SN 2026ejy

A peculiar 1987A-like supernova with an early-phase luminosity excess

Zsófia Vig | University of Szeged



Photometry · Spectroscopy · Physical interpretation

FIKUT NEXTGEN • 4–6 November 2026

MEETING OF YOUNG ASTRONOMERS AND ASTROPHYSICISTS

This project is supported by the National Talent Program (NTP) and the Ministry of Education and Children's Affairs of Hungary.

The 1987A-like supernovae

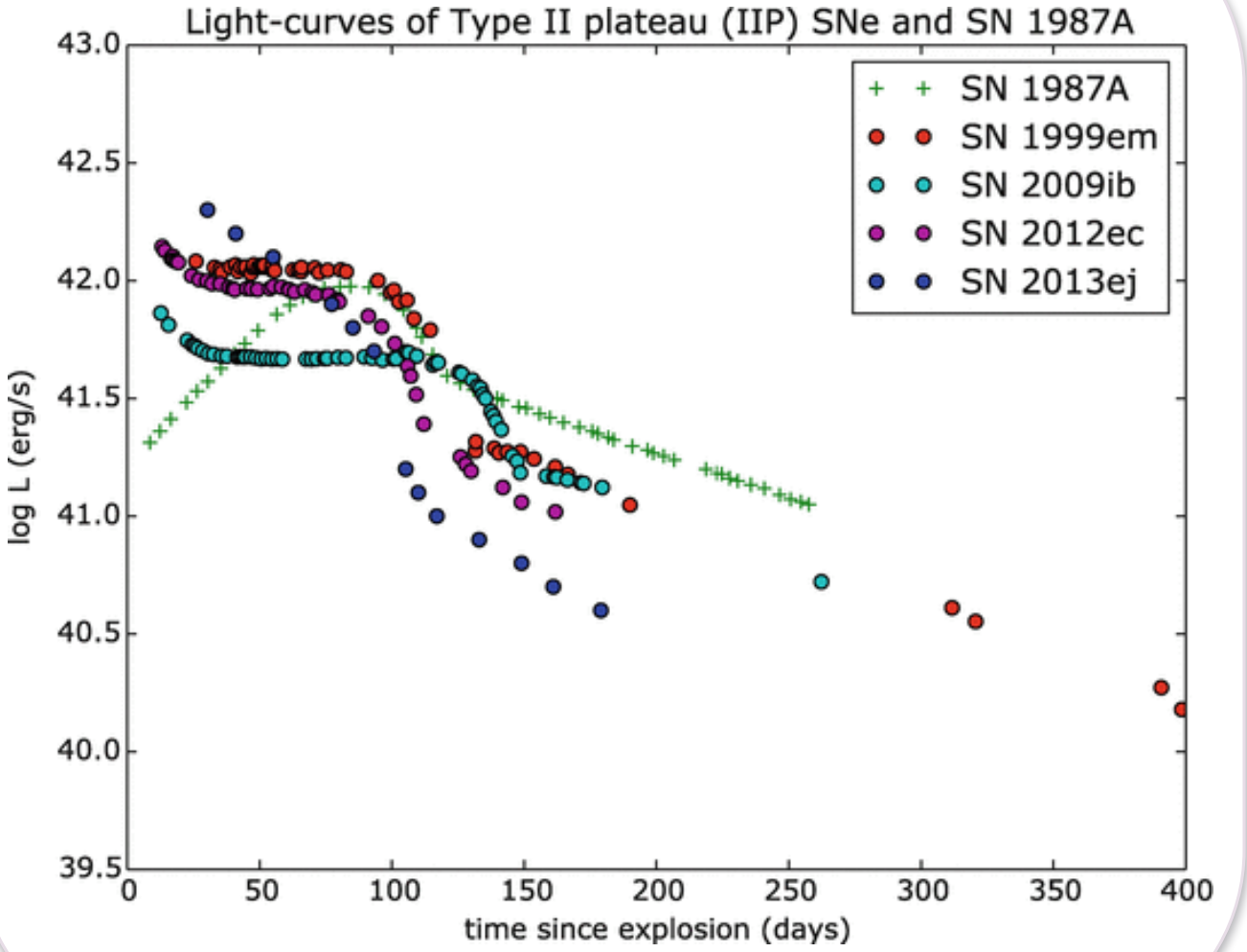
THE SPECTRAL / PHOTOMETRIC MISMATCH

SPECTRA

Hydrogen-rich Type II features can resemble those of Type IIP supernovae.

LIGHT CURVE

The brightness evolution is different: SN 1987A is known for its slow, unusual rise.



Source: Zampieri, L. (2017). Light Curves of Type II Supernovae. In: Alsabti, A., Murdin, P. (eds) Handbook of Supernovae. Springer, Cham. https://doi.org/10.1007/978-3-319-20794-0_26-1

