

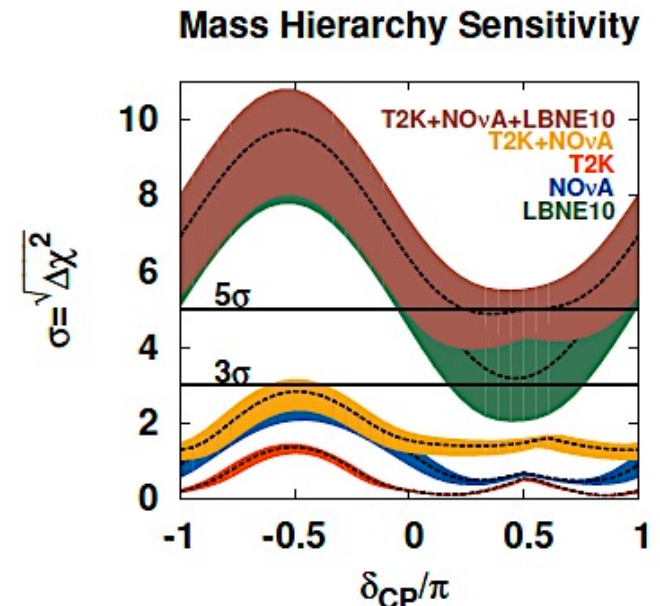
Questions IF11 & IF12

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for the LBNE Collaboration

Neutrino/BNV Colloquium – “Hard Questions” Panel
Snowmass on the Mississippi, 31 July 2013

IF 12: In the current configuration for Phase-I of LBNE (assuming no new international support), what 5-sigma discoveries are possible ?

- 1) LBNE Phase-I will constitute a decisive step for the U.S. particle physics program.
 - Fully realized, LBNE (34kt, underground) is a bold experiment aiming to address a broad array of key questions in particle physics, including leptonic CPV, neutrino MH, tests of 3-flavor mixing picture, searches for proton decay, studies of supernova neutrinos, and precision neutrino interaction measurements, exploiting the cost-effectiveness, scalability, and exquisite capabilities of the LArTPC technology. Its design is mature and costs are well understood.
 - **The first phase will be the enabler for this program.**
- 2) Strong support from international partnerships is emerging,
 - examples: India (near detector), UK (STFC), Italy (INFN – Icarus), Europe/LBNO, Brazil
- 3) We can discover the mass hierarchy
 - Significance $> 5\sigma$, LBNE alone, if δ_{CP} has the right sign
 - $> 5\sigma$, everywhere with LBNE+ NOvA/T2K
- 4) CP Phase Resolution & Establishing CPV
 - Extended reach in phase-I $\rightarrow \delta_{CP}$ to 15-30°.
 - 3σ to just under 5σ for CPV significance for favorable δ_{CP}



See “Science Opportunities w/ LBNE”, arXiv:1307.7335, SNOW13-00081.

IF 11: If additional resources can be found to restore some of the LBNE scope, what is the highest scientific priority: moving underground, or improving beam and/or detectors ?

- Already have heard comments on:
 - Importance of the breadth of the program
 - Discovery potential in non-beam physics (e.g., proton decay, supernova & atm. ν 's)
 - Example: expect $\sim 900 \nu_e$ events in 10kt LArTPC from SN explosion at 10 kpc.
- Moving underground provides infrastructure for further detector expansion at the right baseline & depth for full LBNE program
- Strong consensus within LBNE collaboration to go underground as highest priority given additional resources from new domestic/international partners.
- Potential European partners agree w/ collaboration's goal, namely that LBNE FD should be underground and larger in the first phase.
- Geotechnical studies are now being carried out for the underground site, in anticipation of this.