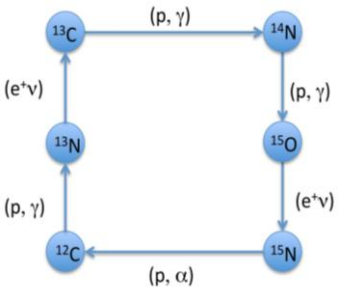
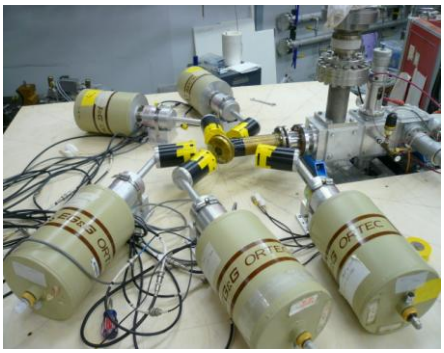
The cross section of the $^{14}N(p,\gamma)^{15}O$ reaction in the CNO cycle



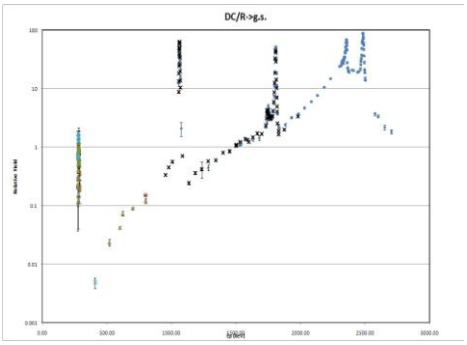
The CNO Cycle


Setup for angular distribution measurements

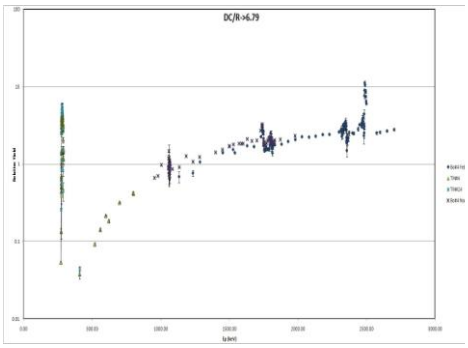
In the stars like the Sun, the energy is generated mainly through pp chain reactions. But in more massive stars, the CNO cycle is the dominant source of energy. In the CNO cycle, $^{14}N(p,\gamma)$ reaction is the slowest one thus it controls the energy generation rate of the whole cycle. It also determines the CNO neutrino production in the sun. The most comprehensive set of measurements were performed by Schröder et al.[1] The reaction rate depends sensitively on the low energy cross section which needs to be extrapolated into the stellar energy range using R-matrix techniques. To remove existing uncertainties in recent measurements [2][3], an improved study is necessary. With the improved accuracy CNO neutrino measurements proposed by the BOREXINO and SNO neutrino detectors can be used for determining directly the core metallicity of our sun.

The experiments were performed at the low energy accelerators of the Notre Dame Nuclear Science Laboratory. The cross section was measured over a large energy range from about 0. 25 MeV to 3.5 MeV. Special attention was given to determine the angular distribution of the emitted γ radiation. A special detector arrangement consisted of a Ge clover detector at 45° with 5 Ge detectors mounted at different angles. Both implanted ^{14}N and TiN targets have been used for the experiments. The experiments were successfully completed and are presently being analyzed.

[1] Schröder et al. Nucl. Phys. A 467, 240 (1987)
[2] Imbriani et al. Eur. Phys. J. A 25, 455 (2005)
[3] Champagne et al. Mod. Phys. Lett. A 22, 243 (2007)



Relative Yield of DC/R to ground state transitions.



Relative Yield of DC/R to 6.79MeV transitions.

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