The 1987A-like supernovae

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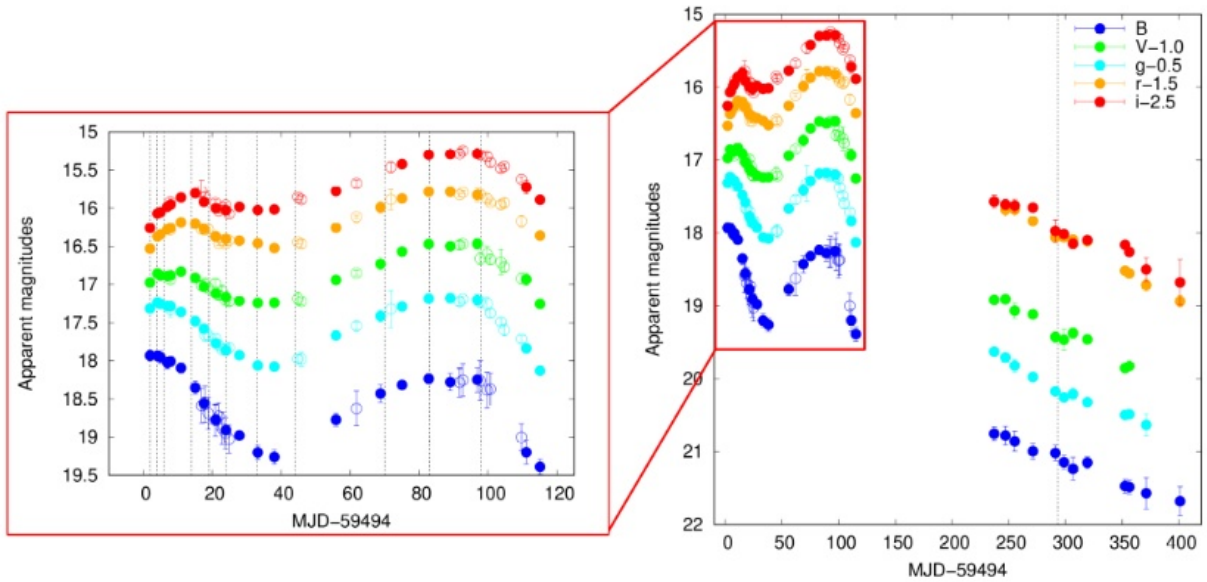
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LIGHT CURVE

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An 1987A-like SN, the SN 2021aatd's lightcurve



Source:The story of SN 2021aatd: A peculiar 1987A-like supernova with an early-phase luminosity excess, T. Szalai, et.al., A&A, 690 (2024) A17

The open question: what do the progenitor structure and pre-explosion mass loss leave behind?

The physical idea: mass loss before explosion

WORKING HYPOTHESIS

1 Mass loss before core collapse can place gas around the progenitor.

2 The expanding ejecta may collide with this circumstellar material (CSM).

3 Interaction can add radiation and modify the observed light curve and emission lines.

Important: an early luminosity excess is a clue, not unique proof of CSM interaction.

SN 2026ejy: a case study

WHY THIS OBJECT IS WORTH A CLOSER LOOK

SN 2026ejy

A peculiar 1987A-like event with an early-phase luminosity excess — a useful test case for the origin of additional early emission.

PHOTOMETRY

What is the shape, timescale, and colour evolution of the excess?

SPECTROSCOPY

What do the spectral features and their evolution tell us?

PHYSICAL PICTURE

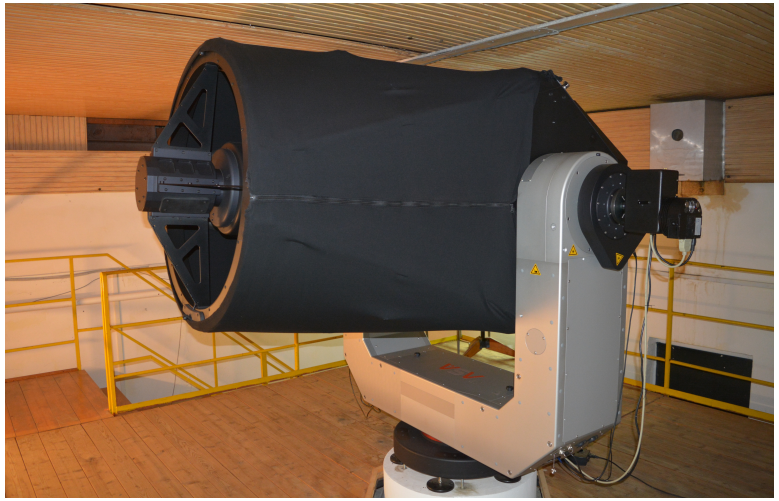
Can a consistent model explain both the light curve and spectra?

Aim: combine calibrated photometry, spectral classification, and model comparison — while keeping alternative explanations in view.

Following transients from Baja

80 CM TELESCOPE · SZTE BAJA OBSERVATORY

We actively monitor selected supernovae and contribute complementary photometric epochs.



