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Ultra-High-Energy Cosmic Rays from Tidal Disruption Events: Composition, Spectrum, and Challenges

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We investigate Tidal Disruption Events (TDEs) as potential sources of Ultra-High-Energy Cosmic Rays (UHE-CRs), motivated by recent associations between high-energy neutrinos and individual TDEs. A key challenge is bridging the gap between these few identified neutrino sources and a broader population of UHECR accelerators. Additionally, we assess the nuclear composition required to match UHECR data, considering stellar progenitors disrupted in TDEs. Our findings suggest that TDEs could explain the observed UHECR spectrum and composition if the acceleration mechanism favors heavier nuclei. The associated diffuse neutrino flux is expected to peak around 50 PeV, supporting a potential connection between UHECR sources and a recent high-energy neutrino detection by KM3NeT.

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