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Broad line SNe-Ibc in GRBs, and in Binary Driven Hypernova: GRB 180720B and GRB 190114C

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It is well accepted that most long gamma-ray bursts (LGRBs) are associated with broad-line SNe-Ibc. There is a broad consensus that the GRBs progenitors are massive stars. Moreover, it is also well accepted that the most massive stars (or at least a significant fraction of them) are members of binary system. This facts have motivated the theoretical approach to model the LGRBs, known as the binary driven hypernova (BdHN) model. All long GRBs, in this model, are assumed to have a common binary progenitor composed of a carbon-oxygen (CO)
star of ~ 10 M⊙ and a NS companion. Right after the CO core collapse, the new configuration is composed of the 3 components: 1) the SN ejecta expanding out of the binary system; 2) the SN ejecta accreting onto the newborn NS(νNS), which is created out of the core collapse of the pre-SN progenitor star; 3) the SN ejecta accreting onto companion NS. The further evolution of the BdHN is based on the interplay of the SN ejecta, accretting on and spinning up both νNS and companion NS. The attention of this work is to address many roles of the SN associated with GRBs in BdHN model. Guided by the BdHN model, we attempt to answer this question: since all SNe associated with GRBs are broad-lines SNe-Ibc characterized by similar properties (e.g. peak of optical luminosity, expansion velocities of the ejecta...), what does produce the different GRBs energetics and their morphology?

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