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Utilizing DESI as a Transient Discovery Machine

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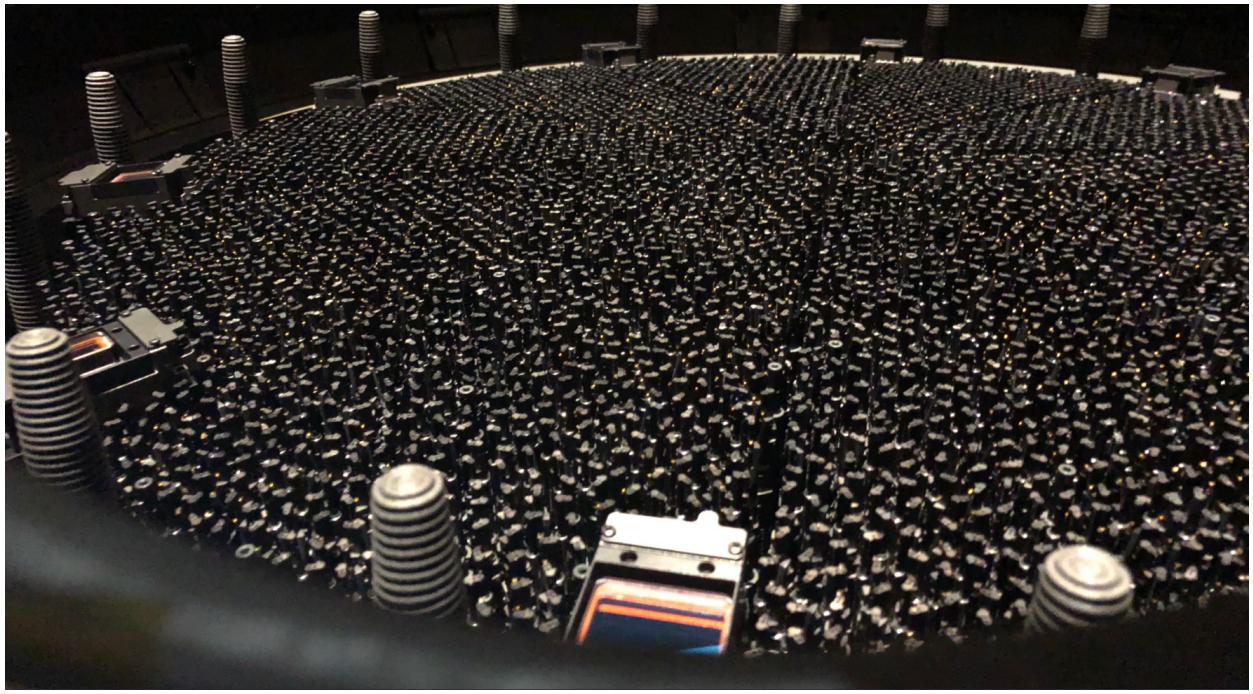
Dark Energy Spectroscopic Instrument (DESI)

- Stage IV cosmology experiment on the Mayall 4-meter telescope at Kitt Peak
- Has observed the redshift over 40 million galaxies and is on track to observe over 60 million

Dark Energy Spectroscopic Instrument (DESI)

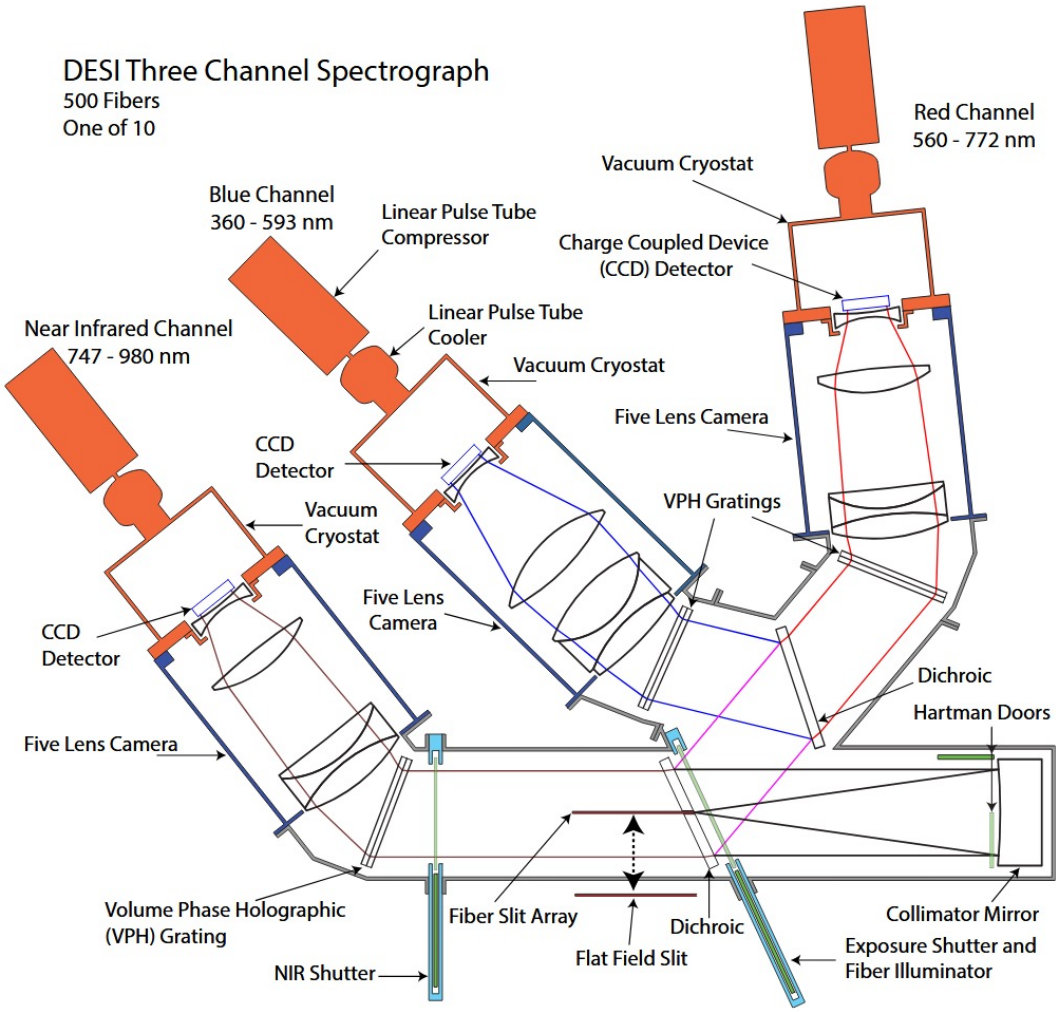
- DESI is made up of 5000 robotic fibers
- Covers ~9 square degrees



