

Neutrinos and Axions from the Earth

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ABSTRACT

Earth contains long lived primordial radioisotopes which provide the main source of Earth's internal heating. The beta decaying natural radionuclides emit anti-neutrinos which are detectable by experiments on the Earth's surface (some of them have already been detected by the KamLAND experiment) providing a new tool for the investigation of Earth's interior.

Recently, it has been proposed that axions or axion-like particles could also be produced in Earth's interior from the nuclear disintegrations of natural radionuclides [Phys. Lett. B 645 (2007) 113-118]. If an appreciable flux of "geo-axions" is produced within the Earth, it could provide an additional channel for investigation of the Earth's interior by a future generation of axion detectors. The axion production probability depends on the axion couplings to ordinary matter which are very weak in the context of simple QCD-axion models for the allowed axion mass range. However, the interaction couplings could be stronger in the frame of recent models for non-standard axion or axion-like particles. Under these considerations, estimates for the global geo-axion production rate are given. Also, the indirect detection of axions emitted from Earth by detecting the gamma and X-rays coming from axion to photon conversion during their passage through the geomagnetic field seems to be an interesting perspective.