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NOTES

CROSS-SECTIONS FOR DESTRUCTION OF ^{6}Li AND ^{7}Li BY LOW-ENERGY PROTONS

In this Note, we give S Gamow factors based on experimental determination of cross-sections for destruction of ^{6}Li and ^{7}Li by low-energy protons. Indeed, accurate determinations of these cross-sections are very important in several domains in astrophysics.

After the pioneering experimental work of Sawyer and Phillips (1953), a number of experimenters have studied these destruction reactions in recent years. The ^{6}Li$(p,\alpha)^3$He cross-section was measured by Fiedler and Kunze (1967), Gemeinhardt, Kamke, and von Rhonech (1966), Marion, Weber, and Mozer (1956), Mac Cray (1963), Beaumevieille (1964), Bertrand, Grenier, and Pornet (1968). The ^{7}Li$(p,\alpha)^4$He cross-section was measured by Fiedler and Kunze (1967), Haeberli (1967), Mani *et al.* (1964), Conrad, Konig, and Timm (1958).

TABLE 1

GAMOW FACTORS FOR ^{6}Li AND ^{7}Li DESTRUCTION REACTIONS

	S (MeV barns)	$S'(0)/S(0)$ (MeV^{-1})	$\frac{1}{2}S''(0)/S(0)$ (MeV^{-2})
^{6}Li Salpeter 1955.....	6±3	. . .	. . . .
^{6}Li This work.....	2.4	−0 8	+0 42
^{7}Li Salpeter 1955.....	0.12±0 05	. . .	. . . . .
^{7}Li This work.....	0.07	+4 5	−2 3

NOTE.—To be used below 1 MeV.

From these experimental results we use the well-known formula to find the S Gamow factors:

$$\sigma = \frac{S}{E} \exp(-2\pi\eta), \tag{1}$$

where σ is the destruction cross-section, E is the proton energy in the C.M. system, and η is a term related to the penetrability of the Coulomb barrier, $\eta = Z_1 Z_2 e^2/\hbar v$ (numerically, $2\pi\eta = 31.285\ Z_1 Z_2 M^{1/2}/E^{1/2}$ with E expressed in keV). Corresponding S Gamow factors are reported in Figures 1 and 2.

It is customary (Fowler, Caughlan, and Zimmerman 1967) to expand:

$$S = S(0)\left[1 + \frac{S'(0)}{S(0)} E + \tfrac{1}{2}\frac{S''(0)}{S(0)} E^2\right]. \tag{2}$$

From a best-fit curve to S (Figs. 1 and 2) appropriate values of $S(0)$, $S'(0)/S(0)$, $\frac{1}{2}S''(0)/S(0)$ are calculated (Table 1, which gives adjusted values of the parameters of eq. [2], together with the values reported by Salpeter [1955]).