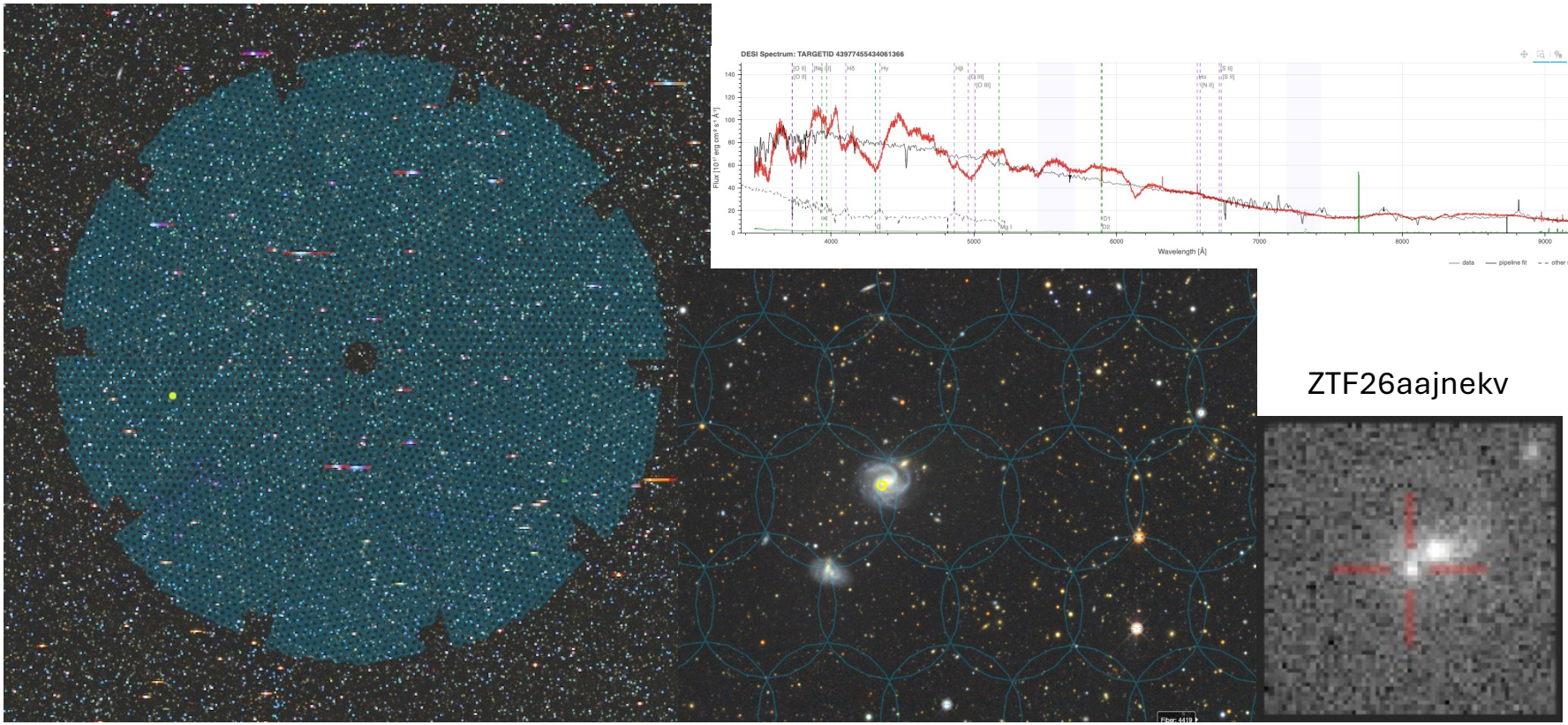
DESI fiber positioning robot

DESI

- DESI 3 channel instrument
- Observes from 360nm – 980nm
- R ~ 2000 – 5000
- Extremely high throughput (70%)

