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THE ZERO-POINT OF THE ZODIAC OF THE HINDU ASTRONOMERS IN ANCIENT INDIA

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ABSTRACT

In modern Astronomy the vernal equinoctial (VE) point is taken as the starting point for measuring celestial longitudes. Due to the precession of equinoxes, the above point is receding back along the ecliptic. As a result, the longitudes of fixed stars are increasing every year. In ancient India, the Hindu astronomers did not favour the idea of fixed stars changing their longitudes. In order to stabilize the zodiac, they had taken as the origin a point which is fixed on the ecliptic and as such is quite different from the VE point. This initial point being a fixed one, the longitude of stars measured from this origin remain invariable for all time. There was an epoch in the past when this initial point coincided with the VE point and thus the epoch may be called the zero-year. There is controversy over the determination of the zero-year. The reasons for the choice for the fixed zodiacal system by the Hindu astronomers as well as the epoch of zero-year have been found out on the basis of information available in various astronomical treatises of ancient India written in Sanskrit.

Key words: measuring longitude from VE point – Hindu method of measuring longitude – zero-year of the Hindu zodiac

1. INTRODUCTION

In modern astronomy, the vernal equinoctial point (VE Point), i.e. the so called First Point of Aries, is taken as the starting point for measuring celestial longitudes. The celestial longitude of a heavenly body measured from this initial point is known as the tropical (or sayana longitude in Hindu astronomy). Due to the precession of the equinoxes, the above VE point is receding back over the ecliptic at the rate of about 50 seconds of arc per year, as a result of which the longitudes of even fixed points in the heavens are increasing every year at the same rate. In ancient India, the Hindu astronomers did not favour the idea of fixed stars changing their longitudes. In order to stabilize the zodiac, they had taken as the origin a point which is fixed on the ecliptic and as such is quite different from the VE point. This initial point being a fixed one, the longitude of stars measured from this origin remains invariable for all time. The distance between this fixed initial point and the VE point is called ayanamsa in Hindu astronomy and the zodiac starting from this fixed origin is known as the fixed zodiac (Figure 1). The longitude of a heavenly body measured from this fixed point is known as sidereal (or nirayana longitude in Hindu astronomy). There was an epoch in the past when this initial point coincided with the VE point i.e. the sidereal zodiac coincided with the tropical one. At that time, the value of ayanamsa was zero and thus the epoch may be called the zero-year.

