Photometry & Spectroscopy of LFBOT AT2026dbl

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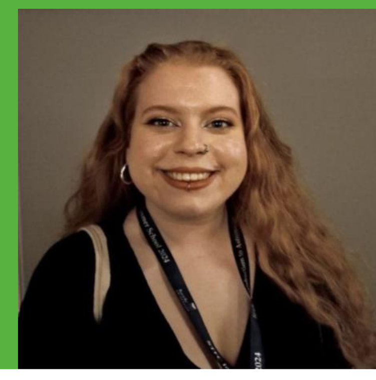
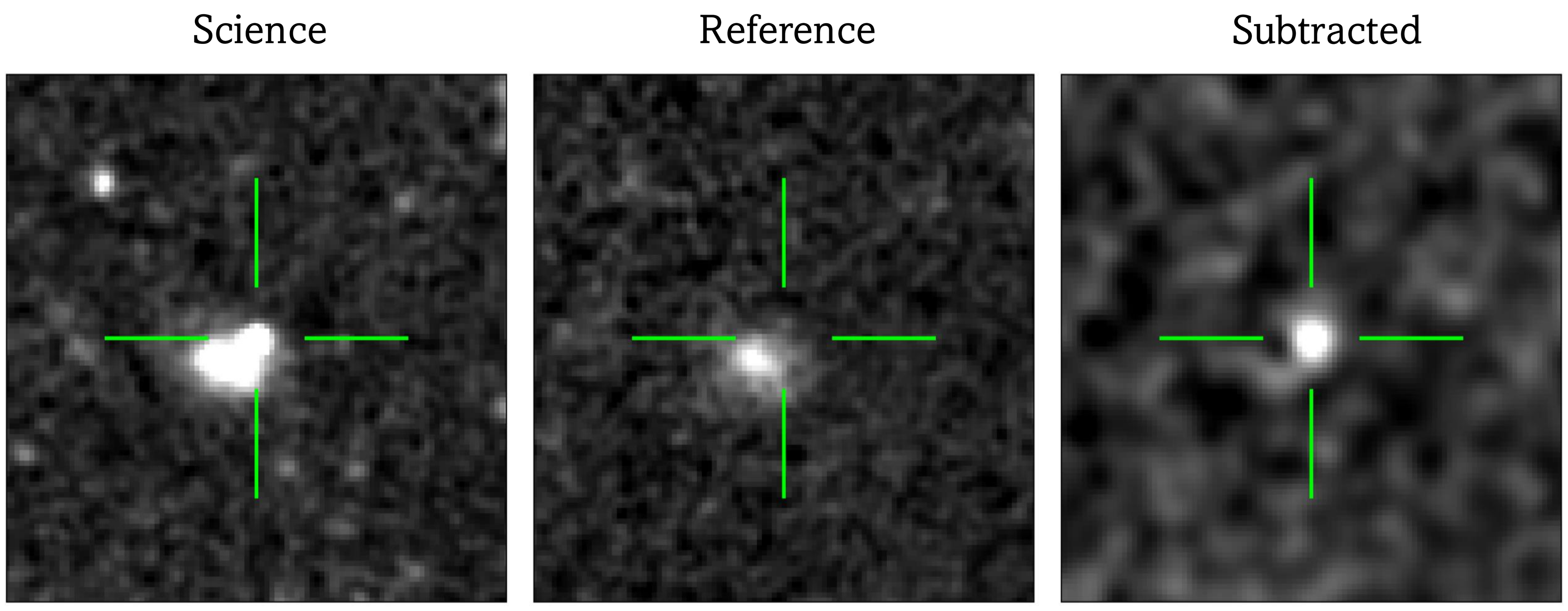


