Data review of $^{7}Li(p,p_0)^{7}Li$ cross-sections

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As a first step, the data sets already exisiting on IBANDL [2-5,11] were compared with the data in the original references and the agreement was good except for the data from Bashkin and Richards [2]: in this case the original cross-section values were given in the laboratory frame of reference, while the data from IBANDL were calculated as if the original data were given in the centre-of-mass (thus the data resulted scaled down by a factor about 1.3). In the following only the original data from [2] will be considered.

The second step was a thorough search in the literature and in nuclear databases for other available experimental data. Several data of interest for application in Ion Beam Analysis (i.e. for backscattering angles in the 90°-180° range) were retrieved [1,3,5-10]. The data appearing in graphical form in the original references were digitized using the DataThief software [12]. All the relevant quantities were converted to the laboratory frame of reference when necessary. Table 1 lists the data sets found in the literature, both already existing on IBANDL and new ones. These new data will be uploaded into IBANDL if deemed appropriate.

Reference	**Data source**	θ_{lab}	E_p **(MeV)**	**Target**	**Quoted uncertainties**	**Data presentation**
[1]	EXFOR	137.8°	0.28-1.40	Li evaporated on Be foil	20%	Tabular
[2]	Original paper	164°	0.88-3.68	Li metal evaporated upon thin Ni foil	20%	Graphical
[3]	IBANDL, EXFOR	102.0° 123.1° 137.9° 156.70°	0.37-1.40	Natural Li on Cu backing	5%	Tabular
[4]	IBANDL	90°	1.36	-	4%	Tabular
[5]	IBANDL, original paper	102.0° 123.1° 145.3° 164.9°	1.35-3.00	Thin lithium layer evaporated on a thin Zapon film	10%	Tabular, graphical

[6]	Original paper	89.2° 101.5° 117.9° 134.6° 144.5° 166.2°	3.0-5.5 1.2-5.5	Isotopically enriched ^{7}Li (99.3%) evaporated on a 1000 Å Ni foil	-	Graphical
[7]	EXFOR	123.1° 145.4° 163.9°	2.36-12.1	Thin isotopically enriched ^{7}Li (99.97%) layer evaporated on a thin Formvar film	15%	Tabular
[8]	EXFOR	90° 120° 140°	2.58-10.6	Enriched ^{7}Li (99.99%, 150 μg/cm^2) evaporated onto 45 μg/cm^2 Ni backings	-	Tabular
[9]	EXFOR	90°	1.36	0.03 to 0.1 mg/cm^2 natural LiF evaporated on a C foil	12% statistical and systematic	Tabular
[10]	Original paper	95.0°	6.868	Natural lithium LiI evaporated on a Formvar backing	2%	Tabular
[11]	IBANDL	150°	3.0-7.2	50 μg/cm^2 LiF on 30 μg/cm^2 C, coated with 20 μg/cm^2 Au	4%	Tabular

Table 1: Available data in the literature on $^{7}Li(p,p_0)^{7}Li$ cross-sections.

Figures 1-5 present in graphical form all the cross-sections listed in Table 1; data referring to similar scattering angles are shown together. In the graphs the proton energy and the differential cross-section are given in the laboratory frame of reference, with energy units in MeV and cross-section units in mbarn/sr.

