

The Neutrinos

Three lectures on neutrino physics and astrophysics by Boris Kayser (Fermilab)

The lectures will ideally cover the basics of neutrino physics and astrophysics, reviewing the current understanding of the nature and role of neutrinos in the context of particle physics, astrophysics and cosmology. An overview of the neutrino theory will be made, as well as its link with the current experimental knowledge, of the open theoretical issues and of the present and future measurements that would advance the field. A review of the current experimental anomalies would also be interesting, at the light of the possible theoretical interpretations.

The target audience is composed of Junior and Senior Staff physicists, PhD students and Post-docs from the particle and astro-particle communities. Most of the audience will be composed by experimental physicist, so the idea will be to have a gentle theorist to lead them in maybe-not-so-familiar territories.

Format: 3 lectures of 1h30' + 30' discussion

Tentative content

- Neutrinos in the Standard Model and neutrino theory
 - Generation mixing, ...
- Neutrino interactions
- Neutrino theory
 - Dirac and Majorana neutrinos, ...
- Neutrino masses and mixing
 - Neutrino oscillations in vacuum and matter
 - Phenomenology of two/three-neutrino mixing
 - Solar neutrinos, atmospheric neutrinos, supernova neutrinos
 - Review of neutrino oscillation experiments
 - Absolute Scale of Neutrino Masses
 - Direct measurement neutrino masses
- Neutrino-less double-beta decay
- Neutrino Masses in Cosmology
- Experimental Neutrino Anomalies