Introduction: LFBOTs

Luminous Fast Blue Optical Transients (LFBOTs) are a new and mysterious transient class. They are unusually fast-evolving, with a rise time of $\lesssim$ 5 days. [1] They have high optical peak luminosity of $M_v < -20$ mag. Their spectra show a blue continuum characteristic of high-temperature ($\gtrsim$ 20,000 K) blackbody radiation. [2][3] LFBOTs show luminous millimetre, X-ray and radio emission, distinguishing them from most other known transient classes. The origin of LFBOTs is still unclear, and current theories only succeed in explaining some, but not all, observational features. One theory is that they are jets from failed core-collapse supernovae: shock heating of the CSM is driven solely by a jet from a BH following direct collapse of a massive star. [2] Another theory is that they are TDEs from IMBHs, or TDEs resulting from a Wolf-Rayet – BH merger. [4][5] This scenario fits with observation: both LFBOT and IMBH TDE light curves decline as a power-law, lack an early free-expansion phase and show a continued high temperature. However, the peak LFBOT luminosity ($\sim 10^{44}$ erg) requires a super-Eddington accretion rate. [2] Much is still unknown about LFBOTs, especially at later times as they quickly become unobservable from ground-based facilities due to their high redshifts and fast evolution. As such, early detection and extensive follow-up across as much of the EM spectrum as possible is crucial in our efforts to constrain the various models.