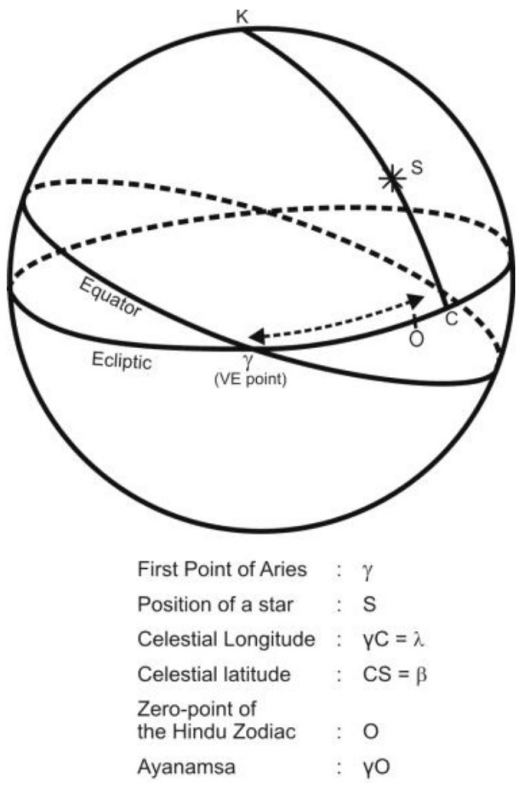

Figure 1. Zero-point of the Hindu-zodiac

2. REASONS FOR THE CHOICE FOR THE FIXED ZODIACAL SYSTEM

The choice for the nirayana system seems to have been based purely on astrological grounds. In the sayana system the longitudes of both stars and planets are changing. In the nirayana system, only the planets are changing their places and the stars are stationary (stars also change position due to proper motion, but such changes are generally very small, the greatest value of which has been found to lie within 3 or 4 mins. of arc in a century). The invariability of the positions of stars in the zodiac, which is the characteristic of the nirayana system, has offered a great advantage to astrology. We get a fixed starry background of the zodiac, which is divided into 12 rasis (zodiacal signs in Hindu astronomy) and 27 nakshatras (segments of the lunar zodiac in Hindu astronomy). This advantage has enabled the ancient astrologers of India to assign some fixed attributes to the different rasis and nakshatras in consideration for the types of the stars and the forms in which they are situated in those divisions. In the nirayana system of astrology, there is, therefore, no need of considering the effects of stars separately, as their combined effect has been duly considered while naming the rasis and assigning their attributes. Astrology based on the nirayana system has, therefore, a rather hard foundation beneath its feet to stand upon.

3. DETERMINATION FOR THE EPOCH OF THE ZERO-YEAR OF THE FIXED ZODIAC

There is controversy over the determination of the zero-year. Let us first come to the question of determining the initial point of the nirayana zodiac vis-a-vis the value of ayanamsa for any particular year. This problem is no doubt an extremely complicated one and it does not lead to any unique solution. As a result, we are, at present, getting values of ayanamsa varying from 19 degrees to 24 degrees. As the sastric rules dealing with this question in Hindu astronomy are not unequivocal, we shall have to examine each case on its own merit and then arrive at a final decision as to which value should be taken as the correct ayanamsa for a year.

In recent years, Cyril Fagan (a famous British Astronomer who studied ancient Indian Astronomy) has found after his researches into antiquity that the two zodiacs coincided in 213 A.D. This gives the ayanamsa for 1st January, 1962 as 24 degrees 19 mins. Fagan has used the positions of the Sun, the Moon and the planets for an ancient epoch and his result is dependent upon these calculated positions. Recent introduction of the ephemeris time in the calculation of planets' positions and other considerations show that the Moon's position may be in error by as much as 2 degrees in 500 B.C., if ephemeris time or the modified values of the Moon's equation are not used in the calculations. Positions of the other planets would also be similarly vitiated in such back periods. Under the circumstances much reliance cannot be laid on the finding that 213 A.D. was the zero-ayanamsa year.

Let us now come to Indian authors. The famous ancient Hindu astronomy treatise Surya-Siddhanta gives a rule for finding the ayanamsa for any year. But the concept of ayana dolana (theory of trepidation or oscillation of the equinoxes in Hindu astronomy) introduced in the Surya-Siddhanta has rendered its findings unacceptable to a modern scholar. Surya-Siddhanta says that ayanamsa was zero in 3102 B.C., it attained a negative maximum value of 27 degrees in 1302 B.C., was zero again in 499 A.D. and since then the ayanamsa has been increasing at the uniform rate of 54 seconds per year.

From the tropical or sayana Sun, obtained by observation compared with the calculated nirayana Sun, Bhsakarachraya-II (the great ancient Indian astronomer) determined the value of ayanamsa as 11 degrees for 1183 A.D. The annual rate of ayanamsa as adopted by him was 60 seconds and as such the zero-ayanamsa year was 523 A.D. On the basis of Bhaskara's observation of 11 degrees for 1183 A.D., we obtain 391 A.D. as the zero-ayanamsa year after applying the correct rate of precession and consequently the ayanamsa for 1962.0 is found to be 21 degrees 49 mins.

At the early stage of calendar reform in our country, the above method of Bhsakarachraya was used in determining the ayanamsa by the reformed panchang makers. Subsequently it was abandoned for the reason that it did not give a true sidereal zodiac.

From the foregoing discussions, it is evident that none of the methods described above can be relied upon in the construction of the true sidereal system of astronomy. For this purpose, we shall have to take recourse to the star positions. Let us now make an attempt to solve the problem from a study of the positions of stars as given in old astronomical treatises. We may first consider the modern Surya-Siddhanta for this purpose.

