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Neutrino emission associated with late-time emissions of gamma-ray bursts

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Gamma-ray bursts (GRBs) have late-time emission components lasting 100-1000 seconds, such as extended emission of short GRBs and X-ray flares of long GRBs. These components could be explained by the internal dissipation of the jets produced by prolonged central engine activity, and could be influenced by the materials around the jet. The prompt jet interacts with the progenitor star or the ejected material, leading to formation of a cocoon. 100-1000 seconds after the prompt emission, the cocoon covers the dissipation region of the prolonged jets, and photons filled in the cocoon should diffuse into this region. We calculated the neutrino emission from the prolonged jets, taking into account the interactions between the cocoon photons and the cosmic rays accelerated in the jets.The cocoon photons enhance the neutrino production efficiency in the PeV - EeV energies, regardless of the values of the Lorentz factor of the jets. We will discuss the detectability of neutrino signals associated with the late-time emission of gamma-ray bursts by IceCube and IceCube-Gen2. Even if we do not detect neutrinos, we can place constraints on the dissipation radius and the baryon loading factor for the prolonged jets.

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