HISTORICAL NOTES

On the Precessional Movement of Saptarṣis*

Effect of precession on the alignment of Saptarṣis with nakṣatras is calculated for a whole cycle of precession. It is concluded that they never stay in one nakṣatra for 100 years, and that rate most probably applies to the motion of the summer solstice, the northernmost point of the ecliptic.

1. Background

Ankit Sule et al[1] have argued that the reference to the movement of Saptarṣis through the nakṣatras at the rate of 100 years per nakṣatra in Indian literature can be traced to a solitary observation that the midpoint of α and β Ursa Majoris was aligned in Right Ascension with the Prascepe (Puṣyā) cluster for 100 years from 2200 to 2100 BC. There are two flaws in this argument:

(1) According to them, people in those times could not measure angles in the sky. It is unlikely that such people could observe the alignment of a point near the north pole with boundaries of a fuzzy object of $70'$ size near the equator consistent with the calculated accuracy of modern computations.

(2) They have restricted the term nakṣatra only to the group of stars associated with them. As the groups span different sized portions of the sky how could one think that Saptarṣis stay in each of them for the same length of time? The very idea of a rate presuppose that nakṣatras occupy equal lengths of arcs on the ecliptic.

For this concept it is necessary to properly understand the purpose and use of the nakṣatras identified by ancient Indians.

2. The Concept of Nakṣatras

Nakṣatras are listed in Vedic literature as small single or multiple star groups which serve as milestones on the Varuṇa's path for the sun and the

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moon i.e. the ecliptic. Nakṣatras are approximately equidistant in angle and 28 or 27 in number. This shows that they were meant for indicating the position of the moon on each day. It has been the practice in India from remote antiquity to name the day according to the nakṣatra near which the moon is found on that day.

Now the moon does not make quantum jumps from one nakṣatra to another. It also occupies the spaces between them. And in spite of not being able to make acurate measurement of angles the ancients could have certainly identified the nakṣatra that might be closest to the moon. Thus each nakṣatra had always a domain associated with it. The mathematical definition of the domain of a nakṣatra as 27th part of the circle was first given in *Vedāṅga Jyotiṣa* of 1400 BC. But appropriate limits given by the midway points between nakṣatras must have been in vogue much earlier. So restricting the domain of the nakṣatra to corresponding star groups was not practical for specifiying the actual position of the moon and other celestial bodies like Saptarṣis. The concept of Yogatārās was most likely a development during Siddhāntic period for some specific purpose as pointed out by us[2].

Table 1. Alignment of pointer and Nakṣatras

Nakṣatra	Entry	Limit	Exit	Duration	
Punarvasu	-	-5500W ($\lambda n = 43$)	-3000E	2500	
Puṣyā	-3000W		-1800E	1200	
Aśleṣa⁻	-1800W		-800E	1000	Forward
Maghā	-800W		+400E	1200	8200 yrs
P. Phālgunī	+400W	+2700E ($\lambda n=143$)	-	2300	
P. Phālgunī	-	+2700E	+6500W	3800	
Maghā	+6500E		+9800W	3300	Return
Aśleṣā	+9800E		+13200W	3400	17600 yrs
Puṣyā	+13200E (-12600E)		-8550W	4050	
Panarvusu	-8550	-5500W		3050	
				Total 25800	

Note: E - Entry or Exit from East   W- Entry or Exit from West

In the light of the above discussion it should be clear from Table 1 of the authors[1] that the pointer representing Saptarṣis was in Puṣyā nakṣatra from 3000 BC to 1950 BC i.e. for 1050 years. The authors have restricted

the domain of that nakṣatra to Prascepe cluster for getting the required duration of 100 years. It is already pointed out that most likely the people could measure angles. And it cannot be taken as an observed phenomenon, particularly as there is no mention of Puṣyā anywhere. As far as observations are concerned there is only one statement about Saptarṣis being in Maghā, during the time of Parikṣit. The Table shows that this was so during the time between *Vedāṅga Jyotiṣa* of 1400 BC and Siddhāntic period of 500 to 800 AD. In this period the summer solstice was in the Maghā nakṣatra, which supports our conjecture that the movement of Saptarṣis is related to the movement of summer solstice, the northern most point of the ecliptic[3].

