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Probing interiors of Earth using magnetized neutrino detector

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Atmospheric neutrinos offer the possibility of exploring the internal structure of Earth. This information is complementary to the traditional seismic and gravitational studies. While propagating through Earth, the upward-going multi-GeV neutrinos encounter the so-called Earth's matter effects due to their coherent forward scattering with the ambient electrons, which alters the neutrino oscillation probabilities significantly. The dependence of matter effects on the electron density of medium can be used to probe the internal structure of Earth. In this talk, I will discuss how well an atmospheric neutrino oscillation experiment like the proposed 50 kt magnetized Iron Calorimeter (ICAL) detector at the India-based Neutrino Observatory (INO) would validate the presence of Earth's core, measure the location of the core-mantle boundary (CMB), and probe the possible presence of dark matter inside the Earth in a unique way through matter effects in neutrino oscillations deep inside the Earth. ICAL can perform these studies owing to its good angular resolution, which helps in observing the core-passing neutrinos efficiently. Also, due to its magnetized setup, it would be able to observe neutrinos and antineutrinos separately, which in turn plays an important role to study different matter effects in neutrino and antineutrino modes.

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