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Next generation long baseline neutrino experiments: what are the options for Europe ?

The CERN-GS neutrino beam has recently begun operation. First events have been collected in the OPERA detector. The OPERA result, together with well established observations of solar and atmospheric neutrino oscillations (Superkamiokande, SNO and KamLAND), will most likely confirm the validity of the 3x3 PMNS mixing matrix approach to describe all the observed neutrino flavor conversion phenomena. However, in order to complete this picture, all the elements (magnitude and phase) of the mixing matrix must be determined. That includes the U_{e3} element for which today there is only an upper bound corresponding to $\sin^2 2\theta_{13} < 0.1$ (90% C.L.) from the CHOOZ reactor experiment.

The determination of this missing element is possible via the detection of $\nu_{\mu} \rightarrow \nu_e$ oscillations at a baseline L and energy E given by the atmospheric observations.

The T2K and NoVA accelerator projects will be optimized for searching such electron appearance and should reach a sensitivity $\sin^2 2\theta_{13} < 0.01$ (90% C.L.) some time after 2010.

DOUBLE-CHOOZ will also attempt to detect a small $\nu_e \rightarrow \nu_{\mu}$ disappearance effect from reactors.

A non vanishing U_{e3} would open the possibility of CP/T violation in the leptonic sector. This condition would induce different flavor transition probabilities for neutrinos and antineutrinos. Due to matter effects however, neutrinos and antineutrinos propagate differently through the Earth. This will also induce differences in oscillatory behaviors of neutrinos and antineutrinos.

The observation of these effects is one of the main challenges of next-generation long-baseline neutrino oscillation experiments beyond T2K and NOVA, requiring new detector technologies and upgraded neutrino beams.

We will discuss the possibility of a new very large liquid argon detector coupled to an intensity upgraded CERN neutrino beam and will expose our envisioned strategy towards achieving this long-term programme.

Lundi 18 juin 2007 à 15 heures

Salle André Berthelot, bât. 141
Le café sera servi 15 minutes avant