



Contribution ID: 45

Type: **not specified**

Neutrino oscillation mass spectrometry with megaton neutrino detectors

Tuesday 15 September 2015 17:50 (20 minutes)

Neutrinos have favorable properties for measuring the elemental composition deep inside the earth's interior. First, they propagate a long distance almost undisturbed through the earth due to their weak interactions with matter. Secondly, neutrino oscillations in matter are sensitive to the electron density of the medium traversed by them, rather than the nucleus density. Using our knowledge about the earth's nucleus density distribution inferred from seismic observations, we can measure the average atomic mass ratio Z/A of the earth's core. There is a little uncertainty in densities of the earth's core, but our knowledge of its main light element is still not fixed. With the advent of the new-generation megaton neutrino detectors, neutrino oscillation mass spectrometry will allow us to constrain directly the light elements in the earth's outer core. We report the detail of this novel technique and the sensitivity study.

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Session Classification: Parallel Session H