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Production of high-energy neutrinos in binary-neutron-star merger events

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High-energy neutral astrophysical messengers, such as neutrinos and photons, can be produced by the interaction of ultra-high-energy cosmic rays (UH0ECRs) with radiation fields, either during extragalactic propagation or within source environments. Neutrinos and gamma-rays can play a crucial role in the study of acceleration mechanisms of cosmic rays. In particular, after being produced, neutrinos leave the source environment and propagate to the Earth without further interactions. They are only subject to energy redshift and flavour oscillation, which makes them bearers of information about their sources otherwise not accessible. We study high-energy environments of the type that are likely to be the end states of a binary-neutron-star (BNS) merger, and we model their local photon field as a black body at a given temperature. Using a modified version of the Monte Carlo code SimProp v2r4 we simulate the propagation and interaction of UHECRs through these environments. We consider several combinations for composition, spectral index and high-energy cutoff of the UHECR primaries, in order to obtain the escaped neutrino flux. We propagate these fluxes to the Earth and compare to the astrophysical IceCube neutrino flux to obtain constraints on the BNS merger spectra properties, emissivity and density rate.

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