Neutrino-deuteron reactions at solar neutrino energies

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Recently the Sudbury Neutrino Observatory (SNO) reported strong evidence for ν_e oscillations obtained by combining the SNO data on the charged-current reaction, $\nu_e d \rightarrow e^- pp$, with the Super-Kamiokande data on the neutrino-electron elastic scattering, $\nu_e e \rightarrow \nu_e e$[1]. In interpreting the SNO experiments, accurate estimates of the νd reaction cross sections are of great importance. We improve the previous estimates of our group[2] by updating some of its inputs and by taking into account the results of a recent effective-field-theoretical calculation[3]. The new cross sections are slightly ($\sim$1 %) larger than the previously reported values. It is shown to be reasonable to assign 1% uncertainty to the νd cross sections reported here; this error estimate does *not* include radiative corrections.

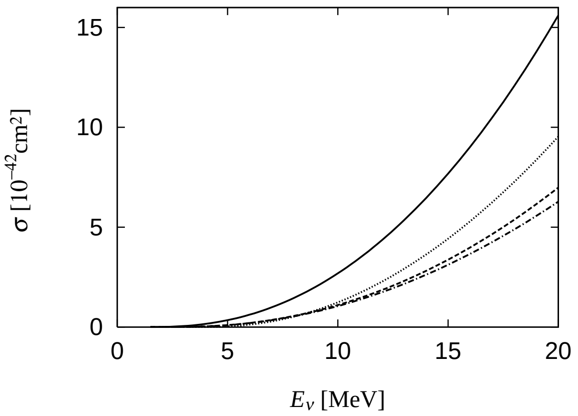

Figure 1: Total cross section for the reactions: $\nu_e d \rightarrow e^- pp$, $\bar{\nu}_e d \rightarrow e^+ nn$, $\nu d \rightarrow \nu pn$, and $\bar{\nu} d \rightarrow \bar{\nu} pn$. The solid and dotted curves show the charged-current reaction cross sections for ν and $\bar{\nu}$, respectively, while the long-dash and dash-dotted curves give the neutral-current reaction cross sections for ν and $\bar{\nu}$, respectively.

References

[1] Q. Ahmad *et al.*, Phys. Rev. Lett. **87** (2001) 071301.

[2] S. Nakamura, T. Sato, V. Gudkov and K. Kubodera, Phys. Rev. C **63** (2001) 034617.

[3] S. Nakamura, T. Sato, S. Ando, T.-S. Park, F. Myhrer, V. Gudkov and K. Kubodera, submitted to Nucl. Phys. A; nucl-th/0201062.