Contribution ID: **11** Type: **Contributed**

Can we constrain the aftermath of binary neutron star mergers with short gamma-ray bursts?

Monday, April 12, 2021 6:15 PM (15 minutes)

The joint observation of GW170817 and GRB170817A proved that binary neutron star (BNS) mergers are progenitors of short Gamma-ray Bursts (SGRB): this established a direct link between the still unsettled SGRB central engine and the outcome of BNS mergers, whose nature depends on the equation of state (EOS) and on the masses of the NSs. We propose a novel method to probe the central engine of SGRBs based on this link. We produce an extended catalog of BNS mergers by combining recent theoretically predicted BNS merger rate as a function of redshift and the NS mass distribution inferred from measurements of Galactic BNSs. We use this catalog to predict the number of BNS systems ending as magnetars (stable or Supramassive NS) or BHs (formed promptly or after the collapse of a hypermassive NS) for different EOSs, and we compare these outcomes with the observed rate of SGRBs. Despite the uncertainties mainly related to the poor knowledge of the SGRB jet structure, we find that for most EOSs the rate of magnetars produced after BNS mergers is sufficient to power all the SGRBs, while scenarios with only BHs as possible central engine seems to be disfavoured.

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Session Classification: Gravitational Waves and Gamma-ray Bursts

Track Classification: Gravitational Waves