.3	240.2	Scorpio	28.0	235.4	Scorpio
Venus	Scorpio	210.0	18.1	228.1	23.3	204.8	Libra	28.0	200.0	Libra
Mars	Pisces	330.0	10.5	340.5	23.3	317.2	Aquarius	28.0	312.5	Aquarius
Jupiter	Cancer	90.0	28.2	118.2	23.3	94.9	Cancer	28.0	90.1	Cancer
Saturn	Scorpio	210.0	17.1	227.1	23.3	203.8	Libra	28.0	199.0	Libra

Table 3. Horoscope of Mahendra born at Delhi on December 17, 1939 at 18:00 hours

Planet	Sign European	Angle-Sign	Planetary Position	Angle European	*Ayanāṃśa* (Devi)	Angle (Devi)	Sign (Devi)	*Ayanāṃśa* (*Vikram*)	Angle (*Vikram*)	Sign (*Vikram*)
1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**
Sun	Sagittarius	240.0	24.4	264.4	23.1	241.3	Sagittarius	27.8	236.6	Scorpio*
Moon	Pisces	330.0	9.6	339.6	23.1	316.5	Aquarius	27.8	311.8	Aquarius
Mercuy	Sagittarius	240.0	3.2	243.2	23.1	220.2	Scorpio	27.8	215.4	Scorpio
Venus	Capricorn	270.0	20.2	290.2	23.1	267.1	Sagittarius	27.8	262.4	Sagittarius
Mars	Pisces	330.0	18.1	348.1	23.1	325.1	Aquarius	27.8	320.3	Aquarius
Jupiter	Pisces	330.0	29.5	359.5	23.1	336.4	Pisces	27.8	331.6	Pisces
Saturn	Aries	0.0	24.3	24.3	23.1	1.2	Aries	27.8	356.5	Pisces*

given in column 6 (here the calculation is based on precession rate of 50.2 arc seconds per year) . It should be noted that the zero value of the *ayanāṃśa* - at the precession rate of 50.2 angular seconds per year – would be corresponding to the year 285 AD approximately. The *Nirayana* values, after subtraction using the *ayanāṃśa*, are shown in column 7. One can conclude that -according to Devi, based on her value of *ayanāṃśa*, the first point of Aries (going backwards) must have been in the year 285 AD, and not in 57 BC. This 285 AD date is contradicted by Meeus as stated by Kaul[13] (Meeus – Morsels of Astronomy, published by Willman-Bell, USA. Page No. 304). Meeus (Kaul[14)] has calculated the transition to have taken place in the year 68 BC which is not very far from 57 BC the year of the Gupta Era astronomers. It should be noted that the variation of the precession correction is not linear but is fitted with a quadratic equation of second order as explained in the explanatory supplement of the Ephemeris. Thus a small error of 11 years accumulated over 2000 years can be explained.

The results after applying the correction are shown in column 7 and the corresponding *rāśis* in the *Nirayana* system are shown in column 8. If we use the 57 BC as the reference, we would have the *ayanāṃśa* shown in column 9 and the results, after the use of this *ayanāṃśa*, will be what are shown in column 10. The rāśis are shown in column 11 corresponding to the values given in column 10. In the Table 2, it is quite clear that the rāśis of the Sun and the Moon are different from those in column 8 (Devi's) where improper *ayanāṃśa* was used. The planetary positions as well as the precession of the equinoxes are shown in Fig. 2. For example, the angular positions of the planets (shown by arrows from the centre to the respective planets) given in any of the columns 5, 7 or 10 in Table 2 are to be read in the counter-clockwise direction starting from their respective reference lines [57 BC (*Vikram*) or 285 AD (Devi or National *Pañcā ṅgam*) or 1954 AD (European)]

Table 3 shows another example for the time of birth of a person born on a different date in Delhi. These results again show that the signs for the Sun and Saturn are quite different from those in column 8 (Devi's or National *Pañcāṅgam*'s).

All of the results in Table 2 can be understood from Fig. 2. This figure has three reference lines corresponding to the position of equinox on 57 BC (shown by a solid line), 285 AD (dashed line), and 1954 AD (dashed line). As time progresses, the equinox moves backwards corresponding to the *ayanāṃśa* of the year. In the year 285 AD, the *ayanāṃśa* in Table 2 is 23.3 degrees. This is shown as the angle between 57 BCE equinox line and 285 AD line equal to (28 – 23.3) = 4.7 degrees. Similarly, the *ayanāṃśa* for 1954 AD was 28 degrees which is shown by measuring the angle between 57 BC line and 1954 line. So, we move 28 degrees in clockwise direction from the 57 BC line.

Here, the planetary positions shown in column 5 (European values) can be read in this circular graph by going counter - clockwise from the equinox line on 1954 AD. The first planet is Jupiter at 118.2 degrees in column 5 of Table 2. The position of Jupiter and other planets are shown by arrows from the origin. Then, it is the Moon at 203.6 degrees. This way, one can see the location of other planets.