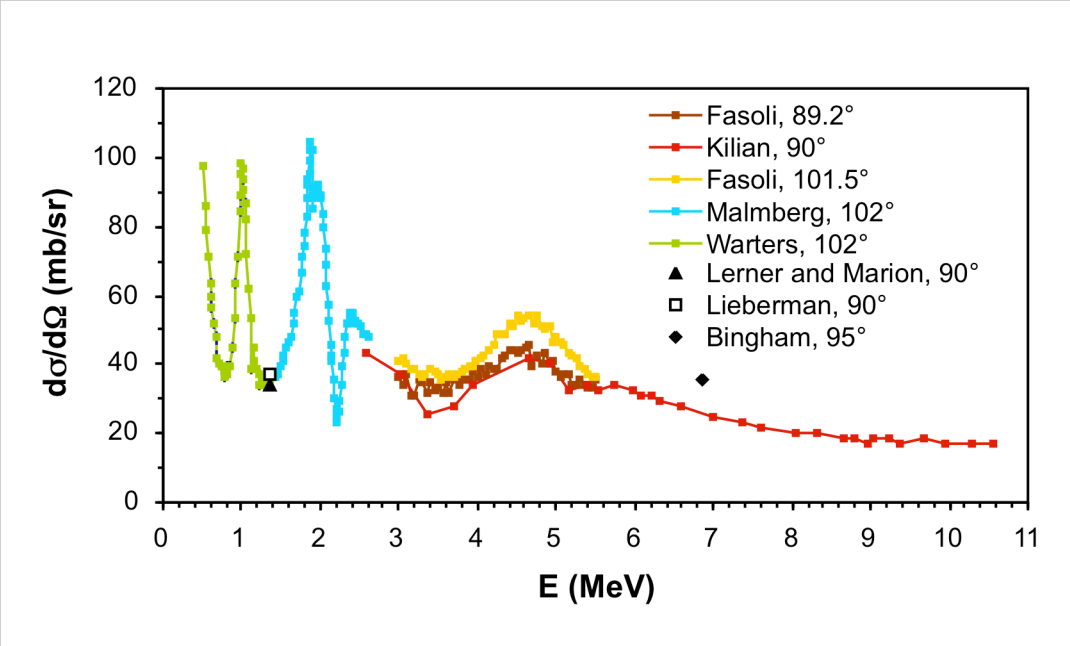

Figure 1: Cross-section values of proton elastic scattering on ^{7}Li versus proton energy at scattering angles in the 90°-102° range. All the quantities are given in the laboratory frame of reference.

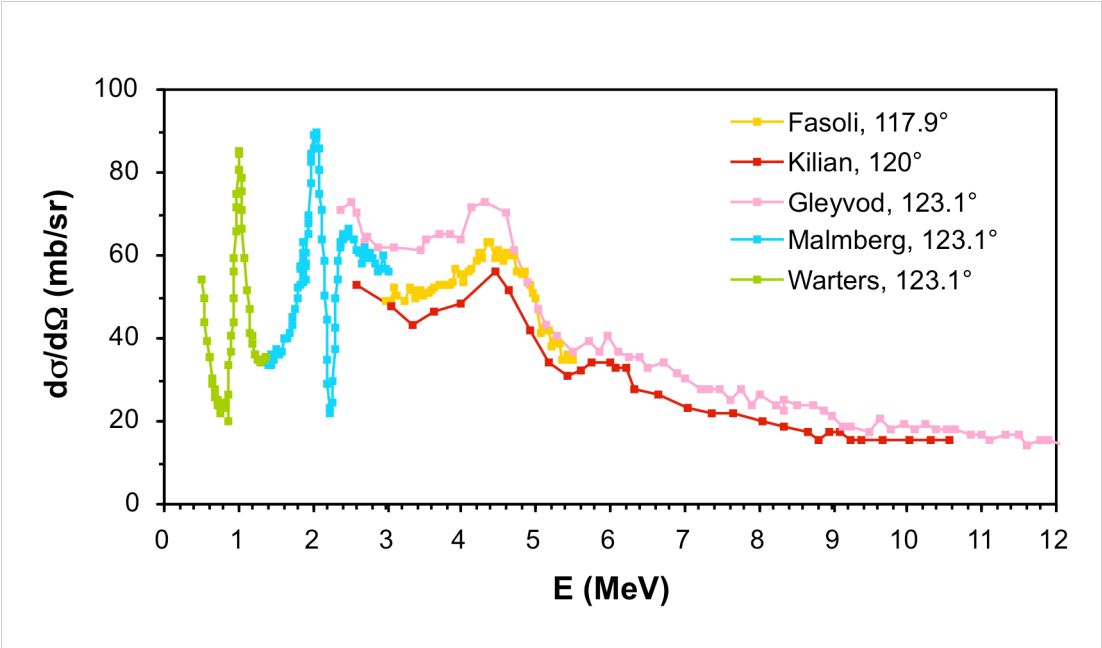

Figure 2: Cross-section values of proton elastic scattering on on ^{7}Li versus proton energy at scattering angles in the 118°-123° range. All the quantities are given in the laboratory frame of reference.