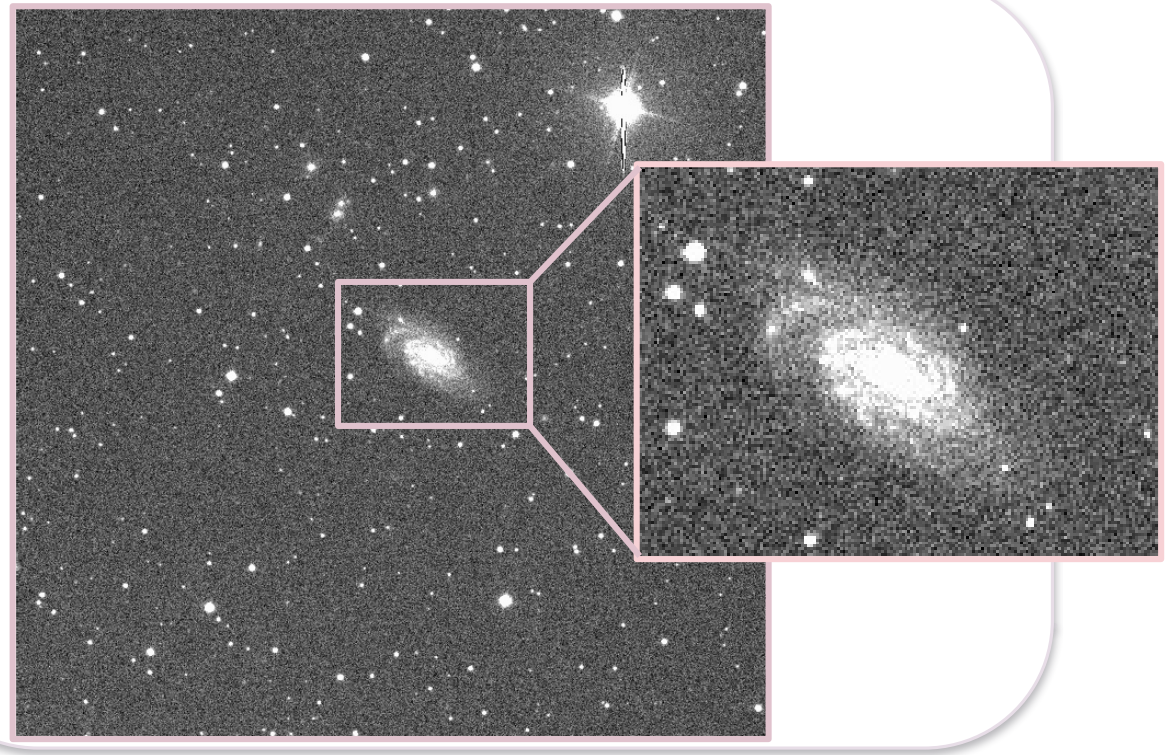
The BRC80 telescope at the SZTE Baja Observatory.

It is a Ritchey-Chrétien telescope with an 80 cm diameter primary mirror.

It is one of the second biggest telescopes in Hungary, because it has two identical one.

FROM IMAGE TO LIGHT CURVE

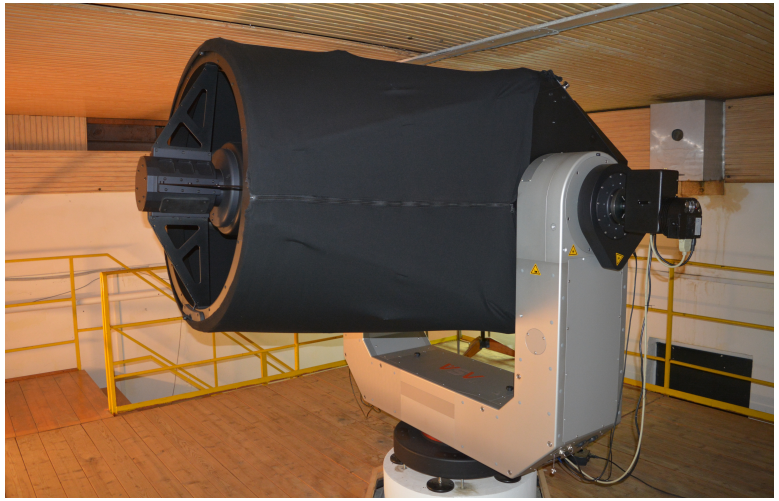
01 **Observe** Acquire science and reference frames



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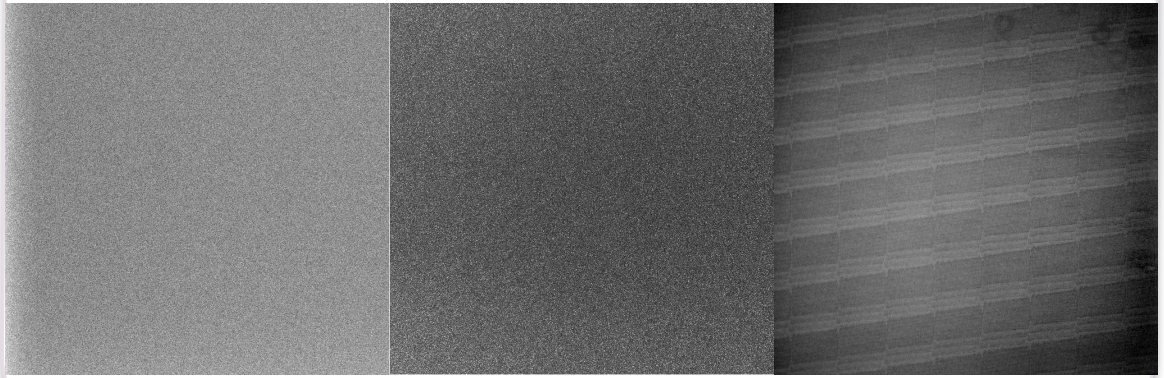
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FROM IMAGE TO LIGHT CURVE

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02 **Reduce** Calibrate and process images