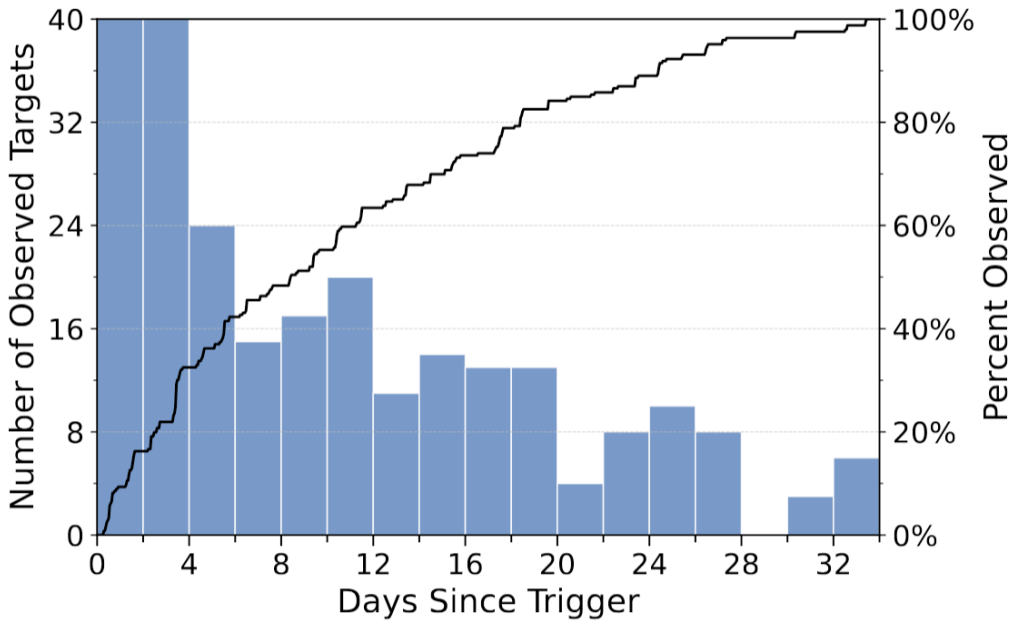


DESI Spare Fiber Program

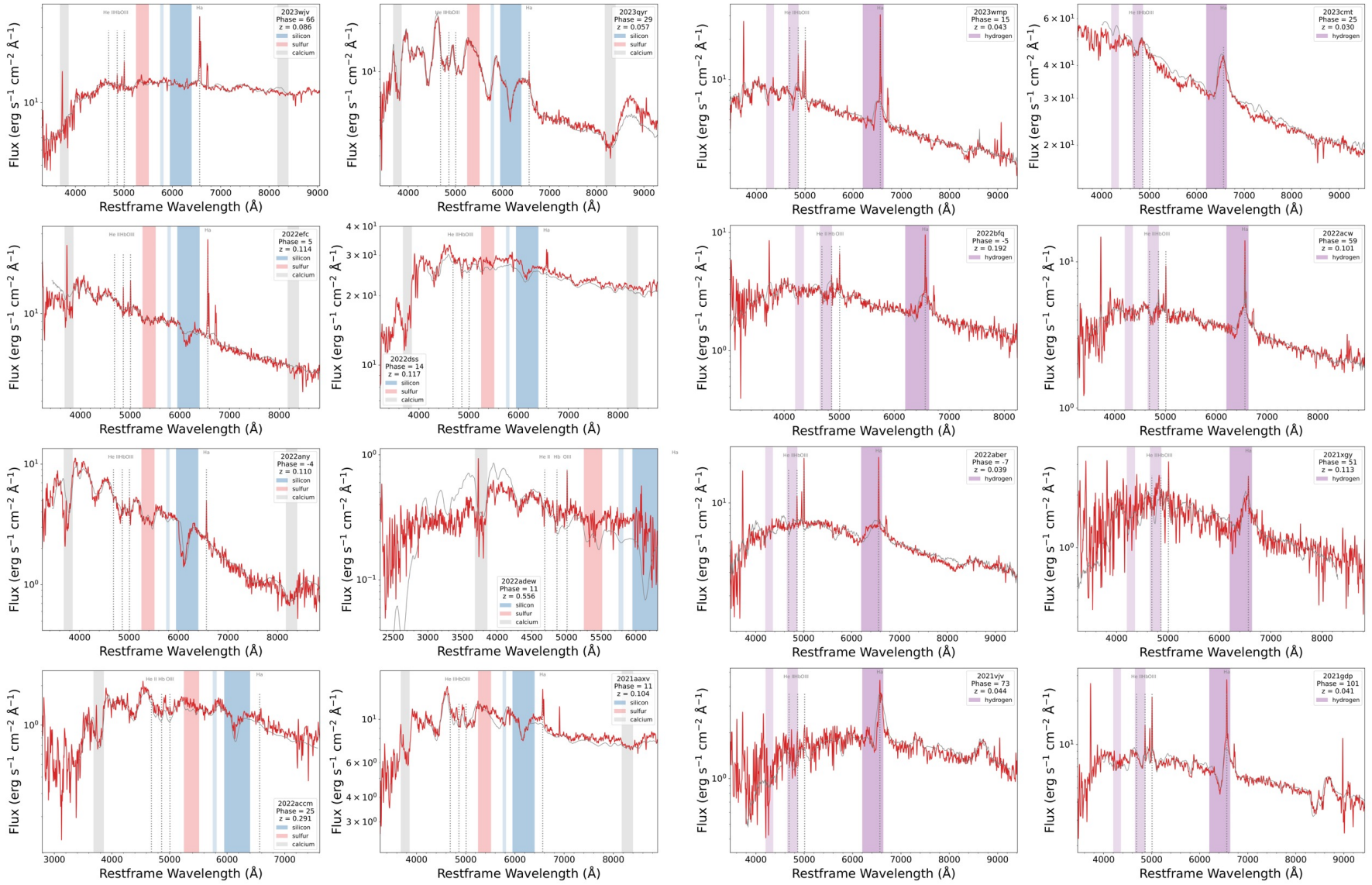


DESI Spare Fiber Program

- Targets were selected from:
  - TNS
  - ZTF Alerts
  - DECam Survey for Intermediate Redshift Transients (DESIRT)
- 1000+ transients observed in one year
- ~20% of transients observed within 2 days



Hall et al. 2026 arXiv: 2601.12611



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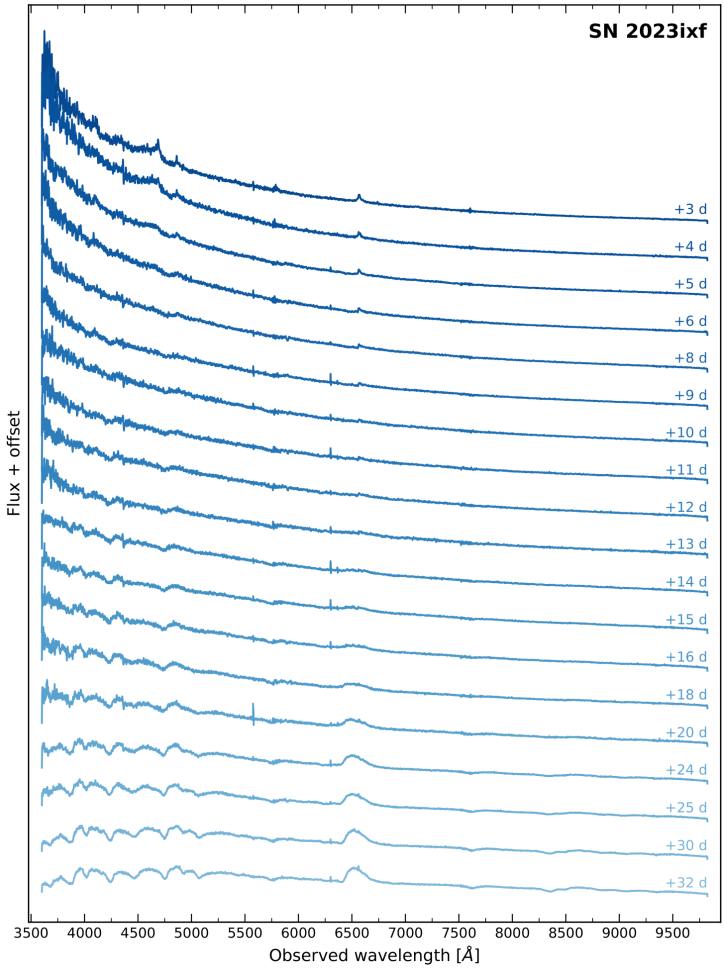

