

# A year-long representation of the ILMT observations in different coordinate Systems



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## Abstract

The 4-meter International Liquid Mirror Telescope (ILMT) is the first optical survey telescope in India that performs zenithal observations of a 22' wide strip of the sky. In order to determine which portion of the sky will be observed by the ILMT during the entire year, we show the ILMT Field of View (FoV) in three different coordinate systems - galactic, ecliptic, and equatorial. We adopt a constant declination of +29°22'26" and varying RA ranges corresponding to the Local Sidereal Time (LST). The observations from June to September are hampered due to the monsoon season. The handiness of such representations will allow us to determine the probable type (supernova, asteroid, ...) of any newly discovered transient in the ILMT FoV. This will enable prompt follow-up observations with other facilities.

## Introduction

- ILMT monitors the same region of the sky night after night as it passes through the zenith.
- To assist us in visualizing the area of the sky we will be viewing over the course of an observing year, the FoV of ILMT has been represented over a year in three distinct coordinate systems.

## Equatorial, Ecliptic and Galactic coordinate systems

- The equatorial coordinate system is the projection of the latitude and longitude coordinate system we use here on Earth, onto the celestial sphere.

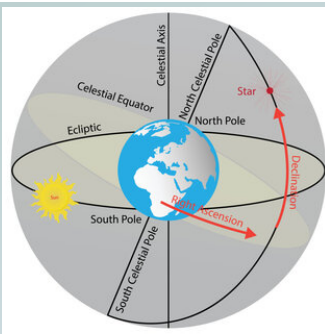


Figure 1: Equatorial Coordinate System (Image Credit : astronomy.swin.edu.au)

- This system is tied to the orientation of the Earth in space, and this changes over a period of 26,000 years due to the precession of the Earth's axis.

- Ecliptic coordinates are defined via the plane of the Earth's orbit about the Sun. In this system, the ecliptic pole is defined as the direction perpendicular to the Earth's orbital plane in the northern part of the sky.

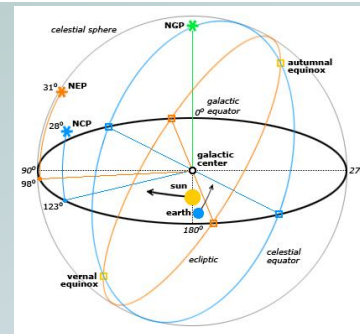


Figure 2: Ecliptic Coordinate System (Image Credit : wikimedia.org)

- As the Earth's obliquity is about 23.5°, the direction of this pole is close to 66.5°. The zero point of longitude is the same as that used for equatorial positions.

- The Galactic coordinate system defines a sphere enclosing the galaxy, with the Sun at its centre, onto which galactic latitude (b) and longitude (l) are projected.

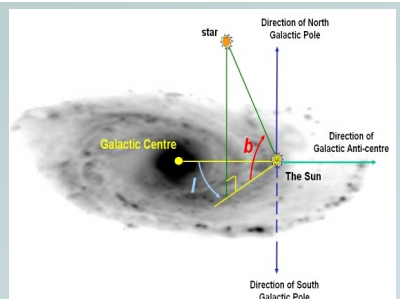
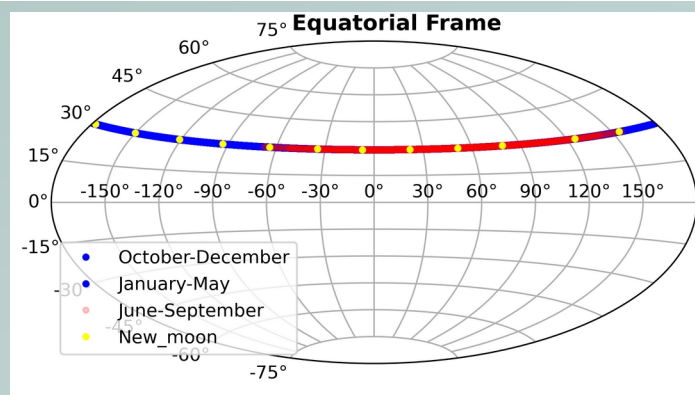


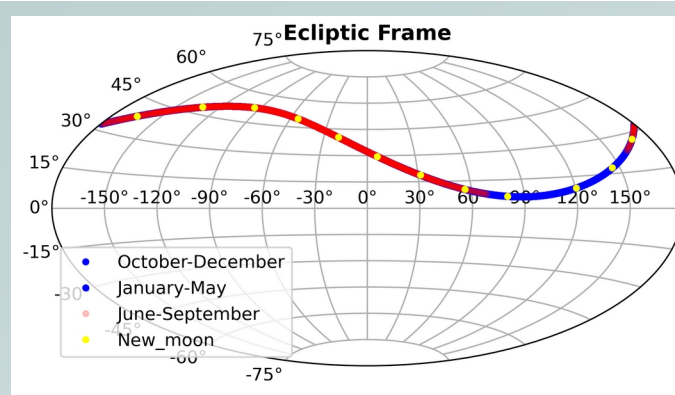
Figure 3: Galactic Coordinate System (Image Credit : astronomy.swin.edu.au)

- The galactic longitude of an object is the angular distance around the Galactic equator from the Galactic centre and the galactic latitude increases counter-clockwise as viewed looking down from the north galactic pole.