Anyway the calculations of Sule et al[1] are novel and we have extended them to a full cycle of precession which has given interesting results.
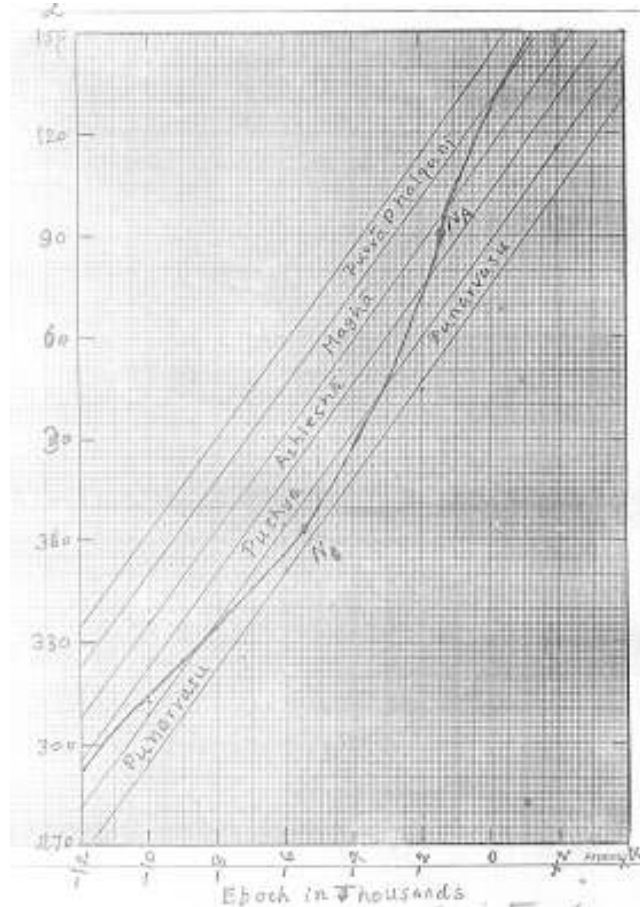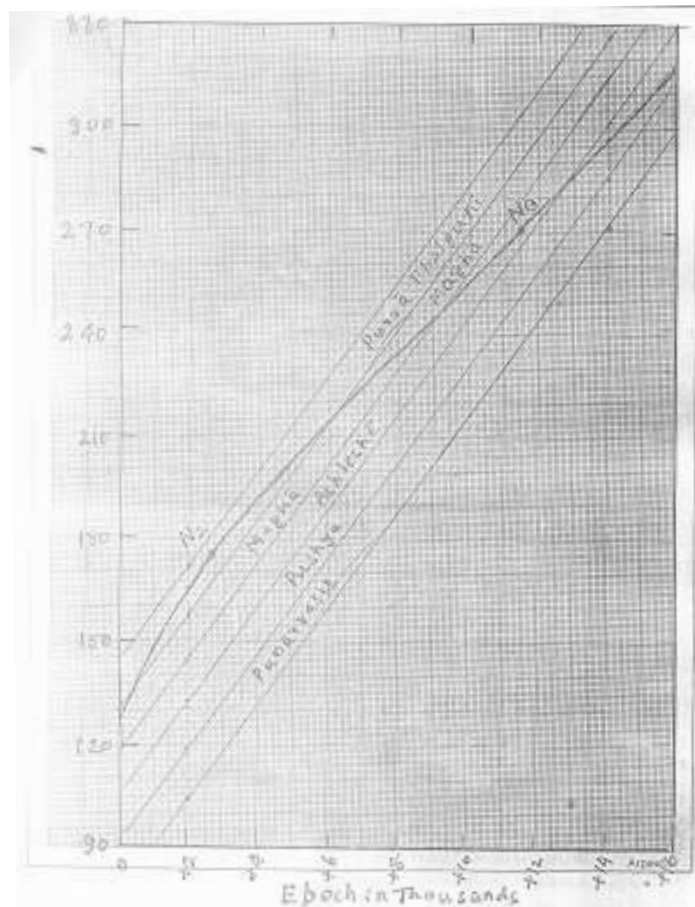

Fig. 1(a). Movement of Saptarṣis through nakṣatras

3. Calculations and Results

We accept Sule et al.'s[1] identification of Saptarṣis with the pointer i.e. the midpoint of α and β Ursa and consider its alignment in Right Ascension with various nakṣatras. As we are not aiming at very high accuracy in time we have neglected the proper motions of the pointer and start with its 2000 AD coordinates R.A. α = 166°, d = +59° which give λ = 138°, β = +47°. The boundaries of the nakṣatras from Punarvasu to Uttara Phālgunī, which span the motion of Saptarṣis, are taken as λ (2000 AD) = λ_n (285 AD) + 24°, where n is the niryana longitude. They are : Punarvasu (104°-117°), Puṣyā (117°-131°), Aṣleṣā (131°-144°), Maghā (144°-157°), Purvā Phālgunī (157°-171°), with β = 0° for all of them.

