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Detection of early (prompt) emission from short GRBs in the VHE gamma-rays: ET, CE and CTA in action

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The production of the early emission of gamma-ray bursts (GRBs) is still highly debated. We mostly rely on the wide field of view gamma-ray instruments in the range of 10 keV-10 MeV. However, at higher energies (above 100 GeV), apparently, it is a critical job to catch it in flagrante. I will discuss the multi-messenger observational strategies to detect the early emission of short GRBs at very-high-energies (VHE; $E > 30$ GeV) in the era of the third-generation gravitational wave detectors Einstein Telescope (ET) and Cosmic Explorer (CE) in association with Cherenkov Telescope Array (CTA). I will describe the capabilities to detect and localize gravitational wave events in the inspiral phase of the compact binaries and provide an early-warning alert for upcoming short GRBs, thanks to the proposed low-frequency response of ET. I will discuss possible VHE components from the synchrotron self Compton components in the leptonic GRB model, the high energy tail of the hadronic GRB model as well as external inverse Compton emission as viable candidates in the energy band of 10 GeV - 10 TeV. The recent discovery of the GeV component from a compact binary merger boosted the possibility of having GeV to sub-TeV emission from a compact binary merging event.

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