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Searching for Precursor Outbursts in 2024jlf

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Type IIn supernovae (SNe) are a subclass of Type II SNe characterized by narrow hydrogen emission lines produced by interactions between SN ejecta and surrounding circumstellar material (CSM). Some Type IIn SNe show these features only briefly, indicating less extended CSM and motivating their classification as Type IIn-like SNe. The origin of this CSM remains a major outstanding question.

Precursor outbursts are episodes of enhanced mass loss from a progenitor prior to explosion theorized to contribute to CSM formation. They have been observed in approximately 25–50% of Type IIn SNe, but only one Type IIn-like progenitor has been linked to precursor activity. We therefore investigate possible pre-SN variability in the progenitor of the Type IIn-like SN 2024jlf.

Using data from the ATLAS Forced Photometry Service, we applied the ATClean pre-SN variability analysis pipeline. ATClean cleans progenitor and control light curves, searches for sustained signals across Gaussian-kernel timescales, and estimates detection efficiency by injecting simulated precursor outbursts into controls.

ATClean detected sustained pre-SN signals across all tested timescales. Binning the cleaned progenitor light curve revealed >5 detections in the same time range. However, difference images revealed variability in a nearby image artefact during the epoch of detections, and ATClean's binning procedure is susceptible to outliers.

Future work such as investigating the above artefacts and refining the ATClean binning procedure is needed to determine the exact source of our detections, thereby constraining pre-SN mass loss in IIn-like systems.

Did you give a contributed talk at CASCA 2026?

No

If you are selected for a poster, would you be interested in giving a short flash talk on your work?

Yes

What is your career level?

Undergraduate

Which keyword describes the area of focus of this talk?

Transients

Primary author(s) : Ms LI, Ai Hua (Dunlap Institute for Astronomy & Astrophysics); Dr GERON, Tobias (Dunlap Institute for Astronomy & Astrophysics); Prof. DROUT, Maria (David A. Dunlap Department of Astronomy &

Astrophysics)

Presenter(s) : Ms LI, Ai Hua (Dunlap Institute for Astronomy & Astrophysics)

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