Some Type Ibn supernovae are not from massive stars

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Led by LCO - PI: Howell

150+ members of the worldwide SN community working together. Members from every continent.

More than halfway to goal of getting unprecedented data on 900+ SNe with well sampled light curves and spectra over 6 years.

Creating tools and incentives for scientists to work together, share data.

Feeder surveys
PTF/iPTF/ZTF
Pan-STARRS
(e)PESSTO
La Silla-Quest
ASAS-SN
Catalina Sky Survey
MASTER
OGLE
KAIT
ATLAS
Gaia
KMTNet
Sky mapper
DLT40
KMTNet
BlackGEM
COME WITH ME IF YOU WANT TO LIVE
SNe IIn have narrow lines of hydrogen, SNe Ibn have no hydrogen, but have narrow lines of helium.

From Nathan Smith’s IIn/Ibn article in the Handbook of Supernovae
Inferred circumstellar material parameters around SNe IIn/Ibn.
From Nathan Smith’s IIn/Ibn article in the Handbook of Supernovae
Added 6 SNe Ibc to bring total known to 22.

SNe Ibc fall into two classes based on early spectra: those with narrow He P-Cygni profiles, and those with narrow He emission.
PS1-12sk is a Ibn that looks like SN 2006jc, the prototype Ibn. SN 2006jc was seen in outburst at Mr~ -14 pre-explosion, modeled as a Wolf-Rayet star with 40 Msun ZAMS, 6.9 Msun at explosion (Tominaga et al. 2008).

Sanders et al. 2013

Figure 2. Low-resolution spectroscopic sequence of PS1-12sk, with time since z-band peak noted at right. See Table 2 for observing details. The moderate resolution MMT/BC spectrum is shown separately in Figure 5. The locations of the He I features λλ3188, 3889, 4121, 4471, 4922, 5016, 5876, 6678, 7065, 7281 are marked with solid lines; He II with a dashed line; and C II λλ6580, 7234 with dotted lines. Spectra of SN 2006jc at representative epochs (Pastorello et al. 2008a) are shown in red.
PS1-12sk is at 28 kpc projected separation from a Brightest Cluster (Elliptical) Galaxy.

HST UV observations show no apparent star formation — see 2kpc x 2kpc region in bottom left.
Rings are in kpc. Nearest source may be ultra-compact dwarf 2.7 kpc away.

Hosseinzadeh et al. 2018
Possibilities

1. Hypervelocity Star (>2.7 kpc in 5M yrs, >530 km/s).
2. Luck - star formation just shut off in the last 5 million years. But this would be the first time this has been seen. “We would expect this a few times per 100 million years per kpc².”
3. Some SNe Ibn do not come from massive stars.
Not all SNe IIn are core collapse! Some are SNe Ia exploding in H-rich environment.
What is the progenitor?

Could a white dwarf be exploding in a He-rich environment?

He nova?

.1a supernovae? He shell detonations on CO white dwarfs accreting from He white dwarfs (AM CVn systems; Bildsten et al. 2007, Shen et al. 2010). But doesn’t match theoretical predictions.

Are all SNe Ibn the same?
Are SNe Ibn…

Ib or not Ib, that is the question (Shakespeare, 1603)