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The quest for new correlations in the realm of the Gamma-Ray Burst – Supernova connection

Gamma-Ray Bursts (GRBs) are very energetic cosmological transients. Long GRBs are usually associated with Type Ib/c Supernovae (SNe), and we refer to them as GRB-SNe. Since the associated SN for a given GRB is observed only at low redshift, a possible selection effect exists when we consider intrinsically faint sources which cannot be observed at high redshift. Thus, it is important to explore the possible relationships between GRB and SN parameters after these have been corrected for astrophysical biases due to the instrumental selection effects and redshift evolution of the variables involved. So far, only GRB prompt emission properties have been checked against the SNe Ib/c properties without considering the afterglow (AG). This work investigates the existence of relationships among GRB's prompt and AG and associated SN properties. We investigate 91 bidimensional correlations among the SN and GRB observables before and after their correction for selection biases and evolutionary effects. As a result of this investigation, we find hints of a new correlation with a Pearson correlation coefficient > 0.50 and a probability of being drawn by chance < 0.05 . This correlation is between the luminosity at the end of the GRB optical plateau emission and the rest-frame peak time of the SN. According to this relation, the brightest optical plateaus are accompanied by the largest peak times. This correlation is corrected for selection biases and redshift evolution and may provide new constraints for the astrophysical models associated with the GRB-SNe connection.

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