PATHANI SAMANTA AND HIS THEORY OF PLANETARY MOTION

Bipin Bihari Panda

INTRODUCTION :

Pathani Samanta was born in 1835 at Khandapara, one of the princely states of pre-independent Orissa. He was entitled as 'MAHAMAHOPADHYA' by the British Govt. His full name was Mahamahopadhya Harichandan Mohapatra Chandersekhar Simha Samanta. He was also known as 'PATHANI' in Orissa.

The first biographer of Samanta Chandrasekhar, pandit Sri Chandrasekhar Mishra mentions few legends which are almost true .

Samanta Chandrasekhar was attending wedding of his relatives in the island state of Parikuda in the Chillika, where he was introduced to the king of Manjusha. He was then invited to Manjusha and asked to estimate the height of 'Mahendra mountains'. Samanta's estimated with his bamboo sticks exactly agreed measurements and the king of Manjusha informed the matter to the then British governor of Madras.

In other incident Sri Samanta calculated the occurrence of a solar eclipse to be visible from England and transmitted it to the Madras government through the king of Manjusha. There was an astronomer, Shri Raghunath Achraya who contradicted Samanta's prediction. But Samanta's calculations came true. He also predicted a solar eclipse with timing to be visible in America, which became true with the variation of few seconds

SAMANTA'S INSTRUMENTS :

The instruments used by Pathani are made up of wood, bamboo pieces and hardly of metallic parts. These instruments are broadly divided into 3 categories.

1. Instruments measuring time

e.g.	Chakra Yantra	:	Sun dials
	Chapa Yantra	:	"
	Golardha Yantra	:	"
	Swasyambhu Yantra	:	Water clock

2. Versatile Instruments :

    e.g. Sanku (gnomon)
    Mana Yantra

3. Armillary Sphere

e.g, Gola Yantra - used as demonstration kit for showing to students, various great circles measuring planetary motion

A. THE MANAYANTRA

Construction : Two bamboo sticks are in the form of T. The cross piece is cut into stairs at 40 angle and each stair further subdivided at half a degree angle.

Principle : the mountain of height y located at a distance x from the point of observations is looked through an appropriate hole of the vertical arm to coincide with one end of the horizontal arm. The same procedure is repeated through another hole which coinciding the other end with the peak.

It is clear from the adjoining diagram . From similar triangles

$$y / p1 = (x + b1) / b1 \qquad (1)$$

and $$y / p2 = (x + b2) / b2 \qquad (2)$$

multiplying (1) by 1 / p2 and (2) by 1/ p1 and subtracting the two results we get

$$(x + b1) / (p2\, b1) = (x + b2) / (p1\, b2)$$

$$p1\ b2 (x + b1) = p2\, b1 (x + b2)$$

$$x (p1b2 - p2\ b1) = b1\, b2 (p2 - p1)$$

$$x = \frac{b1\, b2 (p2 - p1)}{p1b2 - p2\, b1}$$

similarly $y = [p1\ p2 (b2 - b1)] / [p1\, b2 - p2\, b1]$

In this way the height of the mountain & the distance of the mountain from the point of observation is determined.

B. GNOMON (SANKU)

Construction : It consists of a stick of measured height fixed vertically on a leveled ground. By measuring the shadow length of the stick cast by sun.

Use : It was possible to determine local time, the altitude, declination of sun, lattidue, sun's position in the zodiac, etc.

Principle : Sun is assumed to be a point source of light casting a shadow with sharp boundaries. It has a dark umbra & a penumbra with various states of light.

Limitation : The length of the shadow can't be accurately measured. Because the sun has angular diameter of 0.5 degree, the measured altitude has an error of about 0.25 degree

3. CHAKRA YANTRA : It is used to measure the instantaneous zenith of the sun from which time is calculated.

4. CHAPA YANTRA : The time is indicated by the shadow of the axis on the calibrated semicircle.

5. GOLARDHA YANTRA : The shadow tip of the axis moves over a circle during a day drawn on the hemisphere.

THEORY OF PLANETARY MOTION

Samanta Chandrasekhar had his own concepts of the solar system and the universe, based on his own observations. He accepted geocentric hypothesis.