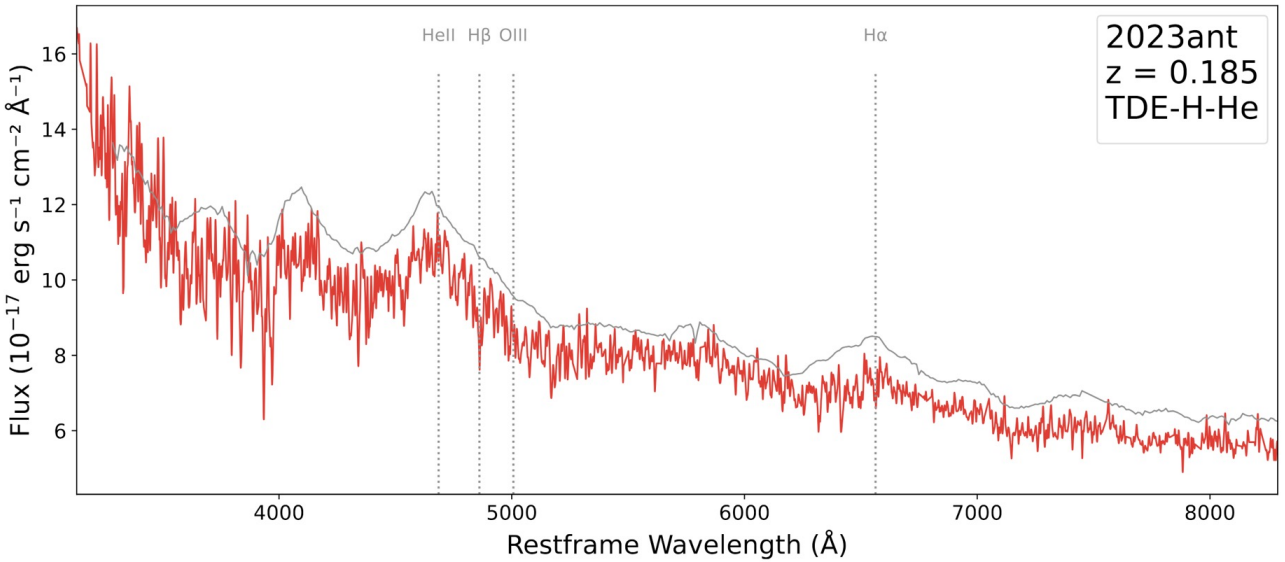

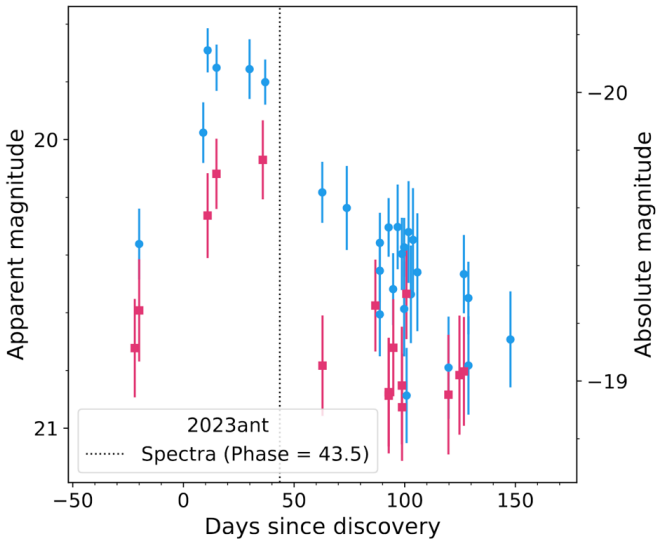

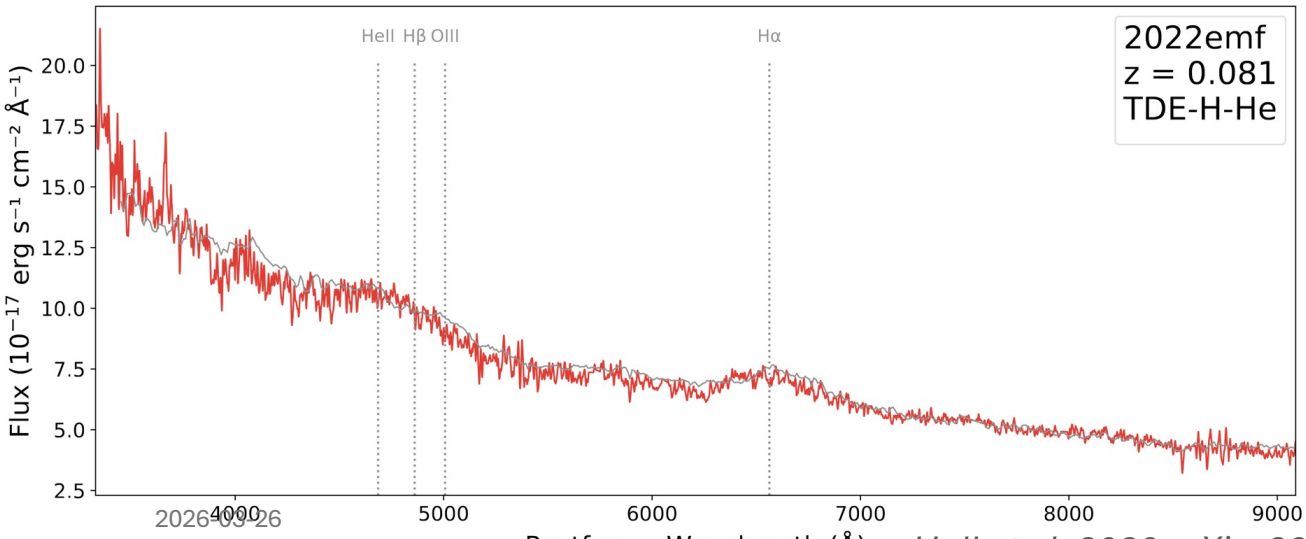

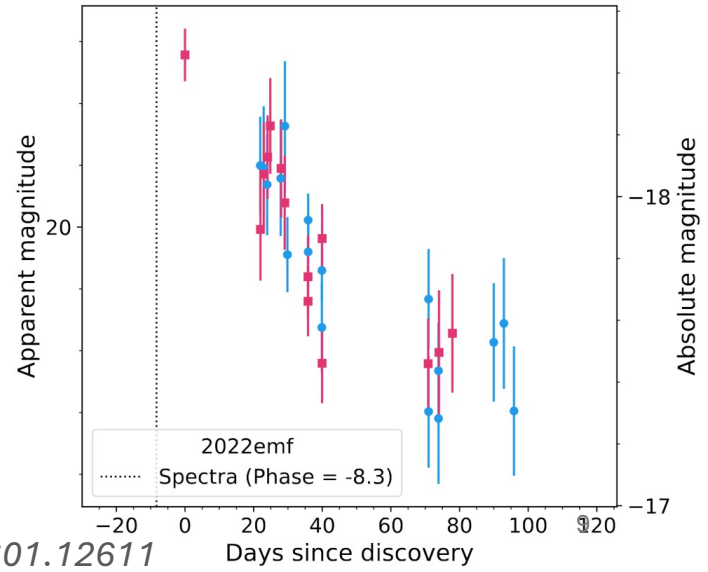

