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Geoneutrinos - a new tool to study the Earth.

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There are several unanswered fundamental questions about our planet, particularly concerning the deep Earth, from where we lack direct rock samples. Today, thanks to advances in particle detection techniques, geoneutrinos —antineutrinos emitted during the decays of long-lived radioactive elements inside the Earth —can be detected and used as a unique tool to study our planet. Geoneutrinos from the 238-Uranium and 232-Thorium radioactive chains, with energies above 1.8 MeV, have been measured by the KamLAND experiment in Japan and the Borexino experiment in Italy, utilizing the charge-current inverse-beta decay interaction on protons. Both detectors are located underground and feature large-volume liquid scintillator targets. The most relevant backgrounds to geoneutrino measurement include reactor antineutrinos, residual muon flux, and the intrinsic radioactivity of the detector. Both experiments achieved similar precision in geoneutrino signal measurement, with a range of 15 to 18%, and confirmed a general consistency of the measured signal with geological expectations. Due to their different geological settings and geographical locations, their results are complementary. This talk will introduce the importance of geoneutrinos to geoscience, provide an overview of the latest measurements, and offer a brief outlook on this interdisciplinary field. SNO+ in Canada is presenting its first full-scintillator antineutrino spectrum at Neutrino 2024, which includes evidence for the detection of geoneutrinos. JUNO, the next-generation detector in China, is expected to collect the equivalent of the existing world geoneutrino statistics in less than a year and is nearing completion. Measurements from multiple locations around the globe are about to mark a new chapter in geoneutrino research, providing important insights about our planet.

Poster prize

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