His planets has novel features that planets mars, mercury, jupiter, Venus and Saturn go round the sun and the sun moves around the earth with these companions. Thus he has assigned heliocentric motion to the planets.

TYCHO AND PATHANI MODEL :

It is believed that he came to know the development of western astronomy through Prof. J.C Roy. He must have accepted helio-centric theory, but Pathani Samanta was unmoved with unflinching faith on his naked eye observations. He went on advocating in favour of the geocentric hypothesis and even did not
hesitate to retain a stanza in 'Sindmanta Darpana' which is a direct challenge to the western astronomers. The strong intellectual courage of the author can be gauged from his fearless declaration in the following sloka

Arguments of pathani in favour of his geocentric theory :

Many of his arguments are directed against a misconception of the new theory.
For instant he argued

1. If the earth be rolling like a wheel, then it ought to move only 12,000 Krosa per day, for that is the length of earth's circumference. But you say its daily motion is 8,00,000 Krosa
2. A stone whirled round has always the same face turned toward us how can there be an alteration of day and night by the rotation of earth.
3. In a sloka Samanta clearly stated that in a two-body system such as the sun & the earth, both revolve around common 'Bharakendra' rather than the earth revolving around the sun.

EXPLANATION :

Hang two massive objects, one heavier than the other from two ends of a rod. balance the one end to the other like one do in country weighing device. In general the rod will be horizontal. This point on the rod is the 'Bharakendra'. The heavier in a smaller circle & the lighter in a big circle, because the bharkendra is nearer the heavier object.

Similar way the sun & the heavier object in orbits around this common bharakendra cause the mass of the sun very heavy compared to that of the earth, the bharakendra deep inside the sun very close to its center. It is on the account of this that the British says earth moves round the sun.

4. The moon present above the equator in a slanting position rotates round its axis. Similiarly if the earth were revolved we would have seen the planets mountains etc. in a slanting manner like the set & rise of stars.
5. If a man runs with his face towards north-west then how his motion is possible in the east direction.
6. If the earth revolves around sun then the moon spot will be seen in the north-east direction (in dakhinayana) & in the north-west direction (utarayana motion)
7. The planets mercury & venus are consists of water vapours. But earth consists of soils and larger than these. So we can’t compare earth with other planets. All other planets are revolving while earth is at rest.
8. If earth is revolving like all other planets then there should be also all the six seasons like the earth. So the clouds which is formed in the planet mars must act like a cover to earth as in amabasya.
9. If we drop a stone from a certain height it will shifted towards east due to motion of earth from west to east. But according to Pathani this is due to a wind called 'prabaha' which shifted the earth in the east direction.

DISCOVERY OF THREE ANOMALIES OF MOON:

It is singular that Chandrasekhar is the only Indian astronomer who has detected all the 3 important irregularities of the moon which were unknown to ancient Indian astronomers.
1. Tungantara (Evection) : It is an irregularity which may put the moon forward or backward over a degree.
2. Pakshika (variation) : Moon has a period of maximum one month and a maximum of 39'31".
3. Digmsa (Annual equation) : Inequality of moon's place and has maximum amount of 11'9" (Tycho-Brahe).

All the 3 anomalies as determined by Samanta in his Sidhanta Darpana & modern values are compared below.

	Darpan	Modern value
Evection	2^o 40'	1^o 17'
Variation	38' 12"	39' 31"
Annual Equation	12'	11'9"
Equation of moon	5^o 40'	6^o 18'
Maximum Evection	2^o 40'	1^o 20'

ACKNOWLEDGEMENTS:

At first I am thankful to my guide Prof. Lambodar Prasad Singh & Dr. (Mrs.) Puspa Khare for their consistent help at the time of need. I am thankful to Physics Dept. Utkal Univeristy for giving me a chance to expose myself. Lastly my thanks goes to my friends & well wishers whose encouragement helped me a lot.

....

Seminar delivered on 7th Oct. 1999

....

REFERENCES:

1. Sidhanta Darpan
2. Bulletin of the astronomical society of India
3. Jyotiska

....

-: THE END :-

....

This is an E – edition of Blossom. Due to some unavoidable circumstances this article may not be exactly identical as in actual Publication The reader is therefore requested to contact the author for details