Next, we look at Shakuntala Devi's values given in column 7 of Table 2 by going 94.9 degrees (for Jupiter) in a counter – clockwise manner from the 1954 AD equinox line. The angle for the Moon is 180.3 degrees. The angles for other planets can be read in a similar manner.

Finally, based on the *Vikram Saṃvat* (column 10) one has to start at 57 BC equinox line and find the locations of planets in a similar manner as described above.

Therefore, process of precession or the use of *ayanāṃśa* is clear from Fig.. 2; the equinox point shifts backwards (clockwise) from higher angles to lower angles as time passes.

One can trace the source of problem associated with the Committee's work which is reflected in Abhayankar's statements :

> "The *rāśi* and *nakṣatra* divisions are directly connected to each other by the conventions that the first point of the Aśvinī *nakṣatra* coincides with the first point of meṣa *rāśi*, which is known as aśvinī – meṣa. The demarcation of *nakṣatras* fixes the boundaries of the *rāśis*, two and a quarter *nakṣatra* making one *rāśi* There is hardly any controversy about both of them now."

At a given time, position of equinox is unique. By no convention, one can assume that the zeros of the two system to be one and the same. Further, fixing the border of the zodiacal constellations has not been uniform all along. It was formalised by the International Astronomical Union about 75 years ago[14]. It may be seen that in Tables 2 and 3, the names of constellations appear to be different; but the angles are within an error of about 5 degrees. Thus, the transit of a heavenly body from one constellation to another can be interpreted differently especially if the planet is at the border. It is here that the numbers depict a better position than the names of the constellations themselves. Thus, any horoscope or time measure giving the names of the constellations only can be erroneous. Quite naturally anything based on the names and angles assigned based on the names will be erroneous.

Abhyankar's statements quoted above do not state the actual facts The assumption is on fixing Gamma with the star Aśvinī. However if one were to go by the numbers, the actual star's position may be different. Thus numbers and not the names of constellations are important for arriving at the date of the epoch. The corresponding extrapolated calculations give us a number which will again be uncertain because the reckoning of new year varied between Autumnal Equinox and Vernal Equinox in different parts of India. The Committee merely adopted what was already in practice in most parts of India. Had the New Year been starting from the *Uttarāyana* in India, *Caitra* would not have been the first month as it is, or was, in most part of India even before the Committee's adoption in 1957. In fact, the Committee's adoptions brought minimum changes in the country. This is one of the reasons why the reformed calendar has remained within the domain of Government agencies and not touched the social and religious authorities.

Conclusions

In the present work, using two examples, it was shown that :

(1) Indian *Pañcāṅgas* / horoscopes are being made with errors, the specific contribution of this work is to define the error and quantify the error.

(2) Similar is the situation with European ones also in the light of the above conclusion.

(3) The knowledge of the corrections for precession adopted by Gupta Era astronomers seem to have evaded the modern Indian astronomers.

(4) The shifting of the new year from *Uttarāyana* to the vernal equinox was made during the Gupta Era thereby *Caitra* became the first month of the year.

References

1. Abhyankar, K. D. and Siddharth, B. G., 1993, "*Treasures of Ancient Indian Astronomy*", Ajanta Publications Delhi, India, 1993, pp 47 - 77
2. Joseph, G. G., "The Crest of the Peacock: Non - Europeans Roots of Mathematics", Princeton, U. S. A, 2000, Chs. 8, and 9.
3. Cunningham, A., *Book of Indian Eras*., Indological Book House, Varanasi, India, 1970, pp 47-50
4. Sircar, D. C., 1969, "*Ancient Malwa and Vikramaditya Tradition*", Munshiram Manoharlal, New Delhi, India, pp ix – xi ; 149-166
5. Tripathy, R. S., 1985, "*History of Ancient India*", Motilal Banarsidas, New Delhi, India, p 251
6. Wolpert, S., 1993, "*A New History of India*", Oxford University Press, New York, U.S. A., p 90
7. Sosigenes, "http://www.usefultrivia.com/biographies/sosigenes_001.html
8. Rao, S. B., 2000, "*Ancient Indian Astronomy Planetary Positions, and Eclipses*", B. R. Publishing Corp Corporation, Delhi, Chs 1,2,4 and Appendix 1
9. Naik, P.C., and Satpathy, L, 1998, "Samanta Chandra Shekhar: The Great Naked Eye Astronomer", *Bull. Astro Soc. of India*, Vol 26, pp 33-49.
10. "Julian Calendar", http://en.wikipedia.org/wiki/Julian_calendar
11. Snowden, B, "The Curious History of the Gregorian Calendar Eleven Days That Never Were", http://www.infoplease.com/spot/gregorian1.html
12. Kaul, A. K. "The Hoax Called Vedic Rashichakra and Vedic Astrology!" http://groups.yahoo.com/group/hinducivilization/
13. Devi, S., *Astrology For You. Orient Paperbacks*, New Delhi, India, 1995, pp 67-81.
14. Meeus, J, Cross refernce by Kaul, Jean Meeus – Morsels of Astronomy, published by Willman-Bell, USA. Page No. 304.
15. International Astronomical Union, 'http://en.wikipedia.org/wiki/International_Astronomical_Union#History'