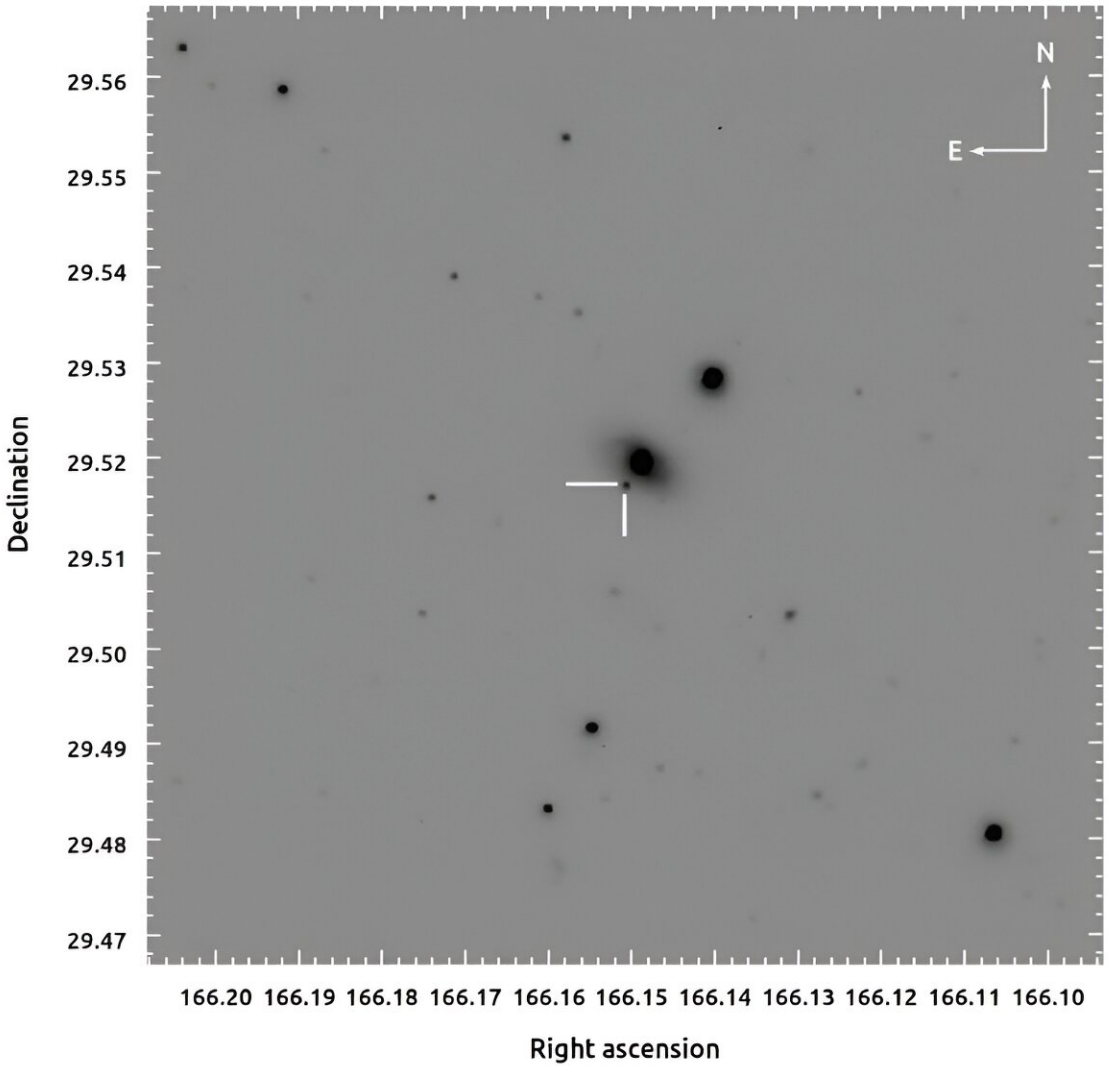
New Indian telescope identifies its first supernova

November 24 2023, by Tomasz Nowakowski



A small segment (size: 6 arcmin × 6 arcmin) of a single image frame (102 sec integration time) obtained with the ILMT is displayed. The location of SN

2023af is marked with a white crosshair. Credit: *arXiv* (2023). DOI: 10.48550/arxiv.2311.05618

A newly built International Liquid Mirror Telescope (ILMT) in India has identified its first supernova—designated SN 2023af. The finding, reported November 8 on the pre-print server *arXiv*, proves that ILMT may be capable of detecting hundreds of new supernovae in the coming years.

Supernovae (SNe) are powerful and luminous stellar explosions that could help us better understand the evolution of stars and galaxies. Astronomers divide supernovae into two groups based on their atomic spectra: Type I and Type II. Type I SNe lack hydrogen in their spectra, while those of Type II showcase spectral lines of hydrogen.

ILMT is a 4-m diameter zenith-pointing telescope located at Devasthal Observatory in Nainital, India. It is entirely dedicated to conduct photometric/astrometric direct imaging surveys. Astronomers hope that ILMT will help them detect many new transient objects such as supernovae of gamma-ray bursts. The telescope saw the first light on April 29, 2022, and is currently in the advanced stage of commissioning.

Now, a team of astronomers led by Brajesh Kumar of the Aryabhatta Research Institute of Observational sciencES (ARIES) in India, reports that ILMT has spotted its first supernova on March 9, 2023—SN 2023af, which was initially detected two months earlier. The team conducted follow-up observations of SN 2023af using ILMT, as well as the 3.6m Devasthal Optical Telescope (DOT) and the 1.3m Devasthal Fast Optical Telescope (DFOT).

"During the commissioning phase of the ILMT, supernova (SN) 2023af

was identified in the ILMT field of view. The SN was further monitored with the ILMT and DOT facilities," the researchers wrote.

The team obtained a light curve of SN 2023af spanning up to 110 days after its discovery. Initial results from ILMT show that hydrogen lines are clearly visible and metal lines also appear in the spectra of this supernova.

Based on the light curve and spectral features of SN 2023af, the authors of the paper suppose that the object as a Type IIP supernova. In general, the type II-Plateau supernovae (SNe IIP) remain bright (on a plateau) for an extended period of time after maximum. This plateau in the light curve of a standard SN IIP typically lasts about 100 days.

It is assumed that SNe IIP like SN 2023af originate from precursor stars that retain a substantial amount of their hydrogen layers (greater than three solar masses) before exploding as core-collapse supernovae (CCSNe).

However, the astronomers added that complementary observations of SN 2023af are needed in order to confirm its Type IIP classification. They explained that a definite conclusion about the plateau length of this supernova is not possible at the moment due to the sparse data points.

Summing up the results, the researchers noted that future ILMT observations will provide a unique opportunity to discover and study different types of supernovae each year, leading to the detection of hundreds of new stellar explosions.

More information: Brajesh Kumar et al, Follow-up strategy of ILMT discovered supernovae, *arXiv* (2023). DOI: 10.48550/arxiv.2311.05618