REPORT

Nehru Planetarium

Nehru Memorial Museum & Library

Research Project: Jantar Mantar Positional Astronomy

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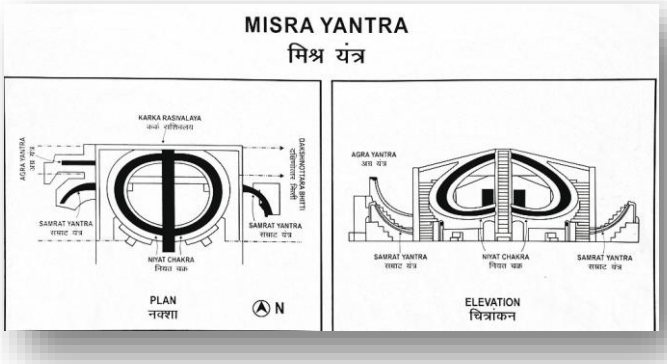
Yantra under observation: NIYAT CHAKRA (Mishra Yantra)

The Mishra Yantra in Jantar Mantar observatory in Delhi is a combination of five instruments composed of Niyat Chakra, Samrat Yantra, Agra Yantra, Kark Rashivalaya, Dakshinottara bhitti Yantra. We took oberservation on Niyat Chakra for measuring the declination of the Sun. The instrument is used to measure the declination of the celestial objects. It consists of four semicircular scales of marbles on either side of gnomon constructed in the middle. These semicircles are inclined with the plane of the meridian by 77.18W, 69.50W, 69.42E, 77.22E. The Niyat is meant to duplicate the declination readings for the meridian arcs of four different places - Notkey in Japan, Serichew in Pic Islands, zurich in switzerlands and Greenwich in England. The chakra inclined at about 77degrees have radius 4.83m and 4.01m outside and inside respectively. The outer scale measures declination in degree and minutes. Each degree on this scale is divided into 10 parts, and the parts are again divided into 3 subparts each. The small division of the outer scale measure 2' of arc.



Observations:

On June 15, 2023, we measured the declination of the sun by fixing a rod into the hole at the center of the chakra and observe the shadow on the semicircles. We can't take the declination at any time through Niyat Chakra. The declination of objects is measure at intervals of few hours as objects travels from east to west in the sky. Generally the declination of the sun is measured at 52 minutes, and 1 hour 24 minutes after sunrise on western side of Niyat Chakra. And on the eastern side, the declination is measured at 4 hour 36 min and at 5 hour 8 min after the noon time.

Data collected on 15th June 2023:

Clock Time IST (H:M:S)	Observed Declination (^{o} arc minute)	Observed Declination (^{o})
17:00:08	23^o 30”	23.5^o
17:01:20	23^o 12”	23.2^o
17:02:40	22^o 54”	22.9^o

Average value of observed declination = $(23.5^o + 23.2^o + 22.9^o)/3 = 23.2^o$

Actual declination of the sun on that day = $23^o17'26.4'' = 23.2906^o$

Average % error = $((23.2906^o - 23.2^o)/23.2906^o) *100 = 0.388\% \approx 0.4\%$

CONCLUSION:

The measurement of the Sun’s declination within the Niyat chakra has provided the valuable insights into the instrument’s capabilities. The study demonstrated the importance of data up to a better accuracy.

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