MAGIC

Science of the Cosmos

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Pulsar Passage: Impacts On The Solar System

Pulsars, rapidly rotating neutron stars formed from supernova explosions, are among the universe's most extreme astrophysical objects. Characterized by immense gravitational pull, intense radiation, and powerful magnetic fields, these celestial bodies provide invaluable opportunities to study extreme physics. Although the scenario of a pulsar entering the solar system is rare and hypothetical, analyzing such an event offers significant insights into planetary dynamics and cosmic hazard evaluation.

This study explores the theoretical consequences of a pulsar's passage through our solar system using advanced gravitational modeling, radiation flux analysis, and magnetic field interaction simulations. Simulation tools such as Universe Sandbox, Stellarium, and MATLAB enable precise predictions of pulsar trajectories, planetary movements, and interactions with magnetic fields. These simulations reveal how a pulsar's passage could dramatically alter planetary orbits, strip Earth's atmosphere, and destabilize the solar system's structure. A close encounter could result in widespread destruction, including the ejection of planets from their orbits and the potential wiping out of all life on Earth.

By calibrating models with real pulsar data, this study categorizes nearby pulsars based on their proximity and threat levels, offering a predictive framework for monitoring and assessing cosmic hazards. Additionally, it highlights the broader impacts on human civilization, such as catastrophic disruptions to technology, communication networks, and power grids.

In conclusion, while the probability of a pulsar entering the solar system is minimal, studying its hypothetical impacts advances planetary defense strategies. The integration of astrophysical theory with practical simulation tools bridges the gap between theoretical research and risk management, emphasizing the importance of preparing for rare but potentially catastrophic cosmic events.

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