Three Strange Verses in Surya Siddhanta and Accurate Astrological Predictions

R. V. Vaidya, M.A., B.T

Introduction

The Indian Almanac makers of the present day follow the Nirayan system for calculating planets’ places. The History of Indian Astronomy shows that the Indians definitely followed the Sayan system upto the time of Surya Siddhanta (S.S.) (SeeuDikshit', pages 417 to 419). The later astronomers, however, appear to have adopted the Nirayana system. It is curious to note that scholars interested in Panchang controversy, point out to a group of three verses in Surya- Siddhant (S.S.) as their ground for adopting the Ayanamsas.

In the following brief article, I have to show:

(i) that these verses were not composed by the author of S.S. but have been interpolated by some later astronomer and
(ii) that they do not advocate the use of a correction (Ayanasamskara) to be applied to the Sayan longitudes of planets but
(iii) that, in reality, they propound a very important theorem which has hitherto remained unknown to the Indian Astronomers.

The Three Verses

The following verses supposed to be written by the author of S.S., occur in the third chapter of the book, the subject matter of the book being विषण (thripasna) or the fundamental problems of time, place and direction:

तिश्चत्र्यं तु भाषा चक्रम प्राकू परिलक्षिते।
तद्दुसंधानं भूतिनेत्रस्करं हुनानादू यदाभयते।
तद्विषणं दशानाकरं विधियं अन्यायं।
तत्तत्त्तसंहतात् ग्रहान कार्ति: फाचार्यादिविकं।
स्फुटम दूकू चक्र चलितम् हीने छायां कार्ति करणागे
अन्तर्दाच्छेराथकूल स्फुटम् स्त्रालिमिके।

A careful scrutiny of the first 12 verses of this chapter will reveal that the first eight verses deal with the problems of the ascertaining of directions, measuring of shadows cast by gnomon the calculation of sine and cosine values of the Sun's declination, etc. The 12th and 13th verses deal with the calculation of the फल्बु (equinoctial shadow) and अक्षाङ्ग (geographical latitude). The above mentioned verses occupy the intermediate place. The subject matter of these verses is the application of a certain correction to a coordinate of a plane Vs place. Naturally, these ought to have occurred somewhere in the first chapter or mean places घ्यमांकिते or in the second chapter which deals with the true places of planets स्थानांकिते. But the last* verse of the second chapter clearly states that according to the writer, "everything concerning the planetary places has been dealt with at length in the first two chapters and nothing else remains to be said". This clearly shows that the three verses have not been written by the author of S.S. They look like "unconcerned visitors" sitting in the midst of a party meeting.

The third chapter treats of shadow, planets, declination, the geographical latitude, the ascensional difference (A.D.) etc. Hence, no one can expect an eminent astronomer like the author of S.S. to commit the blunder of "throwing-in" into this chapter verses which have nothing to do with the subject matter of the chapter.

I quite agree with Rev. Burgess who** regards these verses as "interpolated" by some later astronomer Mr. R. V. Patwardhan of Poona, a staunch supporter of Zeta School of Nirayan system, also holds the same view, how ever, differ from all astronomers on one point, viz., "the exact significance and purpose of those verses"; for, I hold the view that these verses do not contain a

* एक स्फुटि तिथि प्राकू गुणितानुपालिता (स्थानांकिते 69)
**See Translation of S.S. by Rev Burgess. Pages 114 to 118

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Every astronomer, who knows the method of taking observations of heavenly bodies, knows that while the
observer first finds the longitude and latitude of a planet, the
he takes (i) either the Right Ascension and Declination, or (ii) the Azimuth and Altitude or (iii) the
and the Declination, and the is verifiable by the
observation of Sun's Declination. Naturally, the author
of these verses must have thought it proper to treat this "theorem on the verification of calculated results" in the
chapter on the ' Three Problems ' which commences with
the and 

Fall Import of the Passage

Let us try to understand these verses part by part. (A) The
first verse clearly states that the celestial sphere (the star
belt) is slowly moving towards the East, away from some
point in the sky which the author has chosen and with
respect to which he has taken observations of all principal
stars and has recorded them in a chapter in S. S. (this point
was the position of the equinox in the year of observation).

