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Multi-messenger emissions by magnetar remnants of binary neutron-star mergers

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Magnetars formed as a result of binary neutron star mergers are sources of multi-messenger emissions, in particular gravitational wave (GW), neutrino, and electromagnetic (EM) signatures. The physical model consists of a millisecond magnetar, whose rotation drives the pulsar wind nebula, and is surrounded by a kilonova ejecta. We discuss how this system acts as a source of high-energy cosmic rays, neutrinos and EM signatures from the ejecta. We find for our fiducial case of a magnetar at 10 Mpc the maximum all-flavor neutrino fluence is $\sim 0.07 \text{ GeV/cm}^2$ at $\sim 10^8 - 10^9 \text{ GeV}$, which is beyond current IceCube's limit for detection. Although the neutrino signatures from such individual systems may not be detectable, the stacking of observations in IceCube-Gen2 over ~ 10 years will enable us to detect the ultra-high energy neutrinos from such systems. Moreover, the next generation GW detectors will further help trigger such neutrino detections owing to their greater distance horizon. The EM signatures will potentially be seen in optical, X-ray and gamma-ray channels in the upcoming and existing EM telescopes.

Submitted on behalf of a Collaboration?

No

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