The Surya-Siddhanta gives the positions of stars in the divisions of the nakshatras concerned expressed in the unit of 10 mins. of arc. From these figures, the positions of stars can be found measured from the beginning of Mesa (initial sign of the Hindu zodiac). The figures thus obtained are not, however, the celestial longitudes as we generally understand, but are polar longitudes. The polar longitude of a star is the portion of the ecliptic measured from the initial point up to the point of intersection of the ecliptic with declination circle passing through the star.

Burgess (a British astronomer of repute) had converted the polar longitudes of the stars into their celestial longitudes and the figures are given in his Surya-Siddhanta. Comparing these figures with the actual tropical longitudes of the relevant stars for 1962.0, we can find the differences, which are the values of ayanamsa for 1962 as derived from the stars in question. Unfortunately there is no unique solution arrived at by this process. It would thus follow that it is rather difficult to assign any definite position to the initial point of the Hindu Zodiac from a study of the star-positions of the Surya-Siddhanta.

Let us now go back to further antiquity in search of evidence that may give us a correct position of the initial

point of the Hindu Zodiac that was in vogue at that time.

In the Vedanga Jyotisa (1350 B.C.), it has been stated that the winter solstice used to take place at beginning of lunar asterism Sravistha (which is later called Dhanistha) when both the Sun and the Moon became conjoined with the principal star of this asterism. The principal star of this group is either α or β Delphini. We know that Dhanistha division of the lunar mansions begin from the nirayana longitude of 293 degrees 20 mins. and also that the tropical longitude in 1962.0 of α Delphini is 316 degrees 51 mins. and of β Delphini 315 degrees 49 mins. Therefore, it is seen that the ayanamsa in 1962 deduced from the two stars are 23 degrees 31 mins. and 22 degrees 29 mins. respectively, giving the zero-ayanamsa years as 269 A.D. and 343 A.D. respectively.

Let us now come to Pancha Siddhantika, which is a collection of old astronomical treatises compiled by Varahamihira (a great ancient Indian astronomer). This will give us a precise value of the ayanamsa. The Pancha Siddhantika gives the positions of certain stars (in all seven stars), the coordinates of which are presumably not expressed in terms of polar longitudes. It is thought that they are given in terms of arc of the ecliptic or simply longitudes measured from the beginning of the lunar asterisms concerned. The brightest of the zodiacal stars having simultaneous minimum latitudes are Regulus (Indian name Magha) and Spica (Indian name Chitra). The positions of these stars, as given in the Pancha Siddhantika, are 126 degrees 0 mins. and 180 degrees 0 mins. respectively measured from the initial point. In 1962 A.D. the tropical longitudes of these two stars are 149 degrees 18 mins. and 203 degrees 19 mins., yielding the values of ayanamsa of 23 degrees 18 mins. and 23 degrees 19 mins. respectively and giving the zero-ayanamsa year at about 285 A.D. It is also seen that the two results agree closely which is very satisfactory. It is gratifying to note that the initial point that was indicated roughly by the Dhanistha stars of the Vedanga Jyotisa has now been more precisely fixed by the stars Magha and Chitra of the Pancha-Siddhantika. However, for the exact determination of this initial point, we shall have to depend upon only one star – in this case Chitra has the right claim for such a selection as it is situated at a cardinal point i.e. is exactly at the opposite point of the beginning of the nirayana zodiac.

4. PRESENT ACCEPTANCE OF THE EPOCH OF THE ZERO-YEAR OF THE FILXED ZODIAC

The Calendar Reform Committee of the Govt. of India under the Chairmanship of famous astronomer Professor M.N. Saha, accepted the above view and adopted 285 A.D. as the zero-ayanamsa year. But the Committee introduced a slight diminution in the value of ayanamsa by an amount of 5.8 seconds and assigned a rounded value of 23 degrees 15 mins. 0 seconds to it for a modern epoch viz. March 21 1956 A.D. The anchoring of the ayanamsa to an epoch of modern time was done with a view to eliminating any possible further change in the value of ayanamsa arising from future revision of the adopted precession rate. On the above basis the value of mean ayanamsa was 23 degrees 19 mins. 34.02 seconds in 1962.0 A.D. and 23 degrees 51 mins. 25.46 seconds in 2000.0 A.D.

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