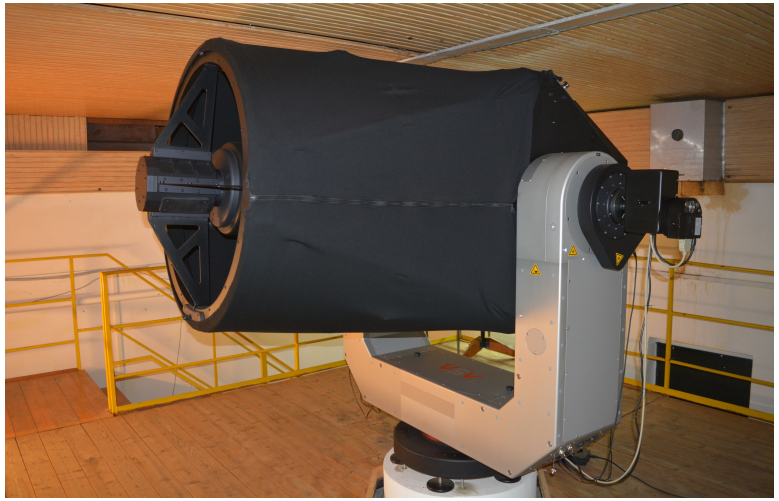
Bias **Dark** **Flat**



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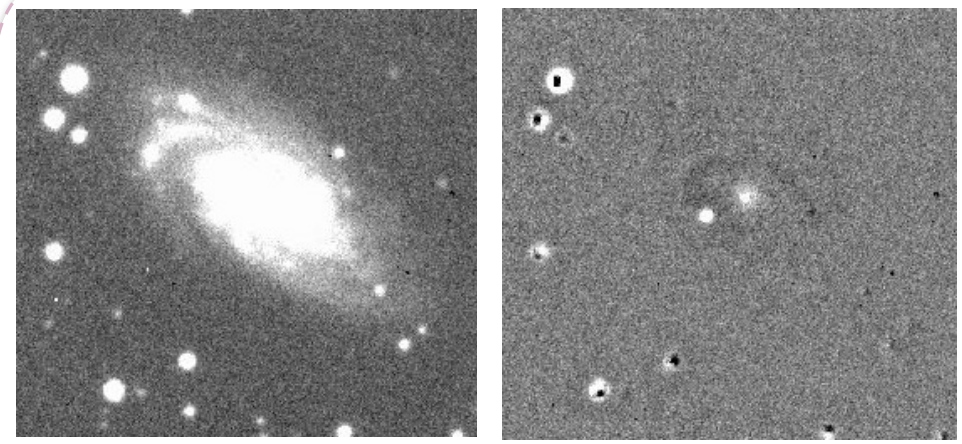
02 **Reduce** Calibrate and process images

03 **Measure** Measure the transient flux with photometrical methods: *aperture, PSF, or image-subtraction photometry*

Photometry: two independent measurements

01 IMAGE-SUBTRACTION PHOTOMETRY

Subtract a reference image to isolate the transient residual, with a script made by Dominik Bánhidi



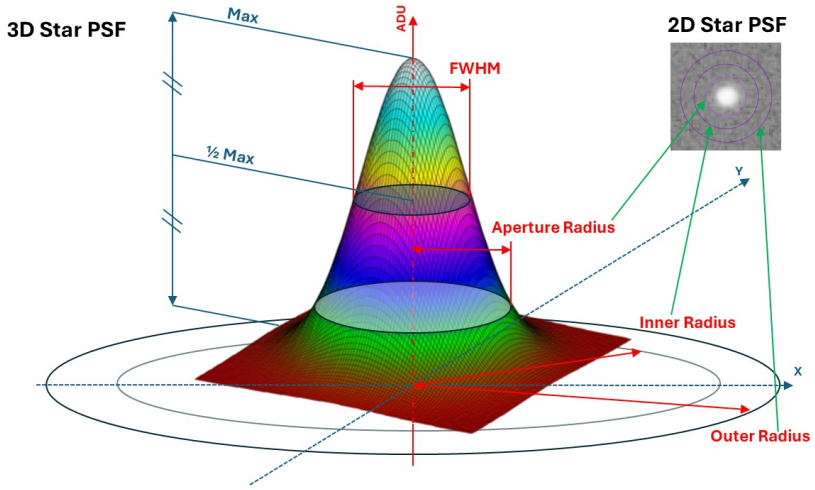
The image before the subtraction

The image after the subtraction

Useful when host-galaxy background or nearby sources complicate the measurement.

02 PSF PHOTOMETRY

Fit a point-spread function to estimate the transient flux.



Source: https://siril.readthedocs.io/en/latest/photometry/quickphotometry.html

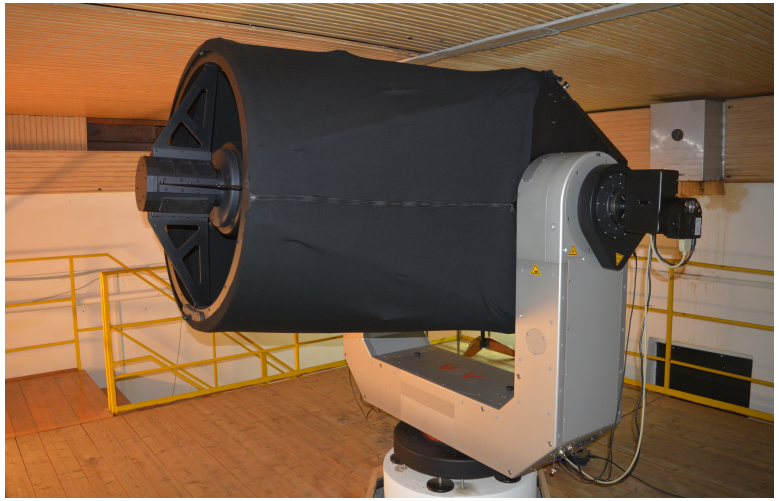
Provides an independent estimate and a useful cross-check on method-dependent systematics.

Cross-check the methods before interpreting subtle light-curve structure.