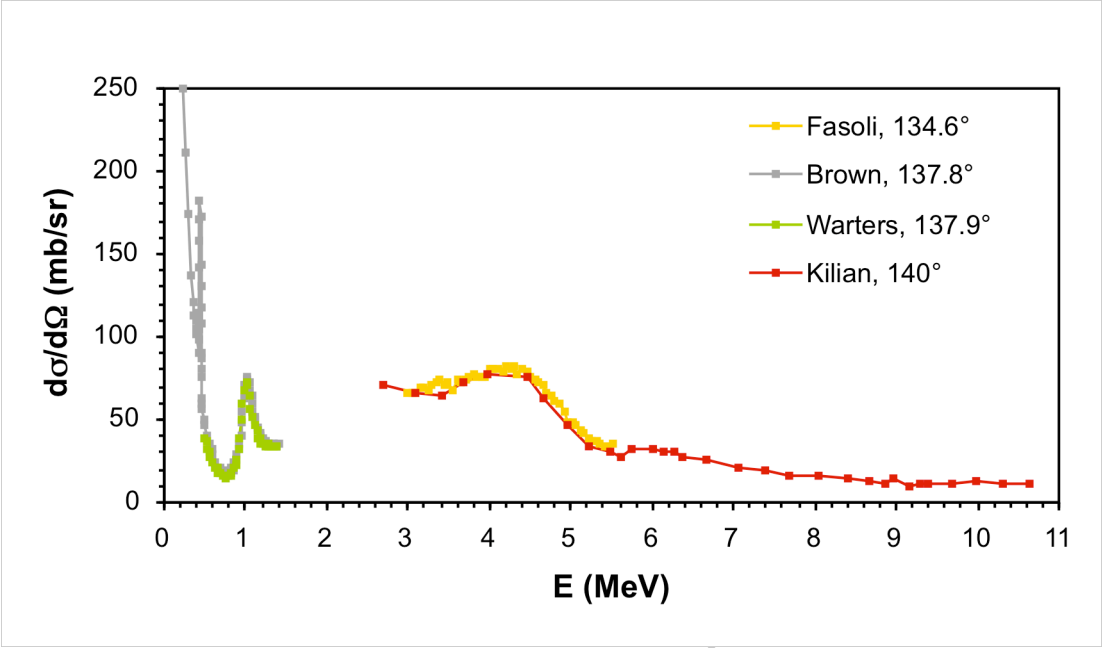

Figure 3: Cross-section values of proton elastic scattering on ^{7}Li versus proton energy at scattering angles in the 134°-140° range. All the quantities are given in the laboratory frame of reference.