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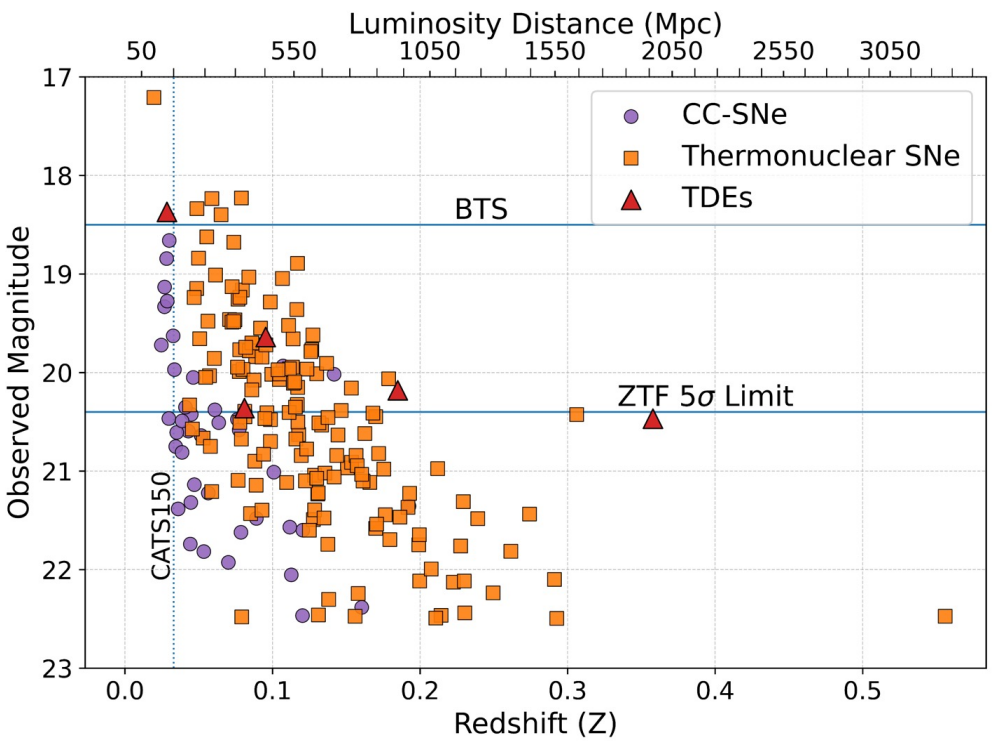
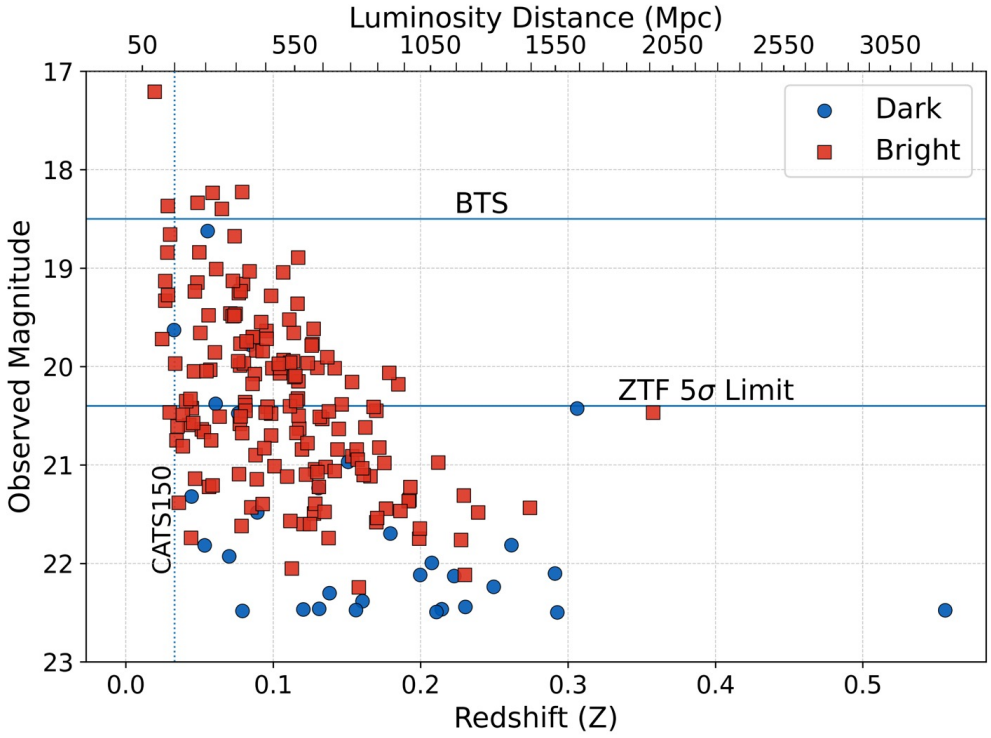
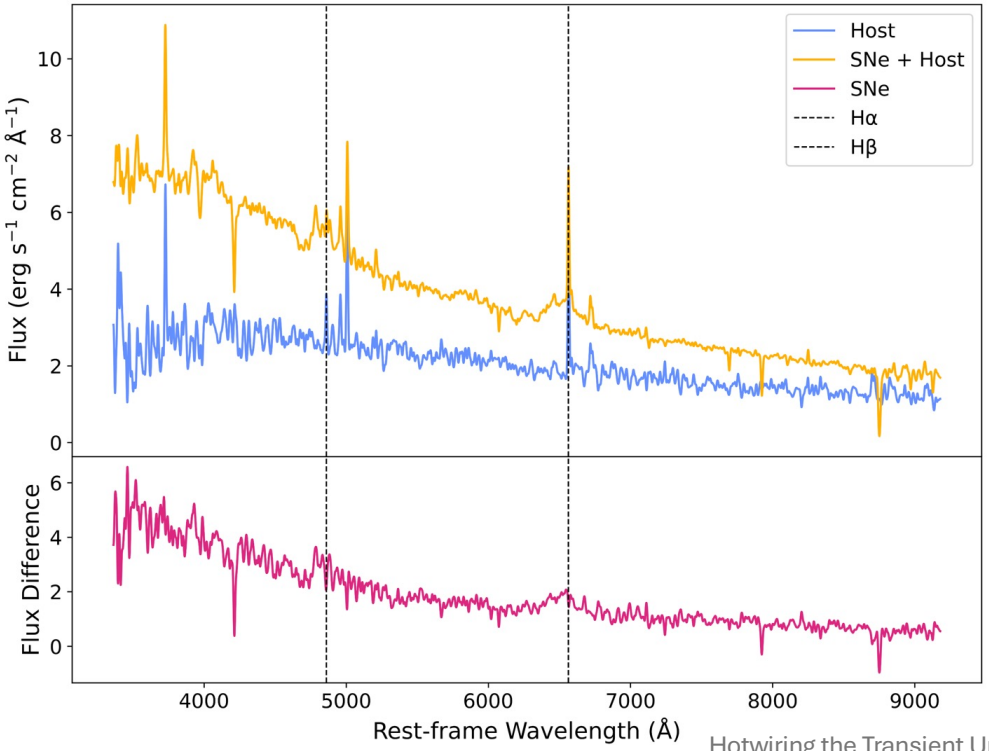
Depth and Redshift Limits



