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Investigating Earth's Mass and the Correlated Densities of Its Internal Layers Using Atmospheric Neutrino Oscillations at IceCube DeepCore

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The information regarding the mass of Earth and its internal structure has primarily been obtained through gravitational measurements and seismic studies, both of which rely on gravitational and electromagnetic interactions, respectively. However, neutrinos offer an independent method for exploring the Earth's interior by utilizing weak interactions, particularly through the effects of Earth's matter on neutrino oscillations. Since these effects are influenced by the electron number density, neutrino oscillations at the GeV scale can be employed to measure the quantity and distribution of electrons within the Earth. This electron number density can then be translated into the matter density of the Earth. In our study, we focus on atmospheric neutrino oscillations at DeepCore, a densely instrumented sub-detector located at the center of the IceCube Neutrino Observatory. This allows us to investigate the matter effects that neutrinos experience while passing through the Earth, providing valuable insights into the planet's internal properties. This talk will primarily highlight the results from IceCube DeepCore in measuring Earth's mass and determining the correlated densities of its various layers, showcasing neutrino oscillations as a unique tool for exploring the Earth's internal structure.

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