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Multiwavelength analysis of three GRB-associated SNe in the context of the full GRB-SN sample

After the discovery of SN 1998bw associated with GRB 980425, the first connection between Gamma-Ray Bursts (GRBs) and Supernovae (SNe) occurred almost 15 years ago, no more than two dozens SN-like rebrightenings and seven solid spectroscopically-confirmed associations have been observed to date. In this talk we present data from the Gamma-Ray Burst Optical and Near-infrared Detector (GROND) and from the Swift X-Ray Telescope (XRT) and Ultra-Violet/Optical Telescope (UVOT) for three GRB afterglows showing SN rebrightenings. We studied the luminosity and evolution of each GRB-SN event and derived accurate values of the host-galaxy extinction through the modelling of the broad-band afterglow spectral energy distribution. After correcting for all sources of foreground extinction, SNe 2009nz (associated with GRB 091127), 2010ma (GRB 101219B), and 2008hw (GRB 081007), exhibited 1.15 ± 0.09 , $1.78^{+0.08-0.17}$, and 0.80 ± 0.10 times the luminosity of SN 1998bw, respectively. After subtracting the afterglow component, we constructed quasi-bolometric light curves and modeled them using Arnett's analytic approach to obtain the physical parameters of the SN explosion, such as synthesized ^{56}Ni mass (M_{Ni}), ejected mass (M_{ej}), and kinetic energy (E_k). From the full sample of 29 GRB-SNe, the largest ever presented, we utilized the SN and GRB parameters to assess the nature of the connection statistically. The average brightness for 27 GRB-SNe corresponds to an absolute magnitude of $M_V = -19.46(\pm 0.12 \text{ RMS})$, where only 7% of all GRB-SNe are significantly brighter than SN 1998bw. No clear correlations are found between the GRB and the SN properties. The data suggest a preference for SN events to be on average associated with soft low-luminosity, however, this can be explained by selection effects solely.

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