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High Energy Cosmic Rays and Neutrinos from Newborn Pulsars
KE FANG, University of Chicago, KUMIKO KOTERA, Institut d'Astrophysique de Paris, ANGELA OLINTO, University of Chicago — Newborn pulsars offer favorable sites for cosmic ray acceleration and interaction. Particles could be striped off the star surface and accelerated in the pulsar wind up to PeV-100 EeV energies, depending on the pulsar's birth period and magnetic field strength. Once accelerated, the cosmic rays interact with the surrounding supernova ejecta until they escape the source. By assuming a normal distribution of pulsar birth periods centered at 300 ms, we find the combined contribution of extragalactic pulsars produce ultra-high energy cosmic rays that agree with both the observed energy spectrum and composition trend reported by the Auger Observatory. Meanwhile, we point out their Galactic counterparts naturally give rise to a cosmic ray flux peaked at very high energies (VHE, between 10^{16} and 10^{18} eV), which can bridge the gap between predictions of cosmic rays produced by supernova remnants and the observed spectrum and composition just below the ankle. Young pulsars in the universe would also contribute to a diffuse neutrino background due to the photomeson interactions, whose detectability and typical neutrino energy are discussed. Lastly, we predict a neutrino emission level for the future birth of a nearby pulsar.

Ke Fang
University of Chicago

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