Contribution ID: **77** Type: **not specified**

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 56Ni mass (MNi), ejected mass (Mej), and kinetic energy (Ek). 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 MV = −19.46(±0.12 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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