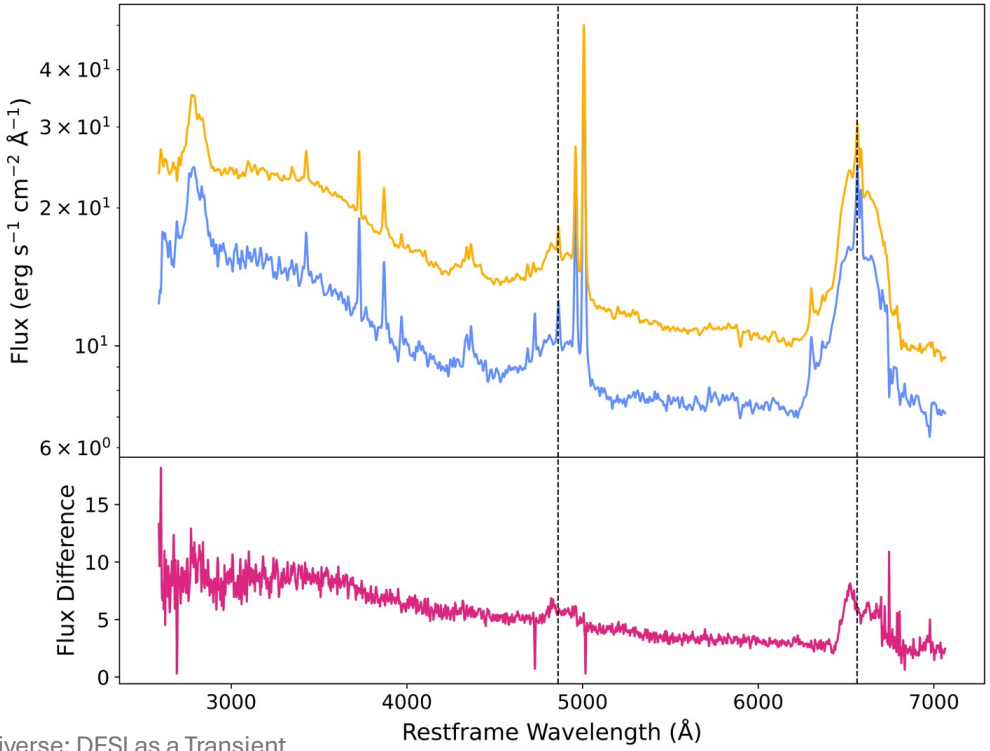


Host Subtraction With DESI

Type II SN

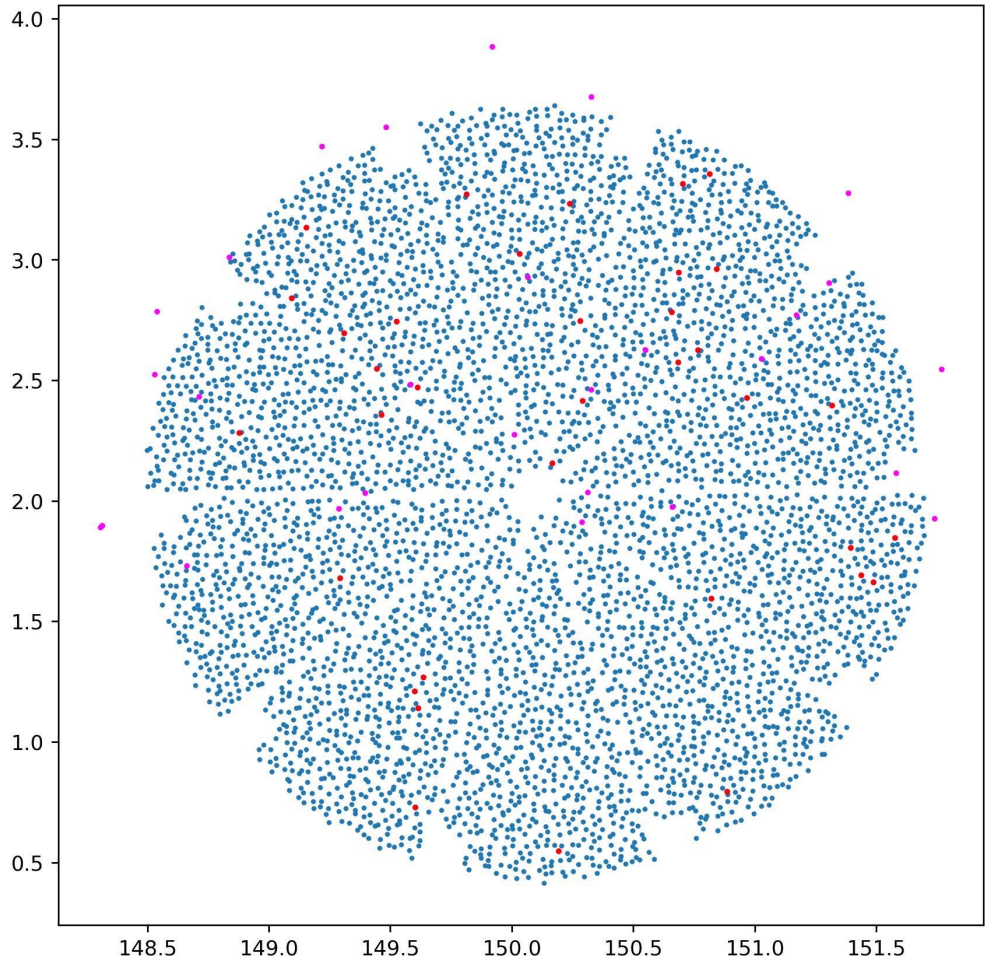


Massive Binary Black Hole Candidate



Observing Rubin COSMOS

- In Rubin COSMOS we selected 668 sources
- 345 targeted by a fiber
  - 63 variable stars
  - 56 AGN
  - 5 SN
    - 3 Type II SN
    - 2 Type Ia SN



2026-03-20 18:23:58 Type: Object/s-Discovery/Classification Bibcode: 2026TNSAN..81....1H

DESI multi-object spectroscopic observations of hundreds of Rubin alerts

Authors: Xander J. Hall (CMU), John Banovez (LBNL), Antonella Palmese (CMU), Stephen Bailey (LBNL), Segev BenZvi (U Rochester), Xinyi Chen (Yale), Dylan Green (LBNL), Anthony Kremin (LBNL), Adam Myers (U of Wyoming), David Schlegel (LBNL), Swayamtrupta Panda (NOIRLab) on behalf of the DESI Collaboration

