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DATE OF THE SOLAR ORBIT OF *ŚATAPATHA BRĀHMAṆA*

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The present paper is an attempt to trace the astronomical epoch that gave rise to the daycounts of 176/189 for the two halves of a year in ancient times so as to get incorporated in the altar design of *Śatapatha Brāhmaṇa*.

Key Words: Angkor Wat, asymmetry of half-years,perihelion, *Śatapatha Brāhmaṇa*.

INTRODUCTION

Subhash C. Kak[1] has shown that the Vedic altars symbolically represented astronomical facts such as the asymmetry between the two halves of the year. The eighth Kāṇḍa of *Śatapatha Brāhmaṇa* describes the construction of an altar in five layers with 29 bricks on the outer rim as representation of the solar orbit. Arrangement of the bricks suggests an offset for the centre of the solar orbit from the earth and a division of the year into two halves of 176 and 189 days. A similar division of the year into 176.37 and 186 days was deciphered out of the design of the temple structure of Angkor Wat by Stencel, Gifford and Moron (SGM). In the words of Kak: "The division of the year into the two halves: 189 and 176.37 has puzzled SGM. But precisely the same division is described in the *Śatapatha Brāhmaṇa*."[2]

Angkor Wat was built between the ninth and twelfth century AD while the *Śatapatha Brāhmaṇa* even by the most conservative estimate belongs to the

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second millennium BC. As such the common astronomical feature points towards the continuity of an ancient astronomical tradition. The ancient Indian tradition considered the half year as either from equinox to equinox or from solstice to solstice, but in neither of these practices can we find half years of 189 and 176.37 days at either the twelfth century AD or second millennium BC. It is therefore quite likely that the above duration of half-years might have arisen at an earlier epoch and must have continued even after the respective astronomical phenomena ceased to have its appearance. The present paper is an effort to trace the epoch at which the two halves of the year had the lengths of 189 and 176 days.

Duration of the Seasons

Astronomically, the duration of the seasons since 4000 BC are as follows at an interval of 1000 years:[3]

Year	Spring	Summer	Autumn	Winter
-4000	93.54	89.18	89.08	93.43
-3000	94.04	89.92	88.62	92.67
-2000	94.28	90.76	88.40	91.81
-1000	94.25	91.63	88.42	90.94
OAD	93.96	92.45	88.70	90.14
1000	93.44	93.15	89.18	89.47

The sums of spring and summer / autumn and winter constitute the half years from equinox to equinox while summer and autumn / winter and spring make up the solstice to solstice divisions. It is apparent from the above data that the 189/176 days division of the year was possible in the past only in either 4000 BC or 1000 AD. The latter one can be ruled out and obviously the half-years of 189/176 days belong to 4000 BC.

Minimum / Maximum Duration of Half-Years

The half-years mentioned above, with reference to either of the cardinal points, shall assume a minimum/maximum value when the perihelion/aphelion coincide with either of the cardinal points. The perihelion in fact coincided with the autumnal equinox in the year 4079 BC (JD=231346 correspond to a perihelion longitude of 180°) to produce the maximum disparity between the lengths of the two half-years considered with reference to the solstices. Minimum and maximum duration can be understood from the following data of seasons for 4000 BC:

	Spring equinox	Summer solstice	Autumnal equinox	Winter solstice
UT	22 April 4000 BC	25 July 4000 BC	22 October 4000 BC	19 January 4000 BC
JD	260535.365	260628.89	260718.038	260807.14

Minimum value of the half-year = 178.25 days
Maximum value of the half-year= 365.25-178.25=187 days

In view of this it can rightly be inferred that the day-count of 189/176 for the half years deciphered out of *Śatapatha Brāhmaṇa* and Angkor Wat is only an approximate reflection of the true astronomical phenomena of 187/178.25 days belonging to 4000 BC. (A similar configuration would have prevailed for the half-years from equinox to equinox in AD 1247 as the perihelion coincided with the winter solstice at JD = 2176188).

SIGNIFICANCE OF 4000 BC

How could a calendar feature of 4000 BC assume so much significance as to appear in the *Śatapatha Brāhmaṇa* after a lapse of (say) 2000 years and in Angkor Wat after about 5000 years?

The reason is that the above half-yearly day count of 178.25/187 represented the original epoch of Indian astronomy from which an astronomical tradition emerged in due course. We need to go a bit deeper into the antiquity to see this fundamental epoch. That is, to 4137 BC wherein the solstices were in a rare conjunction with new moon / Śukla 1 and the autumnal equinox fell exactly over Mūla:

Summer solstice	Autumnal equinox	Winter solstice
UT (-)4136 July 25	(-) 4136 Oct 23	(-)4135 January 20
JD 210590.45	210679.55	210768.705
Sun 90°	Sun 180°	Sun 270°
Moon 85°49′	Moon 177°26′	Moon 278°49′

Location of the solar periphelium at autumnal equinox = 179°03′

The asymmetry in the two halves of the year reflected the year-beginning at summer solstice or Varṣa season as pointed out by Jacobi. As the perihelion coincide with autumnal equinox, Sun had its average motion at the solstices and remained faster in the first half of the year while the latter half had the aphelion in the middle and so the Sun remained slower.

Another interesting astronomical feature of the above epoch is the aphelion falling exactly over Lambda Orionis and as such it marked one of the vertices of the solar orbit. Probably hence the star was originally named as "Mārga-śīrṣa", meaning the 'orbital vertex' rather than the mythological identification as Mṛgaśiras. Alternatively, Mūla marked the vertex of fast motion and so the succeeding solar month was named as above to mean the orbital vertex.

As described elsewhere,[4] 4137 BC had other remarkable features also to serve as the fundamental epoch of Indian astronomy.

YEAR-BEGINNING AT AUTUMNAL EQUINOX

In 4137 BC the autumnal equinox was exactly over Mūla while the perihelion nearly coincided with it. The year-beginning with autumnal equinox *vis-à-vis Mārgaśīrṣa* month and the computation of Sun based on the true motion would have obviously led the ancient astronomers to the discovery of the anomalistic year. Further as the summer and autumn remained sandwiched between new moons the disparity between the duration of summer and autumn versus spring and winter would have been explicitly evident in view of the extra *tithis* of spring and winter. Obviously the solar anomaly could not have remained undiscovered and the traditional use of anomalistic year in Indian astronomy provides substantiation to this view. Similarly the solstitial new moons would have facilitated the discovery of the 19-year cycle of lunation also. This explains the use of the 19-year cycle in *Vedāṅga-jyotiṣa* of Lagadha.

CONCLUSIONS

The asymmetry or maximum disparity in length between the two halves of the year as deciphered from the design of the Angkor Wat temple structure and the altar-design of *Śatapatha Brāhmaṇa* can be traced back to the prehistoric epoch of 4137 BC. The significance of this epoch in the context of sidereal astronomy of India/Babylon has already been brought out in a separate paper.[4]

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