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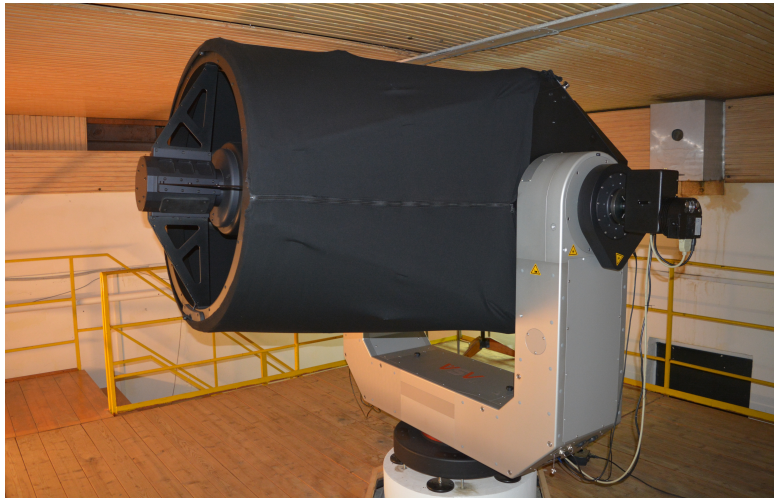
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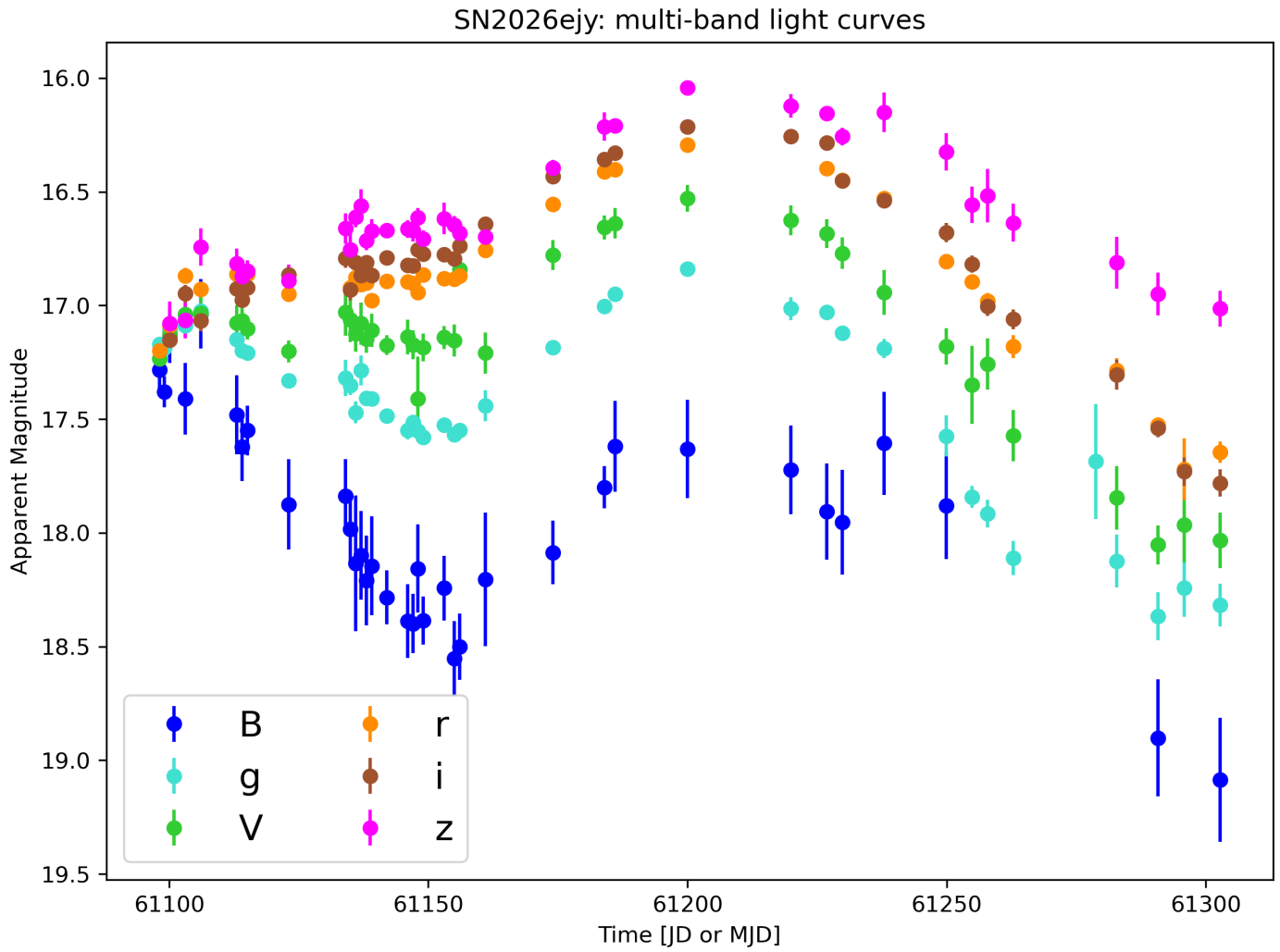
01 **Observe** Acquire science and reference frames

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04 **Compare** Build a consistent light curve

The light curve



EARLY EXCESS

When does it appear, and how long does it last?

EVOLUTION

Rise rate, colour, and transition to later phases.

COMPARISON

How does the shape compare with 1987A-like events?

The light curve motivates the physical question; it does not identify the mechanism by itself.

