DOE/NSF-HEPAP/NSAC
Neutrino Scientific Assessment Group
"NuSAG"

Introductory Report to HEPAP

P. Meyers – July 11, 2005

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From the charge to NuSAG:

Two National Research Council studies (*Quarks to the Cosmos, Neutrinos and Beyond*), two long range planning exercises (HEPAP and NSAC), and most recently a multi-divisional year-long American Physical Society (APS) study have all identified compelling discovery opportunities involving neutrinos. These studies laid the scientific groundwork for the choices that must be made during the next few years. They did an excellent job of explaining the new paradigm of neutrino science, why this science is filled with important and interesting questions, and why the time is right to address these questions.

For those directions where the timescale is long-term, we will wait to take advantage of additional input, such as from the National Academy Sciences study on Elementary Particle Physics (EPP2010). However, for those directions where expeditious action is appropriate, we ask the NuSAG to make recommendations on the specific experiments that should form part of the broad U.S. neutrino science program.

Charge 1

We request that NuSAG address the APS Study's suggestion that the U.S. participate in *"An expeditiously deployed multidetector reactor experiment with sensitivity to ν_e disappearance down to $\sin^2 2\theta_{13}=0.01$, an order of magnitude below present limits."*

The options … should include, but need not be limited to:

- A U.S. experiment (in Diablo Canyon, CA, Braidwood, IL, or elsewhere)
- U.S. Participation in a European reactor experiment (Double Chooz or elsewhere)
- U.S. participation in a Japanese experiment
- U.S. participation in a reactor experiment at Daya Bay, China

Charge 2

NuSAG is requested to address the APS Study's recommendation of a phased program of sensitive searches for neutrino-less nuclear double beta decay. In particular, a timely assessment of the scientific opportunities and resources needed should be performed of the initiatives that are presently under discussion in the research community. These include, but should not be limited to:

- U.S. experiments (Majorana, EXO, others)
- U.S. participation in an Italian experiment (Cuoricino/Cuore)
- U.S. participation in a Japanese experiment (Moon)
- We added: U.S. participation in SuperNEMO (France)

Charge 3

We request that NuSAG address the APS Study's suggestion that the U.S. participate in *"A timely accelerator experiment with comparable* $\sin^2 2\theta_{13}$ *sensitivity [to the recommended reactor experiment, i.e.,* $\sin^2 2\theta_{13}=0.01$*] and sensitivity to the mass-hierarchy through matter effects."*

The options … should include, but not be limited to:

- U.S. participation in the T2K experiment in Japan
- Construction of a new off-axis detector to exploit the existing NuMI beamline from Fermilab to Soudan, as proposed by the NOvA collaboration
- As above but using a large liquid argon detector

- There are two US T2K efforts: B280 and 2km
- Liquid argon is currently directed to other applications

NuSAG should look at the scientific potential of each initiative, the timeliness of its scientific output together with the likely costs to the U.S., and its place in the broad international context. In addition, for the off-axis initiatives (charge 3), the context should include a consideration of what is likely to be learned from other experiments, and the likely future extensibility of each option as part of an evolving U.S. neutrino program.

For all three charges NuSAG should then recommend a strategy of one (or perhaps more than one) experiment in that direction, which in its opinion should be pursued as part of the U.S. program.

NuSAG schedule

It is requested that the NuSAG Report be sent to HEPAP and NSAC by no later than June 2005.

- New schedule negotiated. To be useful:
  - Double beta recommendation by the end of July
  - Reactor and accelerator recommendations by the end of September
- Letter to experiments requesting input: May 11
- NuSAG members on board: May 16
- First meeting: May 31-June 2
  - Presentations from all experiments
- June 16-July 8: questions sent to experiments
- July 17-18: second meeting (mostly double-β)
- Early August: double-β report to NSAC and HEPAP
- Early September: 3rd meeting
- Late September: reactor and accelerator report

NuSAG is completing the information-gathering phase and entering the recommendation phase to respond to the first round of charges.

While we do this, there are some broader issues:

- Are we “the PAC” for neutrino physics?
- Are we the gatekeeper for new initiatives?
- How do experiments get considered after NuSAG?

NuSAG, DOE, and NSF (and NSAC, HEPAP, P5…) will be working this out as we go along.