Virginia Tech

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To: Joseph L. Dehmer, Associate Director, Physics Division (NSF)
Dennis Kovar, Associate Director (Nuclear Physics) Basic Energy Sciences DOE
Robin Staffin, Associate Director (High Energy Physics) Basic Energy Sciences DOE

Cc: Richard N. Boyd (NSF)
Bradley D. Keister (NSF)
Jonathan Kotcher (NSF)
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Gene Beier (Co-Chair, NuSAG)
Peter Meyers (Co-Chair, NuSAG)

Dear Dr. Dehmer, Dr. Kovar, Dr. Staffin,

A large contingent of the physics community actively participated in the four division APS neutrino study recently completed in cooperation with the funding agencies. The resulting report represents the combined wisdom from a very broad base of active researchers, including the output from numerous workshops. Three recommendations emerged from this study and we applaud the efforts of the NSF and DOE to address the ambitious program they laid out.

The charges given to the recently formed NuSAG panel represent a positive avenue to realizing a practical and prioritized approach to implementation. The first two recommendations, being 'high priority' have thereby received further scrutiny and seem to be moving forward. The third recommendation, for the development of a low-energy solar neutrino detector, explicitly highlights the broad belief in the high value of the science in that area.

To date the only real-time measurements of the solar neutrino flux have been limited to the tiny high-energy portion of the 8B flux. Extension of such real-time spectroscopic measurements to low energy neutrinos from the dominant ppI, ppII and CNO cycles (pp, 7Be, pep, CNO neutrinos) promise a high discovery potential. Low energy neutrinos offer a crucial test of the MSW mechanism that predicts pure vacuum conversion at pp energies that changes to matter dominated conversion at 8B energies. Deviations from the MSW prediction offer unique tests of important general particle physics questions. Determining the CNO fluxes would test the central assumption of the standard solar model, the assumed equality between solar core heavy-element abundances and those found on the solar surface today. A complete low energy spectrum measures the neutrino luminosity of the sun that must, in the final analysis, be balanced by the photon luminosity L☼. At present this balance is an assumption (the inference from present experiments is too imprecise (L☼(nu-inferred) /L☼ =1.4+0.3-0.2, Bahcall et al, 1.12 ±

0.21,Robertson) for critical confirmation or discovery. Future experiments expect to improve the neutrino luminosity precision to ~4%, to critically test the physical correctness of present neutrino physics, indications for non-standard particle physics, the assumed hydrostatic equilibrium of energy processes in the sun, and whether hidden sources other than nuclear fusion power the sun.

For these reasons, it is very desirable that DOE and NSF charge NUSAG regarding the APS solar neutrino recommendation. We believe such a charge would allow NuSAG to provide important guidance on the kinds of R&D efforts that must be sustained if we are to make further progress in solar neutrino physics and astrophysics.

Sincerely yours,

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