

Newborn Pulsars as sources of Ultrahigh Energy Cosmic Rays

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The workings of the most energetic astrophysical accelerators in the Universe are encoded in the origin of ultrahigh energy cosmic rays (UHECRs). Current observations by the Auger Observatory, the largest UHECR observatory, show a spectrum that agrees with an extragalactic origin, as well as an interesting transition in chemical composition from light element to heavier element as energy increases. Candidate sources range from young neutron stars to gamma-ray bursts and events in active galaxies. In this talk, we will discuss newborn pulsars as the sources of ultrahigh energy cosmic rays. We will show that a newborn pulsar model naturally injects heavier elements and can fit the observed spectrum once propagation in the supernova remnant is taken into account. With the proper injection abundances, integrated cosmic rays from the extragalactic pulsar population can match observation in all aspects - energy spectrum, chemical composition, and anisotropy. We will also examine the fingerprints of their Galactic counterparts on cosmic ray spectrum. Lastly, we will discuss the multi-messenger smoking gun of this scenario - the detectability of high energy neutrinos from pulsars and magnetars.

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