The author of these verses clearly takes into consideration
the movement of the starry sphere and is thus the follower
of a Sayan system (but in a different sense). The difference
then, clearly lies in the fact that while we get a Nirayan
place from the Sayan by the formula " Sayan place
Ayanamsa = Nirayana place " we should, while making use
of the S. S. rules, follow the formula " Sayan + Ayanamsa
= Nirayan

(B) The author clearly gives, if not the rate of precession
of equinoxes, the rate of change of longitudinal place by
the words विशालकृत्येण सुर्यं i.e., 600 times per Mahayuga
(according to popular belief). त्रिशत् means 30. कृत्यम्
means 20 or 22. If the correct पाठ be कृत्यम् it would mean
a 'square'. Hence विशालकृत्येण or 331 would mean 600,
660 or 900 revolutions per Mahayuga. i.e., 3. 3½ or 4½
minutes of arc per year.

Those, who believe that the S. S. advocates the Nirayan
basis of calculation, will have to adopt one of these 3 rates
of correction to be applied to the longitude of a planet.
The different figures depending upon the sense which विशालकृत्येण
is believed to convey.
(C) The second verse asks one to perform some intricate calculations and to arrive at some result and to name it as Ayanamsa. Suppose, the number of mean solar days in a Mahayuga is \(x\) and the Ahargana on a particular day is \(y\). Then the first step of the result would be \(y \times 600 \times 360/x\) degrees. This result can happen to be a very big one. Let us suppose it to be, say, 3765 days. This is equal to 10 revolutions + 165\(^\circ\). This latter figure is to be represented as a i.e., an acute angle differing from 90\(^\circ\), 180\(^\circ\), 270\(^\circ\), or 360\(^\circ\) by some value. In this example, 165\(^\circ\) = 180 - 15\(^\circ\). Then 15\(^\circ\) is said to be a jif. This multiplied by 3 and divided by 10 would give This is to be called the Ayanamsa.

If, for instance, we try to find the Ayanamsa for the 1821 B.C. being taken) would be 5000 years. The starry belt should be supposed to have moved through 250\(^\circ\), 275\(^\circ\) or 375\(^\circ\) (according to different interpretations of विषालक्ष्या).

The author enjoins us to reduce this to an angle in one of the 4 quadrants. The भुज्य of these angles would be 70\(^\circ\), 5\(^\circ\), and 15\(^\circ\) respectively. One can clearly understand that since every big result must be reduced to an acute angle and since each such angle is always to be multiplied by 3/10, this multiplier acts as a controller and the net result would never exceed 27\(^\circ\), because the maximum value of a भुज्य would never exceed 90\(^\circ\), which when multiplied by 3/10 gives 27\(^\circ\).

Also, since the acute angle can be found always to lie in one of the 4 quadrants, the value of the Ayanamsa naturally increases from +0\(^\circ\) to +27\(^\circ\) in the 1st quadrant, then decreases from +27\(^\circ\) to 0\(^\circ\) in the 2nd quadrant, then 0\(^\circ\) to -27\(^\circ\) in the 3rd and from 27\(^\circ\) to 0\(^\circ\) in the fourth.

The following important corollaries naturally follow from the above considerations:

(i) The Ayanamsa value oscillates between plus 27° and -27°, and that

(ii) it is independent of the rate of movement of the starry belt since no figure in the list of natural numbers for that rate can cause any change in the limiting values of Ayanamsas which are obtained by the "multiplier control" of 3/10 being applied to an acute angle भुज्य which each angle is got to be reduced.

(D) The third verse enjoins the calculator to apply this correction (Ayanamsa) to a planet. The language is very ambiguous here. The author does not state in clear terms as to which coordinate of the planet's place is meant.

The commentators of the S.S. have deluded themselves into believing that this is a correction to be applied to the planet's longitude. The author does not give this verse in the chapters on "planets' places". The correction in this respect is clearly the rate of motion given by विषालक्ष्या:

In my opinion, this is not the correction to be applied either to the latitude or the longitude of a planet but to that co-ordinate of the planet's place which is known as "Declination" (क्रिःतिः), i.e., the distance of the planet from the Equator (North or South).

It is a well-known phenomenon of modern astronomy that as the Equator slides on the Ecliptic, the equinox makes one complete revolution in about 26000 years. The equator passes through each star (situated within the belt of ±23\(^\circ\) of the ecliptic) sometime during the revolution of the equinoctial point; it is sometimes seen to lie to the East and sometimes to the West of each such star. Thus, it will be seen that when the equator passes through a star, its declination is zero, some centuries before this event it must have been positive and some centuries later it will continue to be negative. The value of the declination for each such star will thus be seen to have oscillated between +231/2° and -231/2°.