Spectroscopy: classify, then interpret

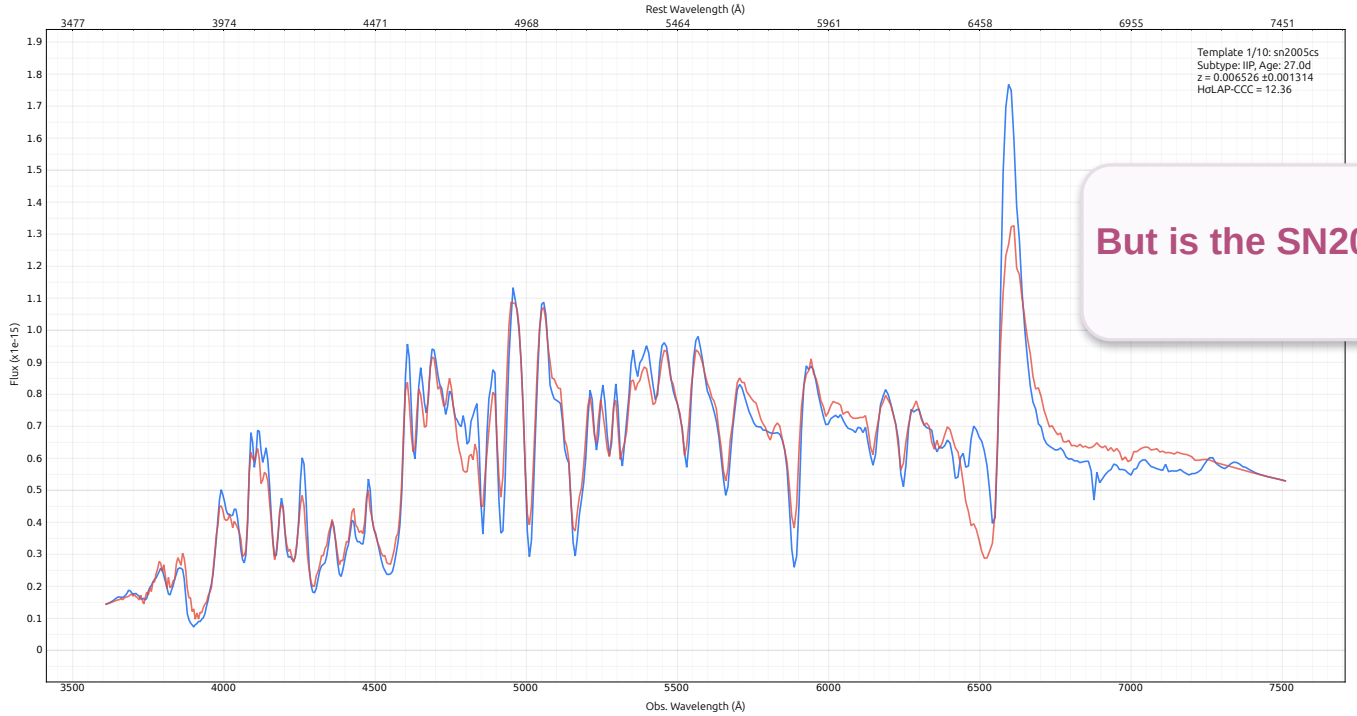
SNID-SAGE — SPECTRAL MATCHING

(Source: Stoppa, F. and Smartt, S. J., 2026, MNAS, 549, stag1066)

Compare the observed spectrum with a library of classified SN spectra to guide classification.

Results

The comparison shows an almost identical spectra to the SN2026ejy, it is the SN2005cs, a low luminosity Type IIP SN.



But is the SN2026ejy actually a Type IIP?