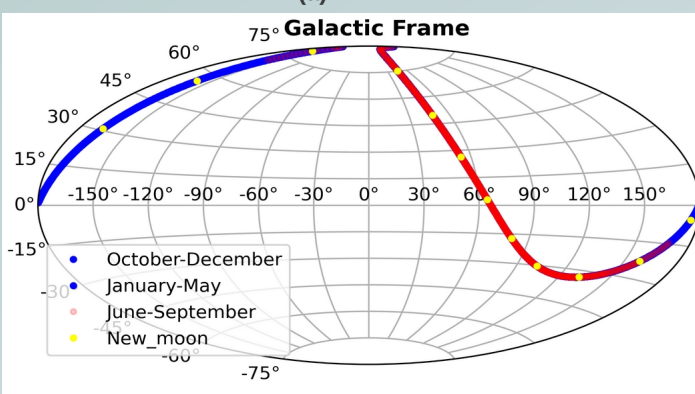
## Field of View of ILMT in three coordinate systems



(a)



(b)



(c)

Figure 4 : A representation of the 4-meter ILMT's FoV over the course of a year in the (a) equatorial, (b) ecliptic, and (c) galactic coordinate systems. The red overlap zone denotes the monsoon, whereas the blue line denotes the coordinates that we were able to monitor during the observing cycle (from June to September). The dates of the new moon for the same year are indicated by the yellow dots.

Date	LST	Gal lon	Gal lat	Eclip lon	Eclip lat
2023-01-21	7.80	-166d 47m 32.0s	30d 47m 00.8s	120d 27m 33.0s	9d 33m 00.8s
2023-02-20	9.78	-160d 18m 37.6s	56d 00m 54.3s	145d 34m 05.6s	17d 29m 43.7s
2023-03-21	11.68	-163d 11m 39.3s	79d 54m 31.7s	169d 08m 23.1s	27d 30m 49.3s
2023-04-19	13.59	45d 55m 26.5s	75d 10m 53.8s	-165d 04m 05.4s	38d 27m 10.5s
2023-05-19	15.56	47d 21m 28.2s	49d 45m 49.0s	-132d 28m 04.1s	48d 19m 49.5s
2023-06-17	17.46	54d 04m 44.6s	26d 25m 14.5s	-95d 02m 28.8s	52d 44m 10.3s
2023-07-17	19.43	64d 30m 04.1s	3d 02m 31.5s	-54d 12m 43.3s	49d 38m 52.7s
2023-08-16	21.41	80d 15m 51.6s	-17d 20m 36.4s	-20d 00m 36.6s	40d 20m 57.6s
2023-09-14	23.31	102d 18m 03.1s	-30d 20m 52.6s	6d 12m 40.9s	29d 34m 40.9s
2023-10-14	01.28	132d 06m 46.2s	-32d 59m 55.4s	31d 28m 03.0s	18d 39m 48.6s
2023-11-13	03.25	158d 36m 50.2s	-22d 51m 03.5s	56d 19m 17.7s	10d 20m 31.3s
2023-12-12	05.16	175d 55m 48.1s	-5d 26m 45.6s	80d 22m 07.4s	6d 17m 30.4s

## Summary

- The FoV of 4-meter ILMT has been studied for a whole year in three different coordinate systems.
- This study is very helpful to discover, identify and follow up the transients, asteroids and other cosmological objects which lie in the FoV of ILMT.

## Acknowledgement

The 4m International Liquid Mirror Telescope (ILMT) project results from a collaboration between Aryabhata Research Institute of Observational Sciences (ARIES, India), the Institute of Astrophysics and Geophysics (University of Liège, Belgium), the Universities of British Columbia, Laval, Montreal, Toronto, Victoria and York University. The authors also thank Hitesh Kumar, Himanshu Rawat and Kushal Singh for their assistance at the 4m ILMT.

Table 1: In this table, the new moon dates for the year 2023 are listed together with their corresponding galactic coordinates, ecliptic coordinates, and LST values for Devsthal, Uttarakhand, India. The monsoon season (June to September) is denoted by the red box, during which observation is halted.