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La ricerca di controparti gamma di segnali gravitazionali prodotti dalla fusione di sistemi binari di stelle di neutroni con CTAO

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"The detection of the electromagnetic (EM) emission following the gravitational wave (GW) event GW170817 opened the era of multi-messenger astronomy with GWs and provided the first direct evidence that at least a fraction of binary neutron star (BNS) mergers are progenitors of short Gamma-Ray Bursts (sGRBs). One of the challenges for future multi-messenger observations will be the detection of GeV-TeV emission from GRBs in association with GWs: this will be crucial for probing the acceleration processes and environments near compact object mergers.

In this talk we describe our efforts to determine whether binary neutron star (BNS) mergers emit GeV-TeV photons detectable with the Cherenkov Telescope Array Observatory (CTAO). CTAO will be a key instrument for the EM follow-up of GW events in the GeV-TeV range, owing to its unprecedented sensitivity, rapid response and capability to monitor a large sky area via scan-mode operation. We simulated CTAO's response on a set of phenomenological models describing the electromagnetic afterglow emission from sGRBs associated with GW events emerging from BNS mergers. We optimized the EM follow-up strategies providing an estimation of the number of joint sGRB-GW events detectable with CTAO in the future LIGO-Virgo-KAGRA (LVK) science run O5 (from 2027 onward). Our study aims to maximize the scientific return of CTAO observations by examining how key physical parameters—such as jet opening angle, luminosity, distance, and off-axis viewing angle—shape the expected gamma-ray emission. This work can be further extended to the next generation of GW detectors, like the Einstein Telescope and Cosmic Explorer."

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