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Oscillation tomography of the Earth with solar neutrinos and future experiments

Saturday, July 30, 2022 5:20 PM (15 minutes)

We study in details the Earth matter effects on the boron neutrinos
from the Sun using recently developed 3D models of the Earth.
The models have a number of new features of the density profiles,
in particular, a substantial deviation from spherical symmetry.
In this connection, we further elaborate on relevant aspects
of oscillations (ϵ^2 corrections, adiabaticity violation, entanglement, {\it etc.})
and the attenuation effect.
The night excesses of the $\nu e-$ and $\nu N-$ events and
the Day-Night asymmetries, A_{ND}, are presented in terms of the
matter potential and the generalized energy resolution functions.
The energy dependences of the cross-section and the flux improve the resolution,
and consequently, sensitivity to remote structures of the profiles.
The nadir angle (η) dependences of A_{ND} are computed for future detectors DUNE,
THEIA, Hyper-Kamiokande, and MICA
at the South pole.
Perspectives of the oscillation tomography of the Earth
with the boron neutrinos are discussed. Next-generation detectors
will establish the integrated day-night asymmetry with high confidence level.
They can give some indications of the $\eta-$
dependence of the effect, but will discriminate among different models
at most at the $(1-2)\sigma$ level.
For high-level discrimination, the MICA-scale experiments are needed. MICA can
detect the ice-soil borders and perform unique tomography of Antarctica.

Attendance type

Virtual presentation

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