Contribution ID: **193** Contribution code: **TRANS/MWL/MM/DM** Type: **Poster**

Very high energy observations of BNS and BHNS mergers in the Einstein Telescope era

Wednesday 4 September 2024 08:18 (1 minute)

The recent detections of Very High Energy (VHE) emission from GRB afterglows by the MAGIC and H.E.S.S. telescopes has opened new prospects for observing these energetic transients. Just before these detections, the seminal event GRB170817A, associated with the gravitational wave (GW) signal from a binary neutron star (BNS) merger, marked a new era in multi-messenger astronomy, providing invaluable insights into the origins of short GRBs and the properties of relativistic jets. Despite extensive searches by MAGIC, H.E.S.S., and HAWC, no VHE counterpart was detected for GW170817, largely due to challenges in sky localization and response times. However, the next generation of VHE observatories, such as the Cherenkov Telescope Array (CTA), promise significant improvements.

Building on previous studies where we constructed synthetic cosmological populations of BNS and BHNS mergers and predicted their electromagnetic counterparts for the O4 and O5 observing runs of Advanced LIGO and Virgo, we extended our model to the era of the Einstein Telescope (ET). In this talk, I will present our projections for detecting VHE emission from BNS and BHNS short GRBs in conjunction with next-generation GW detectors like the ET. I will discuss optimal observational strategies to maximize the detection of these VHE counterparts, highlighting the synergy potential between CTA and ET in the upcoming era of multi-messenger astronomy. This comprehensive approach aims to illuminate the bright future of VHE observations and their critical role in understanding the most energetic events in the Universe.

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Session Classification: Poster hang