

A STUDY OF THE $\text{Li}(p,n)\text{Be}$ EXCITATION FUNCTION AT INTERMEDIATE ENERGIES USING RESIDUAL ACTIVITY

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The excitation function of the ${}^7\text{Li}(p,n){}^7\text{Be}$ reaction was measured in the proton energy range of $E_p = 60\text{--}200$ MeV. Such a measurement was needed to determine the total reaction cross section which in the course of other ${}^7\text{Li}$ 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 ${}^7\text{Be}$ (53d) activity. This method has been used at lower energies¹ and at 120 MeV² to calibrate large volume neutron detectors.

Typically at each energy a 10–20 mg/cm² enriched ${}^7\text{Li}$ 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 ${}^7\text{Be}$ was identified by its (10%) electron capture branch to the 477.4 keV level in ${}^7\text{Li}$. The samples were counted over several months to insure the 477.4 keV γ -ray decayed with the ${}^7\text{Be}$ 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 $(V_t^2 + 2.95 V_{\sigma t}^2)$ 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).

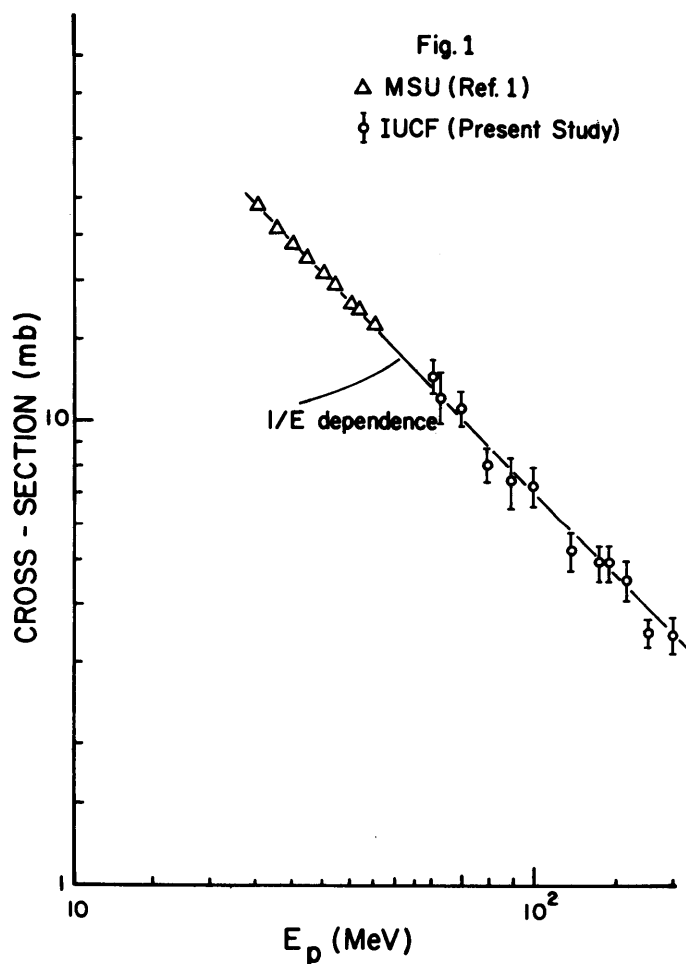


Figure 1. Measurements of the ${}^7\text{Li}(p,n){}^7\text{Be}$ total cross section as a function of energy from this work (dots) and Ref. 1 (triangles). The straight line represents a $1/E$ dependence.