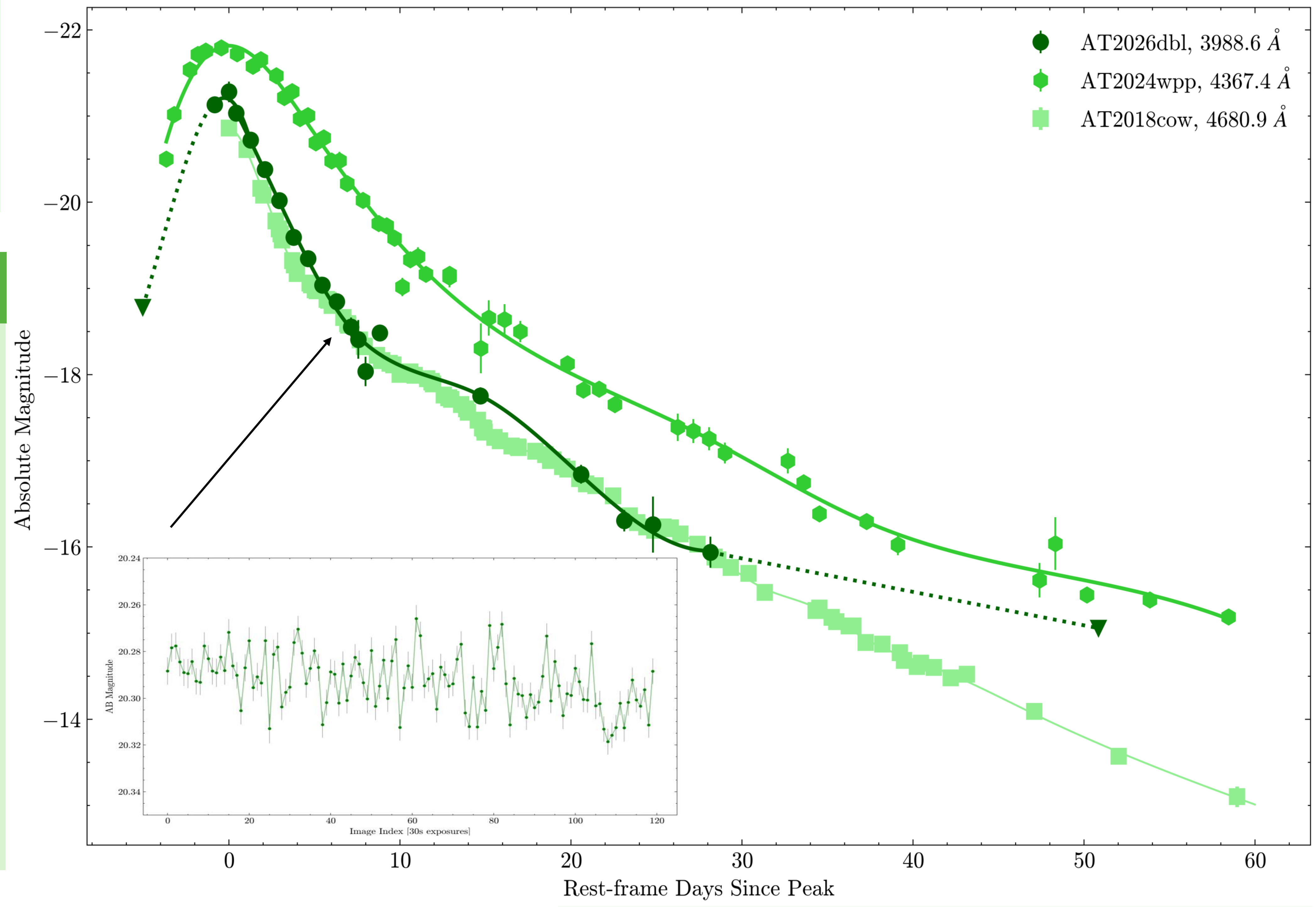
AT2026dbl

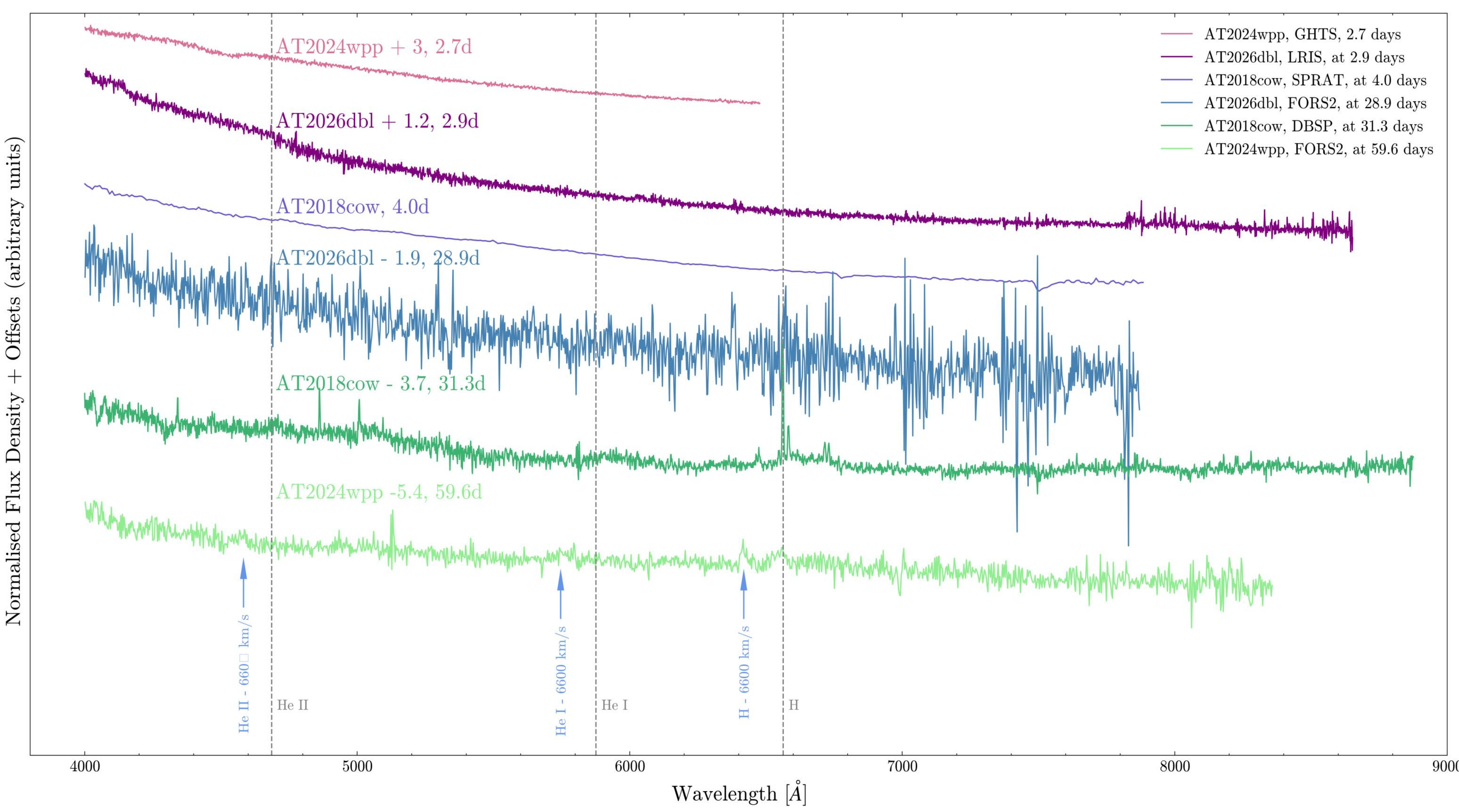
AT2026dbl is the most recent LFBOT to be discovered. It was first identified on February 14th, 2026, by the Zwicky Transient Facility (ZTF). It was flagged as an LFBOT candidate due to its exceptionally blue colour and fast evolution. Its redshift is 0.19, determined via the host galaxy Mg II absorption doublet at 2796Å and 2803Å in the Keck spectrum taken 2.9 days post-discovery. Extensive, multiwavelength follow-up has been undertaken since, using facilities including Liverpool Telescope (LT) Very Large Telescope (VLT), Gran Telescopio Canaria (GTC), Very Large Array (VLA), Northern Extended Millimeter Array (NOEMA), Green Bank Telescope (GBT), Einstein Probe (EP) and Lowell Discovery Telescope (LDT). The cutouts on the right show the VLT FORS2 g-band image from March 15th (30 days post-discovery), the Legacy Survey reference image, and the PSF subtraction.



