Neutrino Absorption Tomography of the Earth's Core with IceCube 40 strings data

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Efforts to deduce the internal density profile of the Earth have been driven by the body-wave and the free oscillation studies based largely on seismic wave measurements. While significant contributions of these techniques on the development of the PREM[1], they are still indirect measurements and can not reduce substantial uncertainties that depend on temperature constraint, detailed composition of core, etc. Meanwhile, the neutrino absorption tomography has been considered as a novel technique that is totally independent of any geophysical model. However, the practical measurement has not been done due to two critical challenges: 1) requires a kilometer scale neutrino detector, and 2) requires high statistics of neutrinos at the energy range over 10 TeV.

The IceCube Neutrino Telescope[2] instruments a volume of one cubic kilometer of glacial ice at a depths between 1500m and 2500m at the South Pole and was completed in 2011.
In 10 years of full-sized IceCube data, we expect at least 3 sigma separation in averaged density between core and mantle [3].
Meanwhile, we start to analyze half-size IceCube data obtained in 2008.
Several Monte-Carlo simulations based on various Earth models were generated in order to compare with 2008 data. The result will be presented in this talk.
We also present future expectation of this analysis with 10 years operation of full-size IceCube.
Systematic uncertainty from atmospheric neutrino flux, energy reconstruction and calibration will be discussed as well as ongoing plans to reduce systematic errors.

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[1] Dziewonski and Anderson, Phys. Earth. Planet. Int., 25, 297-356
[2] http://www.icecube.wisc.edu/
[3] M. C. Gonz´alez-Garc´ıa, F. Halzen, M. Maltoni and H. K. M. Tanaka, Phys. Rev. Lett. 100 (2008)