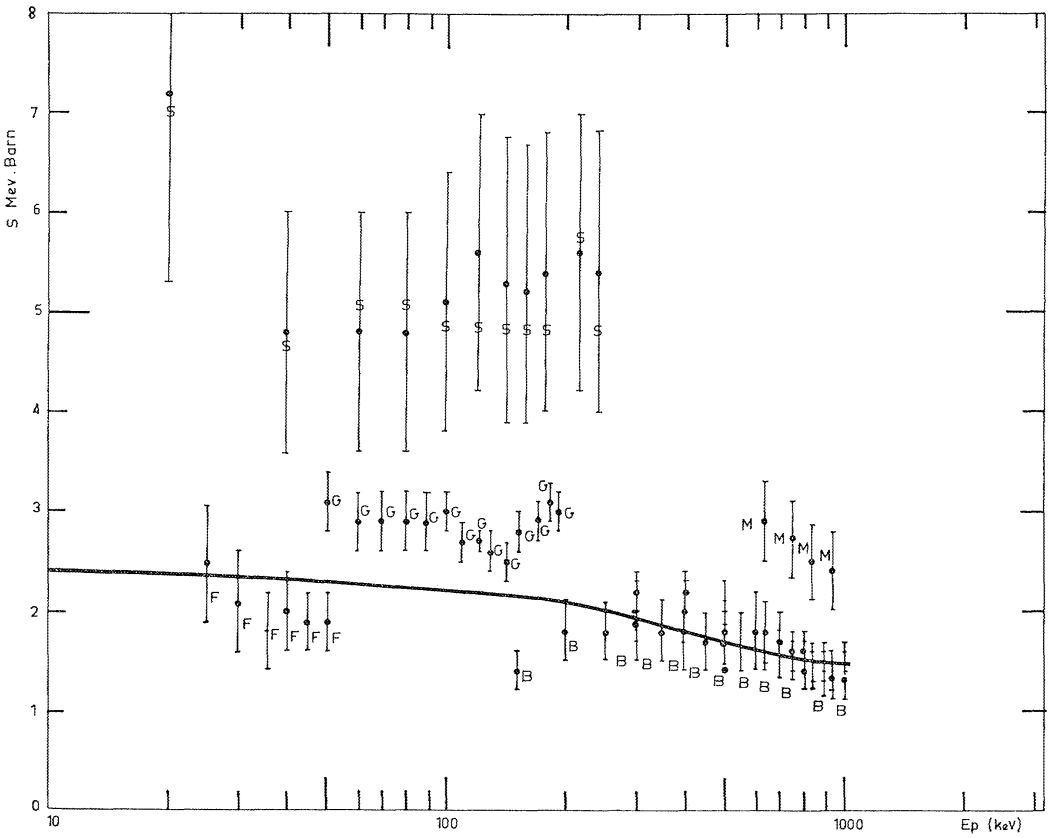

FIG. 1.—Experimental S factors for the reaction $^6Li + p$. The letters S, F, G, B represent, respectively, the work of Sawyer and Phillips, Fielder and Kunze, Gemeinhardt *et al.*, and Bertrand *et al.* The letters MB design the results of Beaumevieille normalized by Mac Cray. Curve corresponds to the choice of parameters listed in the table.

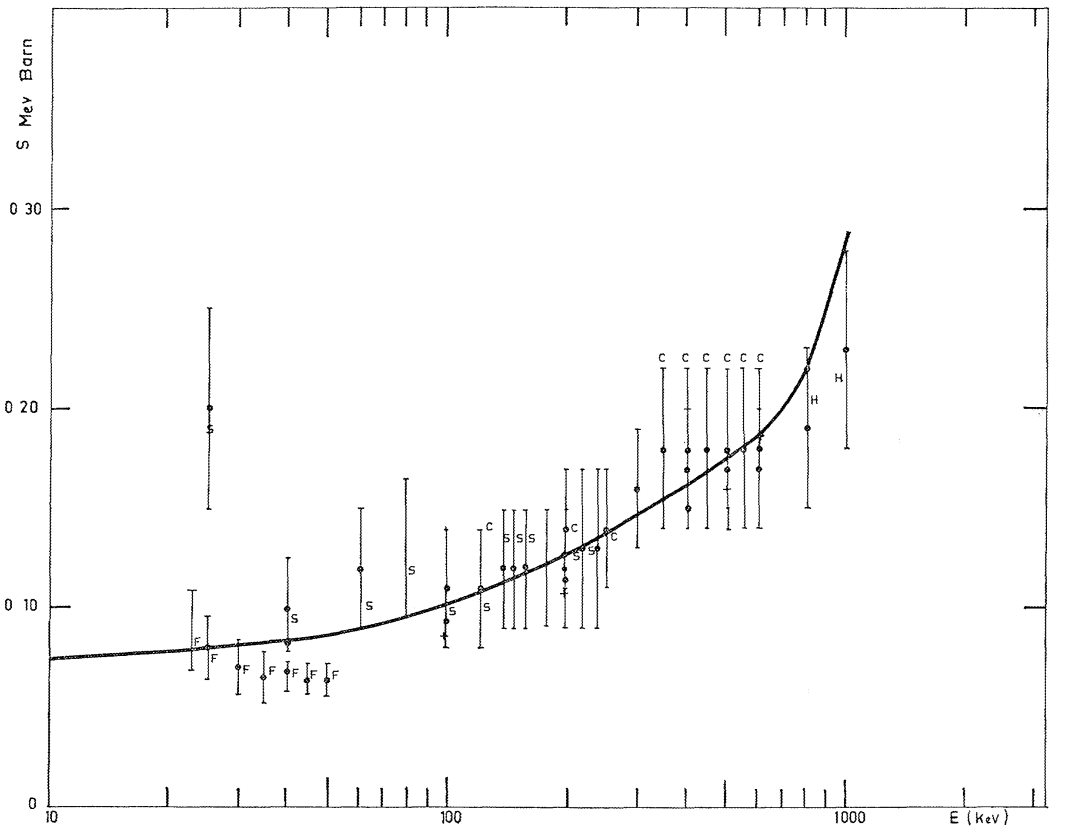

FIG. 2.—Experimental S factors for the reaction $^7Li + p$. The letters S, F, C, H represent, respectively, the work of Sawyer and Phillips, Fiedler and Kunze, Conrad *et al.*, and Haeberli. These two last works are normalized with the work of Mani. Curve corresponds to the choice of parameters listed in the table.

More details on this analysis are given in an unpublished report (Audouze and Reeves 1969).

To extract the best possible astrophysical factors, several workers were contacted. We wish to thank Drs. Bertrand, Grenier, Haeberli, Humblet, Kunze, Lejeune, N. Longequeue, and Mani for discussion on their results.

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