Photometry

The graph on the right shows AT2026dbl's g-band evolution compared with two other LFBOTs – the flagship event, AT2018cow [2] and the second latest discovered LFBOT, AT2024wpp [6]. Also included are the g-band central wavelengths at their respective redshifts. AT2026dbl peaked at $M_{G,\,peak} \sim -21.3$, making it brighter than AT 2018cow (-20.9) and less bright than AT2024wpp (-21.8). Like its predecessors, it fades fast (~ 0.4 mag/day in all bands) and stays persistently blue throughout its evolution ($u - g \sim -0.6$ mag) High time-resolution HiPERCAM imaging taken 6, 7 and 9 days post-discovery shows no significant short-duration variability such as the rapid, luminous optical flares seen in AT2022tsd. [7]





Spectroscopy

The left graph shows an early-time spectrum taken 2.9 days post-discovery and the latest spectrum for AT2026dbl taken 27.9 days post-discovery, as compared to spectra from AT2018cow and AT2024wpp at similar and later epochs. The spectra for AT2026dbl remain featureless and blue up until this final epoch, ruling out emission lines as strong as those seen in AT2018cow at similar phases. We were able to probe up to 30 days, so the late-time emergence of H and He emission lines, as is seen in LFBOTs with late-time spectra and is captured in the final AT2024wpp spectrum, is not ruled out.

References

1. Ho et al. (2023) *ApJ* 949 120
2. Perley et al. (2019), *MNRAS* 484 1031–1049
3. Ho et al. (2020), *ApJ* 895 49
4. Chen & Shen (2018), *ApJ* 867 20
5. Metzger, B.D (2022), *ApJ* 932 84
6. Perley et al. (2026), *MNRAS* stag678
7. Ho et al. (2023) *Nature* 623, 927–931