Fig. 1(b). Movement of Saptarṣis through nakṣatras

We calculate λ's for each millennium from -12000 BC to +16000 AD with the formula:

λ (Epoch) = λ (2000) + 14° (Epoch - 2000)

with an average rate of precession equal to 50″.4 per year. There is no change in β. These coordinates give Right Ascention α (Epoch) with the usual formulae. The results are shown in Figs 1(a) and 1(b) for periods -12000 to +4000 and 0 to +16000, respectively. In them the boundaries of nakşatras are shown by straight lines and the movement of Saptarşis (pointer P) is shown by the wavy line. The actual movement of the north pole N around the ecliptic pole E and the fixed position of the pointer P are shown in Fig. 2. The straight line joining N and P passes through the nakşatras between Punarvasu and Purva Phālgunī as shown therein. The times of entry
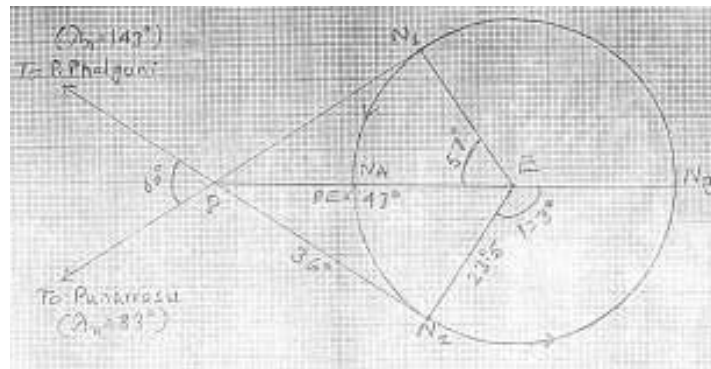

Fig. 2. Relative motion of and Saptarşis (P)

Table 2. Centenial rotation rates of P and n (Nakştra)

Point	N₁	N_A	N₂	N_B
Epoch	-5500	-1400	+2700	+11500
α (P)	5°	90°	175°	270°
λ (P)	33°	90°	142°	270°
δ (P)	+54°	+70°.5	+57°	-19°.5
δα (P)/δt	1°.3/c	2°.80/c	1°.3/c	1°.0/c
α (n)	5°	90	175°	270
δ (n)	+3°	+23°.5	+3°	-23°.5
δα (n)/δt	1°.3/c	1°.5/c	1°.3/c	-0°.5/c
δα (P)/δt -δα(n)/δt	0°/c	+1°.3c	0°/c	-0°.5/c

and exit from east (E) and west (W) as well as the duration of Saptarṣi's stay in each nakṣatra are given in Table 1.

4. Comments

We see that as the north pole moves from N_1 to N_2 in anticlockwise direction, Saptarṣis move from Punarvasu in -5500 (BC) to Pūrva Phālgunī in +3000 (AD) with a minimum sojourn in Aśleṣā for 1000 years. They then retrace their path as the pole moves from N_2 to N_1 in the longer arc on the right from +3000 (AD) to + 19300 (AD) or -5500 (BC), with the minimum stay in Maghā for 3300 years. They spend the maximum time in Pūrva Phālgunī for 6050 years and Punarvasu for 5500 years. The forward journey takes 8200 years while the return journey takes 17600 years. The fastest motion occurs at N_A and the slowest at N_B, while there are standstills at N_1 and N_2 as shown in the last line of Table 2. The point N_A is reached in 1500 BC and not in 4000 BC as claimed by Sule et al, while N_B will be reached in 11500 AD.

The conclusion is that Saptarṣis do not show movement at the rate of one nakṣatra per century due to precession. The reference to such motion can be traced to summer solstice on the basis of the statement that they were in Maghā at the time of Parikṣit as Summer solstice was in Maghā in and around *Vedāṅga Jyotiṣa* period.

References

1.   Ankit Sule et al., "Saptarṣi's visit to different nakṣatras: subtle effect of earth's precession", *IJHS*, 42.2(2007) 133-147.

2.   K.D. Abhaynakr, "On the Dhruvaka-Vikṣepa system of astronomical coordinates", *IJHS*, 41.2 (2006) 151-157.

3.   K.D. Abhyankar and G.M. Ballabh, "Kaliyuga, Saptarṣi, Yudhiṣthira and Laukika eras", *IJHS*, 31.1 (1996) 19-34.