Source Group: DESI

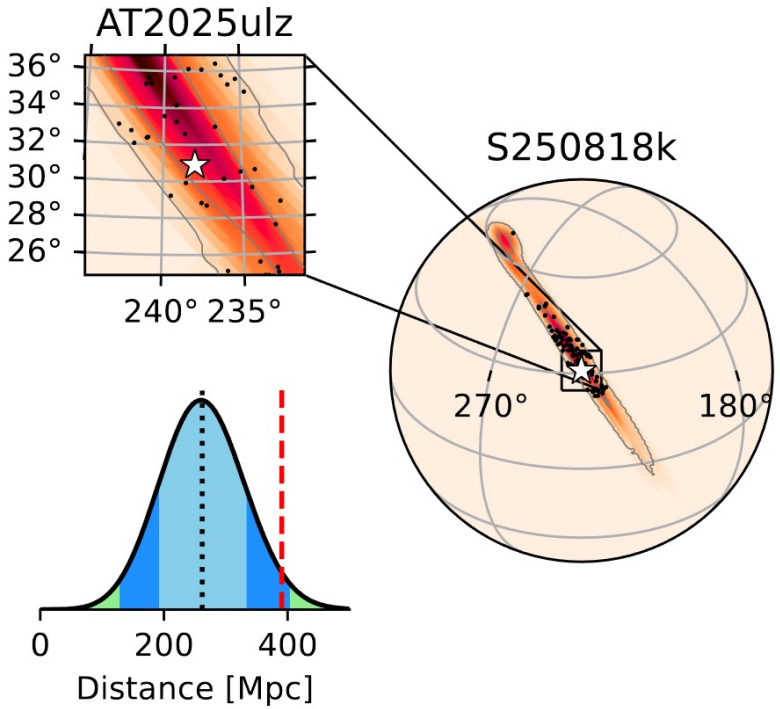
Keywords: Surveys , Supernova

Abstract: We report the first spectroscopic follow-up of Rubin alerts with the Dark Energy Spectroscopic Instrument (DESI). During our initial campaign, we targeted 345 alerts from the Rubin Legacy Survey of Space and Time (LSST) in the COSMOS Deep Drilling Field and will continue monitoring new alerts as they are issued in the coming weeks. Using our first observations, comprising 2 DESI pointings, we are able to classify 61 alerts, including 5 supernovae publicly released on TNS. These results highlight the power of DESI to rapidly and efficiently complement Rubin LSST observations, particularly for supernova science and more broadly for transient astrophysics.

S250818k and Discovering AT2025ulz

- S250818k was a sub-solar mass merger
- The Zwicky Transient Facility began observations 2.7 hours after merger
- Tiled 168.3 square degrees (25.2%)
- Left with 58 transients and one candidate highlighted
  - AT2025ulz

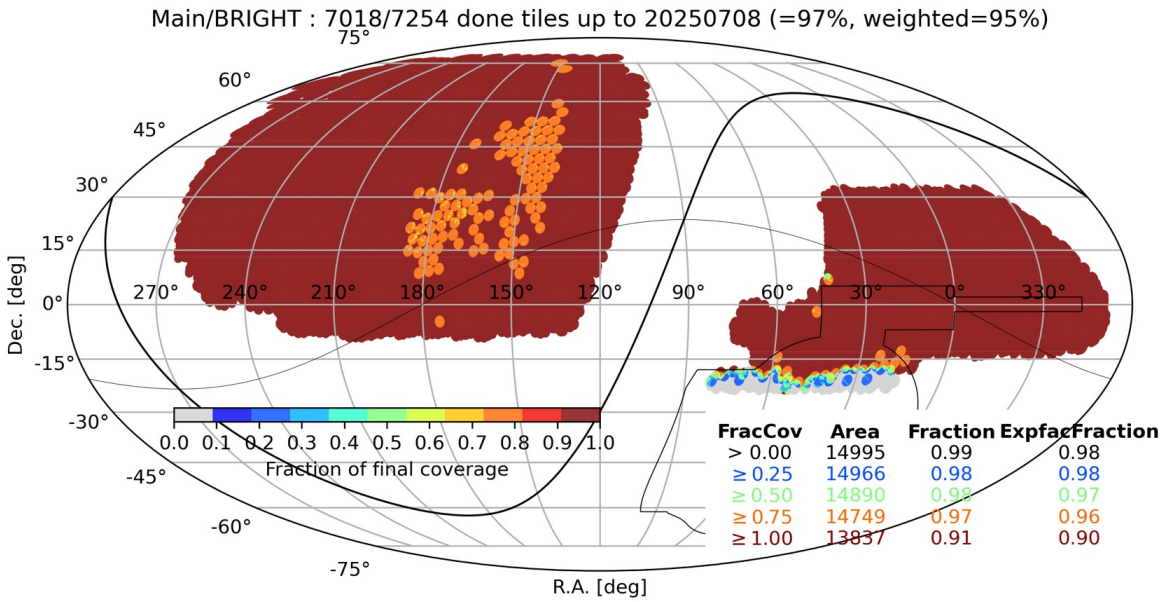
Kasliwal et al. 2025 arXiv:2510.23732



DESI Aided Localization

- 152 Transient Reported to TNS
  - 73 have DESI Redshifts
  - 58 are outside the volume
  - 15 are inside the volume
    - 2025ulz