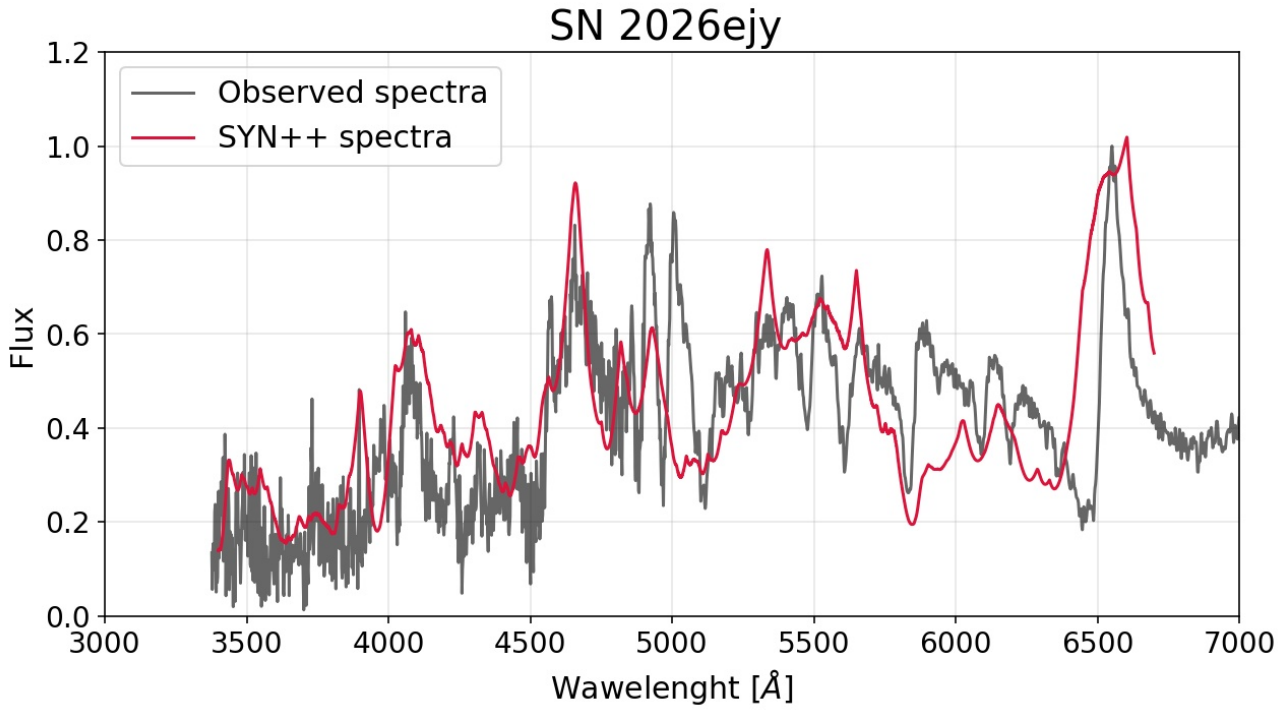
Spectroscopy: classify, then interpret

SYN++ — SPECTRUM SYNTHESIS
(Source: Thomas, R. C., Nugent, P. E., & Meza, J. C., 2011, PASP, 123, 237)

Test plausible line identifications and approximate photospheric conditions.

Results

Photospheric conditions: T_{phot} , v_{phot} , ions, …



Radiative-transfer comparison

FROM A PLAUSIBLE STORY TO A PHYSICAL TEST



QUESTIONS FOR THE MODELS

Can a model reproduce the early excess?

Is the spectral evolution consistent with the same scenario?

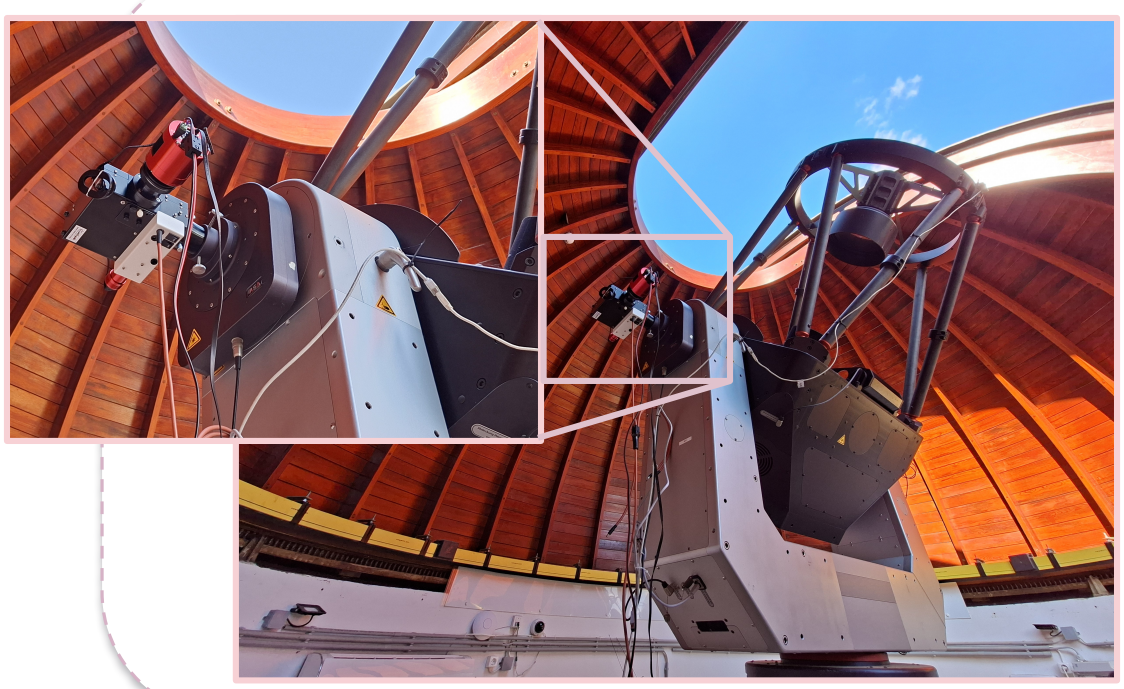
Which ejecta / CSM parameters are constrained by the data?

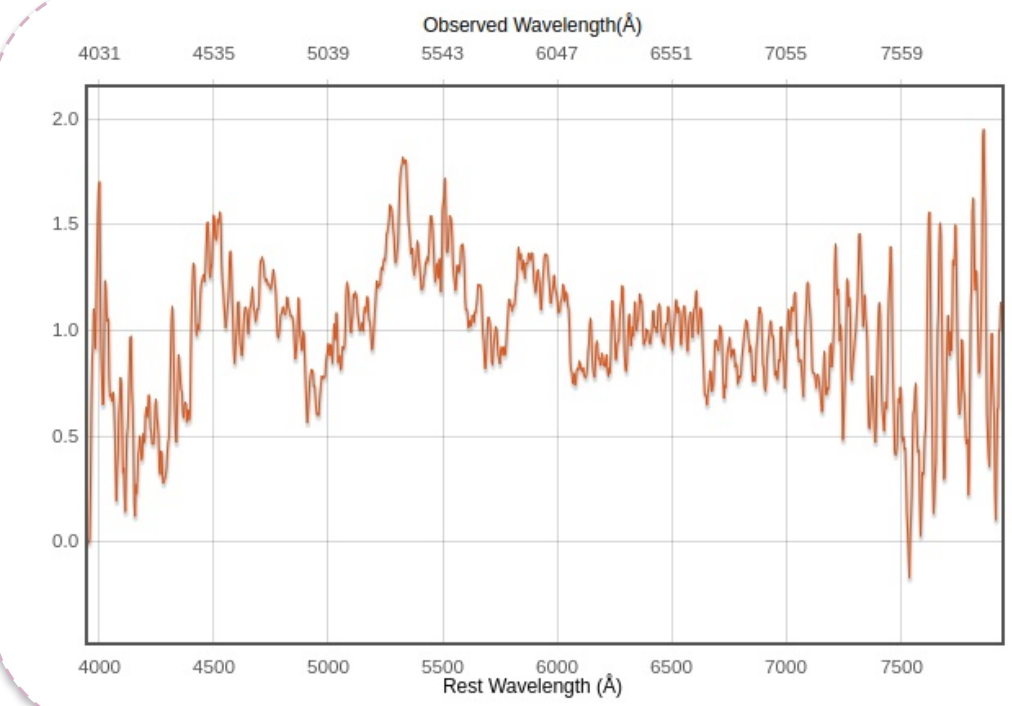
What degeneracies remain?

