A STUDY OF THE Li(p,n) Be EXCITATION FUNCTION AT INTERMEDIATE ENERGIES USING RESIDUAL ACTIVITY

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The excitation function of the $^7Li(p,n)^7Be$ reaction was measured in the proton energy range of E_p= 60-200 MeV. Such a measurement was needed to determine the total reaction cross section which in the course of other ^7Li studies could be used for calibration purposes.

The total cross sections were determined using standard off-line γ-ray detection techniques by measuring the residual ^7Be (53d) activity. This method has been used at lower energies[1] and at 120 MeV[2] to calibrate large volume neutron detectors.

Typically at each energy a 10-20 mg/cm^2 enriched ^7Li target was irradiated with 20-100 nA·hr of protons. After bombardment the irradiated target was counted in a prescribed counting geometry with known γ-ray efficiency. The ^7Be was identified by its (10%) electron capture branch to the 477.4 keV level in ^7Li. The samples were counted over several months to insure the 477.4 keV γ-ray decayed with the ^7Be half-life of 53.3d.

The results of these measurements at twelve energies between 60-200 MeV are shown in Fig. 1 along with the previous results of Schery, et al.[1] The error of our measurements was typically 8-10%. A theoretical analysis of the striking 1/E dependence has been made by Prof. George Walker. Assuming the PWIA, an energy independent, very short range interaction (using harmonic oscillator wave functions and neglecting exchange effects), yields such a 1/E dependence for the summed inelastic scattering differential cross section to a particular state. This

result implies that $(V_\tau^2 + 2.95 \, V_{\sigma\tau}^2)$ is independent of E, and that $\sigma(E) = 725.2869 \, (1/E) - 0.2952$ with σ in millibarns, E in MeV and a correlation coefficient of 0.99845.

1) S.D. Schery, L.E. Young, R.R. Doering, S.M. Austin, and R.K. Bhowmik, Nucl. Inst. and Meth. 147, 399 (1977).

2) C.A. Goulding, M.B. Greenfield, D.E. Bainum, J. Rapaport, C.C. Foster, T.E. Ward, C.D. Zafiratos, S.D. Schery, and C.D. Goodman, Nucl. Phys. A331, 29 (1979).
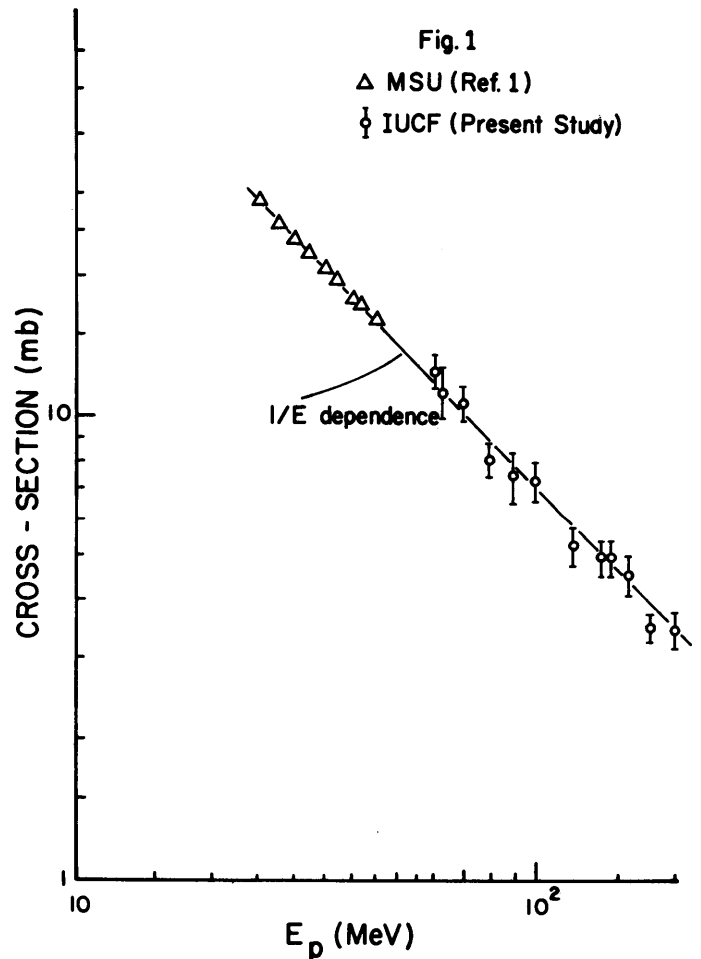
Figure 1. Measurements of the $^7Li(p,n)^7Be$ total cross section as a function of energy from this work (dots) and Ref. 1 (triangles). The straight line represents a 1/E dependence.