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Prospects of Earth Composition Measurements via Neutrino Tomography at Next-generation Neutrino Detectors
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The Earth matter density is well determined through seismological measurements, however the chemical composition of the Earth has not yet been measured and only been inferred from meteorite samples. The Earth interior composition could be determined using neutrino tomography. Neutrinos are naturally produced in the Earth atmosphere and can be detected at neutrino telescopes. Neutrinos are elementary particles that are extremely light and only rarely interact, so that they can traverse the entire Earth without being absorbed. For the measurement, one can utilize a unique property of neutrinos, which is known as matter induced neutrino oscillations. This effect changes the neutrino properties based on the electron density of the medium through which the neutrino travels.

The dependence on electron density is what allows us to get a handle on the composition of the Earth. While seismological measurements determine the matter density, so to speak the average mass of nuclei, the oscillation effects depend on the electron density. In combination we can determine the average Z/A, where Z is the proton number (number of protons per nucleus) and A is the atomic mass (number of protons and neutrons per nucleus). The talk will introduce the measurement and discuss prospects at next-generation neutrino detectors like PINGU and Hyper-K, that could perform it.

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