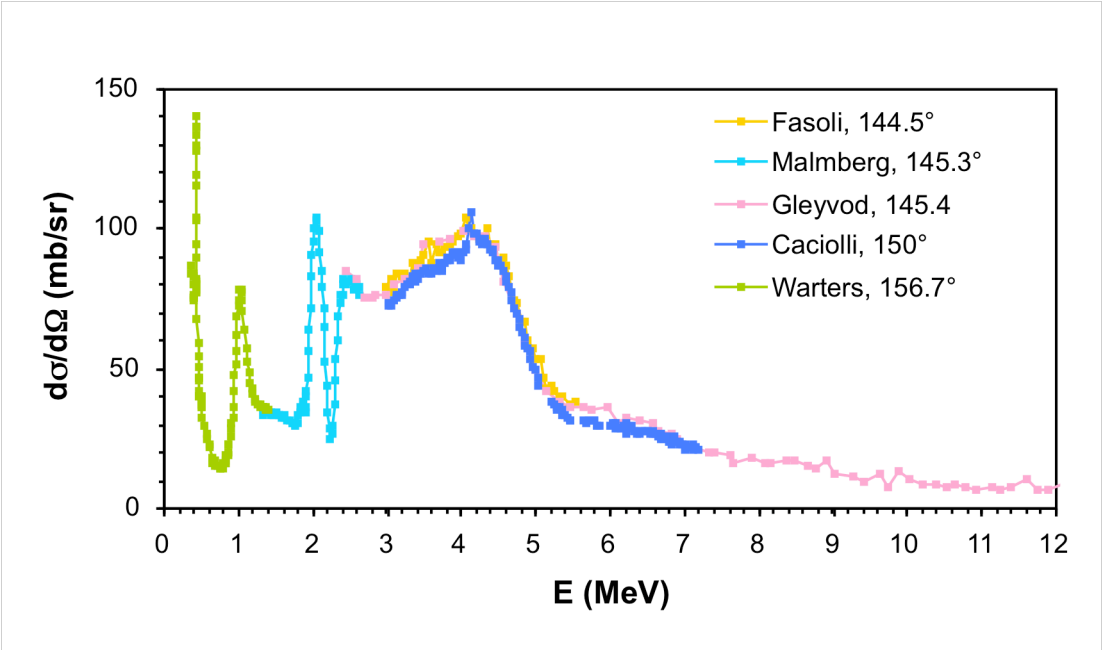

Figure 4: Cross-section values of proton elastic scattering on ^{7}Li versus proton energy at scattering angles in the 145°-157° range. All the quantities are given in the laboratory frame of reference.

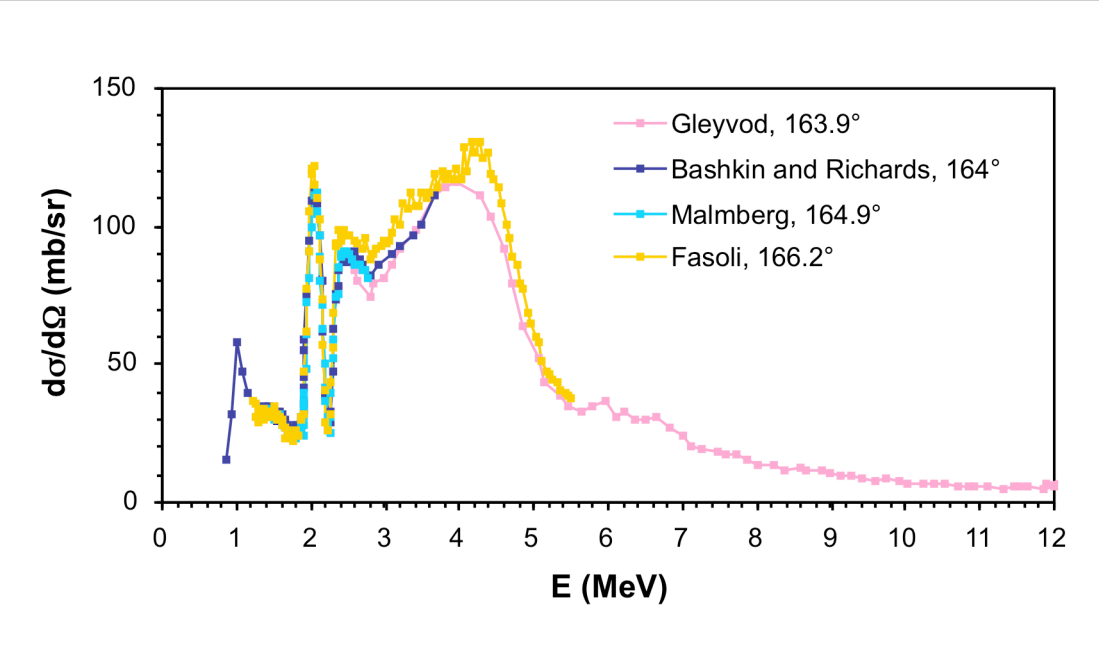

Figure 5: Cross-section values of proton elastic scattering on ^{7}Li versus proton energy at scattering angles in the 164°-166° range. All the quantities are given in the laboratory frame of reference.

In general, the agreement between the data – even those referring to slightly different scattering angles – is fairly good, except in a few cases.

In particular, data from Kilian [8] appear systematically lower (10-15%) than the other data at similar angles [5,6].

From Figure 2 a disagreement appears between data from Malmberg [5] and Gleyvod [7] at a scattering angle of 123°: cross-section values from [7] are about 10% higher than those from [5]; however, this systematic disagreement is within the experimental uncertainties quoted in Malmberg's and Gleyvod's works, 10% and 15% respectively.

Note that in Figure 5, the higher cross-section value in correspondence of the maximum of the 2.05 MeV resonance from Fasoli [6] as compared to the one from both Bashkin and Richards [2] and Malmberg [5], might be due to the slightly different scattering angle (166.2° and 164°, respectively).

Experimental data in the energy range 1.5 – 2.5 MeV at scattering angles around 135°-140° are missing and new measurements should be encouraged.

References

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[12] http://www.datathief.org/