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The VHE emission of structured GRB jets: the case of GW170817 and prospects for future detections

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The binary neutron star merger gravitational-wave event GW 170817 and the multi-wavelength observations of its off-axis afterglow have allowed to probe the lateral structure of its associated relativistic jet. In addition, several gamma-ray bursts such as GRB 190114C or GRB 221009A (the brightest GRB ever observed) have recently been detected at Very High Energy (VHE, > 1 TeV) and are challenging the radiative models explaining the afterglow emission by synchrotron radiation only. In this talk, I will present our model of GRB afterglows, including both the lateral structure of the jet, and a detailed treatment of the synchrotron emission and synchrotron self-Compton (SSC) scatterings in the Thomson and Klein-Nishina regimes. This model is computationally-efficient, allowing for multi-wavelength data fitting, up to the energy range of instruments such as H.E.S.S., MAGIC and the CTA. In the case of GW 170817, the SSC flux is much dimmer than the upper limit from H.E.S.S. observations. However, we show that either a smaller viewing angle or a larger external density would make similar events detectable at VHE. In particular, large external densities at the location of BNS mergers may be frequent if a channel of fast-merging binaries exists, in which case VHE detections would help probing efficiently such a sub-population.

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