Measured Metallicities at the Sites of Stripped Core-Collapse Supernovae

Maryam Modjaz (1), J. S. Bloom (1), A. V. Filippenko (1), L. Kewley (2), D. Perley (1), J. M. Silverman (1)

((1) UC Berkeley, (2) Hawaii)

Metallicity is expected to influence not only the lives of massive stars but also the outcome of their deaths as supernovae (SNe) and as gamma-ray bursts (GRBs). However, there are surprisingly few direct measurements of the local metallicities of different flavors of core-collapse SNe. Here we present the largest existing set of host-galaxy spectra with H II region emission lines at the sites of 34 stripped-envelope core-collapse SNe. We derive local oxygen abundances in a robust manner in order to constrain the SN Ib/c progenitor population. We obtain spectra at the SN sites, include SNe from targeted and untargeted surveys, and perform the abundance determinatinos using three different oxygen-abundance calibrations. The sites of SNe Ic (the demise of the most heavily stripped stars having lost both the H and He layers) are systematically more metal rich than those of SNe Ib (arising from stars that retained their He layer) in all calibrations. A Kolmogorov-Smirnov-test yields a very low probability of 0.1% that SN Ib and SN Ic environment abundances, which are different on average by 0.2 dex (in the Pettini & Pagel scale), are drawn from the same parent population. Broad-lined SNe Ic (without GRBs) occur at metallicities between those of SNe Ib and SNe Ic. Lastly, we find that the host-galaxy central oxygen abundance, widely inferred from the host-galaxy luminosity, is not a good indicator of the local SN metallicity; hence, large-scale SN surveys need to obtain local abundance measurements in order to quantify the impact of metallicity on stellar death.

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Email: mmodjaz@astro.berkeley.edu