Experimental Study of the ^{8}B Neutrino Spectrum

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The primary source of high energy neutrinos from the sun is the beta decay of ^{8}B, which is produced by nucleosynthesis deep in the solar interior. The exact spectral shape of the neutrinos from ^{8}B is of current interest because of plans to measure the solar-neutrino energy spectrum directly with the Sudbury Neutrino Observatory and SuperKamiokande detectors in a search for possible distortions due to "matter enhanced" neutrino oscillations.

The beta decay of ^{8}B is allowed and the decay proceeds primarily to the unbound first excited state of ^{8}Be at 2.9 MeV which decays to two alpha particles. The ^{8}B beta and neutrino spectrum deviate from the allowed shape due to the broad and complicated energy profile of the final state.

In the past, the neutrino spectrum has been calculated from measurements of the delayed alpha spectrum and in one case from constraints imposed from measurements of the beta spectrum[1]. Recently, Bahcall *et al.*[2] have reviewed all the available experimental data attempting to predict the ^{8}B neutrino spectrum. It is pointed out in that work that the five existing measurements of the alpha spectrum are in poor agreement. While the basic shape of the spectra are similar there are discrepancies of about 80 keV in the energy scales, making it difficult to asses the overall systematic uncertainty.

We are currently working on an experiment to measure the beta-delayed alpha spectrum from ^{8}B using the novel technique of implanting ^{8}B in a silicon detector. Previous experiments used ^{8}B implanted externally in thin metallic foils and the uncerntainties of the foil and source thickness is suspected to be the source of the discrepancies. This experiment is approved to run at the ATLAS Spectrograph with a new technique of producing secondary beams from a gas cell target. Work is currently in progress to produce a secondary ^{8}B through the ^{3}He(^{6}Li,n)^{8}B reaction. At present, secondary ^{8}B beams with an intensity of 0.5 particles per second have been achieved. Beam development is in progress to achieve the ten particles per second intensity required by this experiment.

Footnotes and References

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1. J. Napolitano, *et al*., Rev. C36, 298 (1987)
2. J. N. Bahcall, *et al.*, Phys. Rev. C58, 411, (1996).

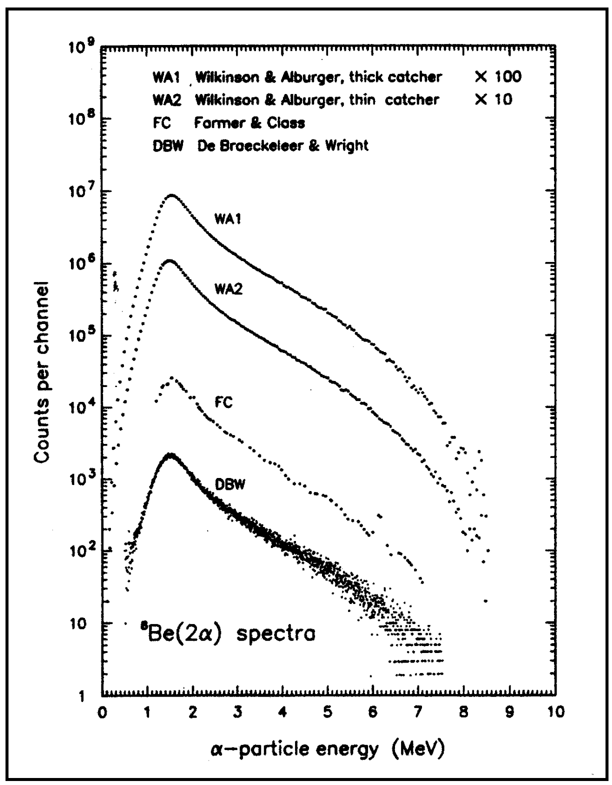

Fig. 1 Delayed alpha particle spectra from previous experiments.