The History of Indian Astronomy tells us that in the days of शालस्थापाकरण (Sathapatha Brahmana) the Pleades' (Krithika) used to rise exactly in the East. This shows that the declination of the star was, thus, zero in those times. The S.S., however, gives +19° as the declination and in our present times the declination of this star is about +24°. As centuries will roll by, this value will appear to be decreasing.

The author of these verses very well knew that the formulae of calculating planets विषालक्ष्या and declinations as given by S. S in verses 56, 58 (Chapter 11) will not continue to hold good after some centuries. He also believed that the starry belt gradually revolved eastwards and hence the declination value of each star when observed in future centuries, will not tally with the places as calculated by the standard formulae of S.S. He was, therefore, forced to introduce some correction to be applied to the declination value. He seems to have estimated the rate of variation which he gives by the term विषालक्ष्यायोगः:

(E) In the last portion of the verse the author says that this corrected figure will appear to tally with the observed declination of the planet. He recommends 4 occasions for taking observations viz. the two solstices and two equinoxes. The reasons for selecting these days are quite obvious.
In this connection, it is worth noting that while the
declination of each star does change as the centuries pass, the rate of variation is never constant e.g., the rate
of variation between 1° and 14° is about 200 years per
degree; from 14° to 18°, it is about 250 years per degree;
from 18° to 21°, it is about 300 years, and from 21° to 22°
it is 500 years per degree and finally during the last degree
of declination its rate is about 1200 years per degree.

The author of these verses has, however, assumed a
constant rate of variation which is a drawback.

(F) Another drawback appears to be the value of + 27°
in place of ±24° (the value for the obliquity of the ecliptic
as adopted by S.S.). I do not quite understand why this
figure has been adopted by the astronomer. I am inclined
to presume that, since during a period of 26000 years the
value of the planets' longitude increases continuously
from 0° to 360° (it is, as it were, measured along the
circumference of a circle) the declination value makes a
complete oscillation along the diameter. The astronomer
must have supposed the rate of variation roughly to vary
in the ratio of the "diameter to the circumference". This is
simply a conjecture. I leave it to learned research scholars
to find a better explanation.

Is त्रिशत्कृत्यः a Correct Term?

It त्रिशत्कृत्यः be taken to be the author's words, one must
be ready to accept 3 min., 3\(^\frac{1}{2}\) min. or 41 min. of arc as the
annual rate of motion for the starry sphere; but none would
be willing to accept this rate even as "approximately
correct". Bhaskaracharya has suggested त्रिशत्कृत्यः as
the correct meaning thereby that the rate of motion (in
longitude) would be 30 revolutions for Mahayuga or
*400 years per degree or 9 seconds of arc per year.

This appears to be a correct figure. The duration of a year
(according to S.S.) is 365d. 15 gh. 31 p. 30v. I have proved
in an independent article that according to S. S. the year
is definitely a सौर वर्ष (i.e., an interval between the Sun's
successive crossings of the equator in its northerly course).
Since the author of the 3 verses supposes the starry belt to
move eastwards, the Sayan year must necessarily be a bit
longer than the true sidereal year. The eastward motion
of the sphere is 9° per year. Hence, the correct measure
of a नाक्षत्र वर्ष would be 365d. 15gh. 31p. 30v.

minus 9 palas which gives 365d. 15-22-30—measure
which tallies with the modern one within a few seconds.

From this, we can appreciate the greatness of an eminent
astronomer who lived nearly 1500 years ago.

Conclusion

I place before the learned public, for the first time, the
following conclusions for their consideration:

1) The Surya Siddhant has, in verses 9 to 11 of Chapter
III, given a theorem for verifying the calculated
decimation of a planet with its observed place.

2) He supposes an eastward motion to the starry
sphere—a motion which is not oscillatory but circular
or — its rate being "त्रिशत्कृत्यः" Per year.

3) He declares that the declination value of each celestial
body if calculated according to standard rules of S.S.,
will be found to vary from 0° to 27° both ways during
each revolution.

4) The S. S. is thus not an advocate of any kind of
Nirayan system of longitudes.

5) Hence, the adoption of a Sayan system for Panchangas
is the solution of the Panchang Controversy.