Contribution ID: **33** Type: **Student short presentation**

Neutrino mass hierarchy measurement with DUNE

Wednesday 29 March 2023 14:00 (10 minutes)

Neutrinos oscillations are a quantum mechanics phenomenon for which an initial state neutrino emitted with a known flavour can be subsequently detected in a different flavour state violating the conservation of the lepton number.
In 1957 Bruno Pontecorvo presented a new theoretical model which made a breakthrough into the neutrino's description: the possibility that each flavour eigenstate, which is associated depending on the charged lepton a neutrino is emitted with, does not correspond uniquely to a single mass state but is instead a superposition of three independent mass eigenstate. This probability of oscillation obtained, depends directly on the mass squared difference between the initial and final state thus, as the opposite assumption in the Standard Model, neutrino can't be considered a massless particle anymore. Although the study of solar and atmospheric neutrino fluxes allowed the measurement of the order of magnitudes of these mass differences, is impossible to extract neutrino absolute mass from this phenomenology. The configurations that can be derived from the knowledge of the third mass square difference are known as hierarchies labelled as normal, as intuition suggests if the third mass will be the heaviest or inverted if is the lightest.
The MSW model provides an experimental way to discriminate the two hierarchies. It is possible to introduce a controllable interference between the oscillation phase in the vacuum and a phase, whose sing is known a priori, due to the propagation of a neutrino in a dense matter. Conceiving this kind of experiment is typically tough since neutrinos are tiny neutral particles. Their revelation requires maximising the cross section for neutrinos interactions with precautions like the capability to produce very high neutrino beams as pure as possible. High statistics standards, precise awareness of the energy distribution of the neutrino beam and of which leptonic families are present in the initial state can be achieved through accelerator experiments such as DUNE where two different detectors are placed at different distances to obtain
The future result from these measurements will establish which hierarchies are correct and are going to improve the actual estimation of the other parameters necessary to characterize the neutrino oscillation phenomenology. This essay has concluded with a future perspective on the fundamental role played by the research in neutrino physics that will (and it already did) imply new beyond Standard Model theories for our understanding of Physics

Title

Neutrino mass hierarchy measurement with DUNE

Author: LUPI, Giulia

Presenter: LUPI, Giulia

Session Classification: Presentations