Interpretation depends on phase coverage, assumptions, and model limitations.

New opportunities for SN spectroscopy in Hungary

A NEW LINK BETWEEN TRANSIENT MONITORING AND SPECTROSCOPY





LOCAL CAPABILITY

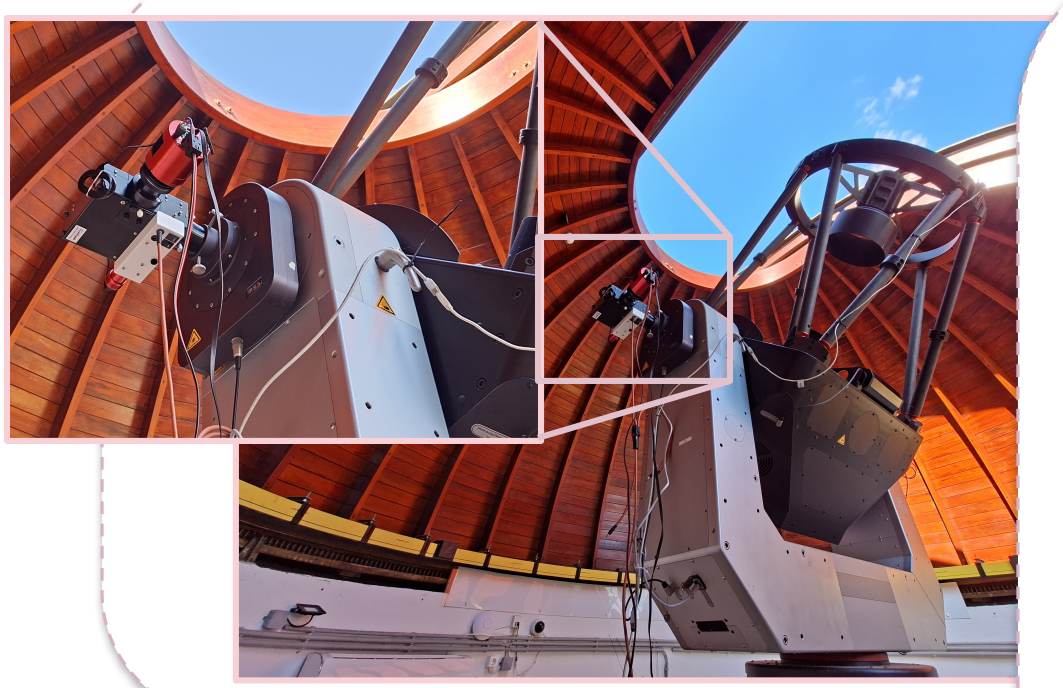
Spectroscopic follow-up is becoming more accessible in Hungary.

SCIENTIFIC VALUE

Faster feedback between photometry, classification, spectroscopic analysis and interpretation.

New opportunities for SN spectroscopy in Hungary

A NEW LINK BETWEEN TRANSIENT MONITORING AND SPECTROSCOPY



LOCAL CAPABILITY

Spectroscopic follow-up is becoming more accessible in Hungary.

TRANSIENT NAME SERVER

Search AstroNotes Groups Bots LVK GW Stats News

Classification certificate for object 2026aeiv

TNS Classification Report No. 24847 [2026TNSCR4045....1H]

Date Received (UTC): 2026-10-07 06:53:41
Sender: Jozsef Vinko
Group: None

Agoston Horti-David (Konkoly), Dominik Banhidi (U Szeged), Zsofia Vig (U Szeged), Jozsef Vinko (Konkoly) report/s a classification of object: **SN 2026aeiv**

Type: SN Ia-91T-like
Redshift: 0.0077

Remarks: The spectrum was taken with the LISA spectrograph attached to the RC80 telescope at Piszkesteto station of Konkoly Observatory. Classification was done by SNID-SAGE.

The following Classification spectrum was provided:

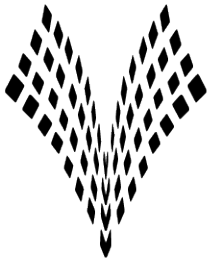
Obsdate: 2026-10-07 02:39:50
Instrument: Other
Telescope: Other

Remarks: 800.

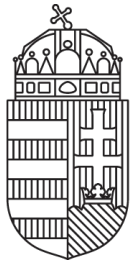
Thank You

For Your Attention

This project is supported by the National Talent Program (NTP) and the Ministry of Education and Children's Affairs of Hungary.



National Talent Program



Oktatási és Gyermekügyi Minisztérium