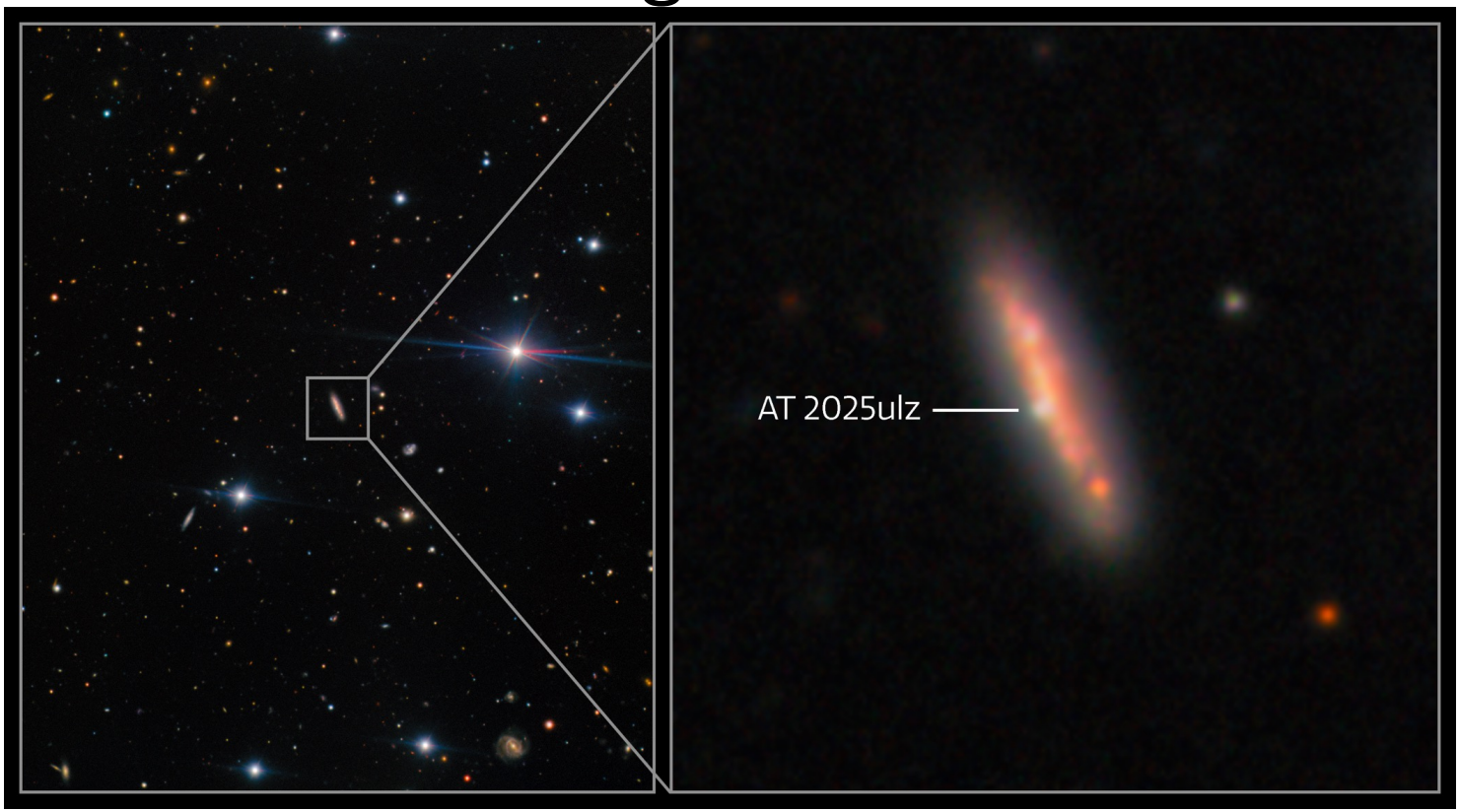
Hall et al. 2025b arXiv: 2510.23723



Conclusions

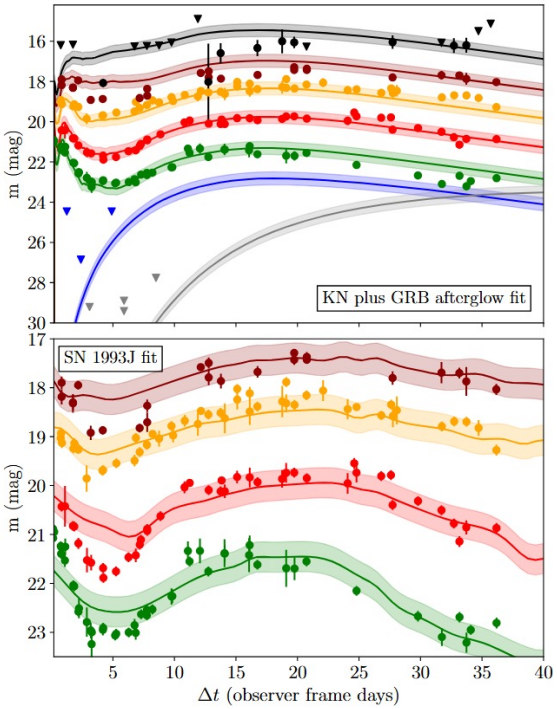
- DESI Spare Fiber offers a way to provide spectroscopic classifications for a thousands of transients from LSST down to 22.5 mags
- DESI Dedicated Tile program will provide thousands of spectra for LSST discovered transients
- The DESI catalogs can provide critical help in localizing possible counterparts to GW events
- What is the best way to share Non-SN spectra to the community?

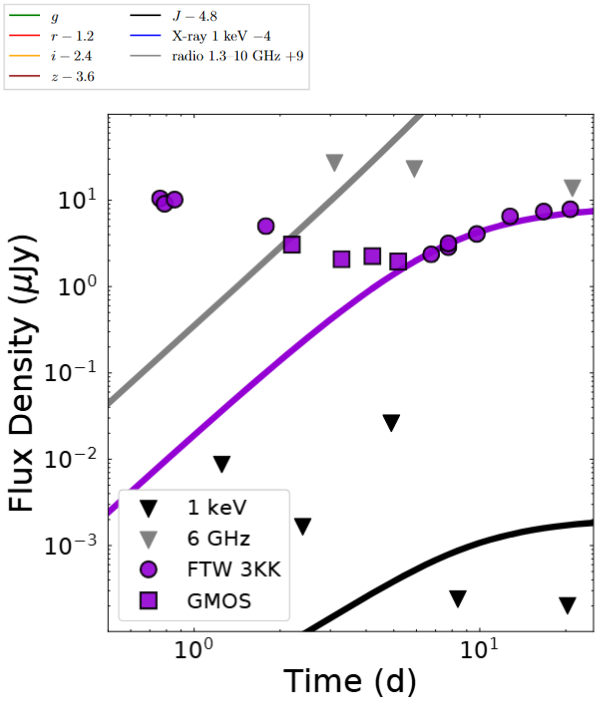
Continued Monitoring with Gemini-N

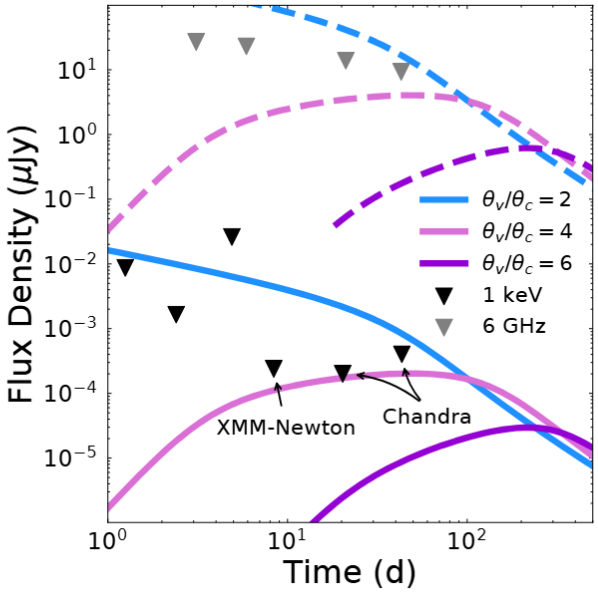


Hall et al. 2025a arXiv:2510.24620; Image Credit: International Gemini Observatory/NOIRLab/NSF/AURA

Late Time Modeling & X-ray Limits







Hall et al. 2025a arXiv:2510.24620

O'Connor et al. 2025 arXiv:2510.23728