Type Ibn Supernovae May Not All Come From Massive Stars

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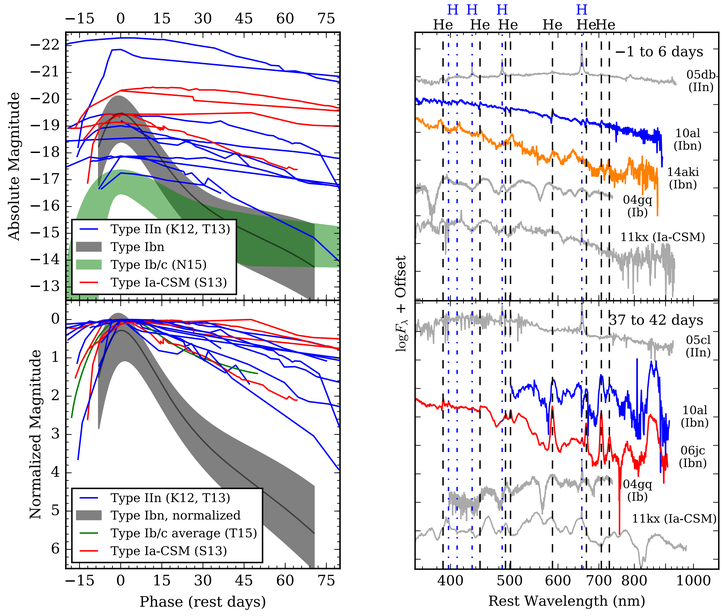
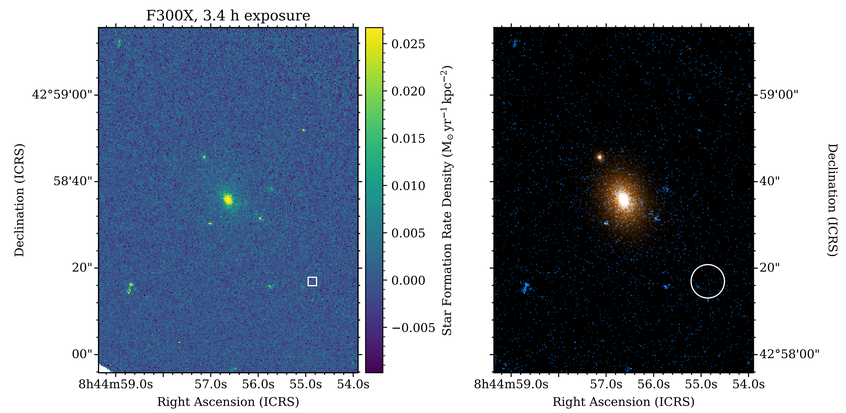
Type Ibn supernovae are a rare class of stellar explosions whose ejecta interact with **hydrogen-poor circumstellar material**. Unlike Type IIn supernovae, which interact with hydrogen-rich circumstellar material, Type Ibn supernovae have **fast and relatively homogeneous light curves**. Their early spectra can either show narrow P Cygni profiles on a hot thermal continuum or narrow emission lines on top of broader features.

Left: Type Ibn template light curve (black) compared to other interacting supernovae (blue and red) and other stripped-envelope supernovae (green). Light curves in the lower panel are normalized to maximum light.

Right: Type Ibn spectra (colors) compared to other interacting and stripped-envelope supernovae.

For more detail, see Hosseinzadeh et al. 2017, ApJ, 836, 158.





PS1-12sk was a Type Ibn supernova that occurred on the outskirts of an elliptical brightest cluster galaxy (Sanders et al. 2013). We obtained deep ultraviolet observations of its host cluster with *HST*+WFC3 that show **no sign of active star formation in the vicinity**.

Left: Ultraviolet (F300X) image of the host cluster. The white square in the top panel contains a 2 × 2 kpc around the supernova location, which is shown in the bottom panel.

Right: Two-color image of the host cluster (F625W ≈ *r*′ and F300X ≈ *u*′). The white circle in the top panel contains a 3 kpc radius around the supernova location, which is shown in the bottom panel. A nearby ultra-compact dwarf is marked with a white ellipse.

This limit on the star formation rate rules out all core-collapse supernova hosts in the sample of Galbany et al. (2018), calling into question the presumption that PS1-12sk came from a massive star. Arrows in the figure indicate 3σ nondetections.

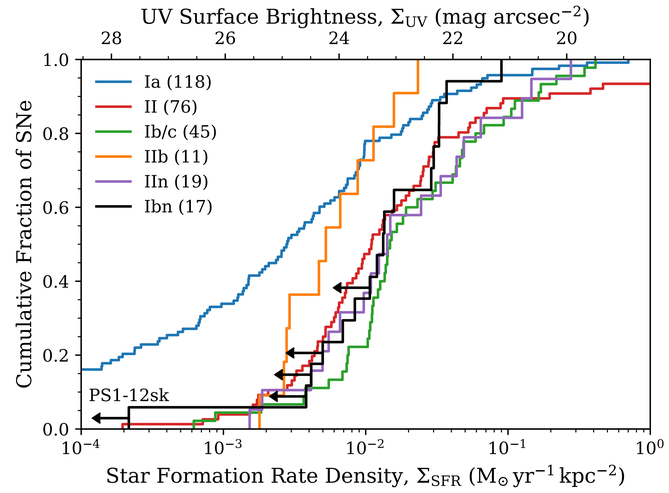
Three possibilities for the progenitor of PS1-12sk remain:

1. The progenitor was **ejected or stripped from the ultra-compact dwarf**. It would need a velocity > 530 km s^{-1} to reach the supernova location within its lifetime.

2. There is a **very low level of star formation** beneath our limit, meaning the supernova we observed was a very statistically unlikely event (1 Myr^{-1}).

3. PS1-12sk was the **explosion of a low-mass star**. No known white dwarf progenitor systems can fully explain the supernova properties.

For more detail, see Hosseinzadeh et al. 2019, ApJL, 871, L9.



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