WG1 – Monday Afternoon Discussion

QUESTION from the WG organizers: "Provide physics motivation of LBL oscillations within wider context of particle physics, beyond a relatively small (compared to the scale of the facility) circle of neutrino aficionados"

Presentations: H. Minakata and R. Mohapatra, and A. Ibarra, see also G. Senjanovic.

Main Point:

Neutrino physics provides a unique window on new physics and on the problem of flavour.

- Origin of Neutrino Masses?
- Origin of Flavor?
- How Are They Related?
- How About Sterile Neutrinos, Different (Apparent) Masses for ν and $\bar{\nu}$?
  - How are these questions addressed by neutrino experiments?
  - How are these questions addressed by nonneutrino experiments?

– Can we probe the origin of neutrino masses at the LHC?

Yes, we might. [Senjanovic, Ibarra]. Need more than the simplest model (SM + right-handed neutrinos). E.g. Inverse seesaw, left-right models...

– If θ_{13} is as large as hinted by T2K, what do we learn about flavor? Is the tri-bi-maximal (TBM) paradigm still useful?

"Large" θ_{13} good fit to some sophisticated top-down approaches to flavor (e.g., SUSY GUTs [Mohapatra]). Large θ_{13} is also consistent with the most naive guess, anarchy [Minakata]. TBM still useful benchmark, but, if it is a fundamental consequence of a symmetry the latter seems to be strongly broken.

– What do we learn from measuring all oscillation parameters? How well do we need to measure them?

From the point of view of top-down scenarios, different measurements point in different directions (NH versus, IH, $\sin^2\theta_{23}$ deviation from maximum, ... [Mohapatra]). Correlations are very important ($\theta_{13} \propto \cos 2\theta_{23}$, etc), provide some guidance for precision. Need to address the second question better!

– What if sterile neutrinos are discovered?

A: This would be a "paradigm shifting" discovery. Might indicate that the origin of neutrino masses is very low. "Revolution in particle physics" [Minakata].