Data review of $^{19}F(p,p_0)^{19}F$ cross-sections

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As a first step, the data sets already exisiting on IBANDL [1,3,7,8,10] were compared with the data in the original references and the agreement was good.

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 [1,2,4,6,9]. The data appearing in graphical form in the original references were digitized using the DataThief software [11]. 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]	Original paper, IBANDL	122.8° 158.7°	0.55-1.80	Thick target LiF	6%	Graphical, tabular
	Original paper	97.0° 107.1° 133.8°	1.30-1.50	Thick target LiF	6%	Graphical
[2]	Original paper, IBANDL	122.8° 138.8° 158.7°	0.50-2.06	LiF evaporated on to a C backing	10%	Graphical, tabular
[3]	IBANDL	90°	1.36	0.03 to 0.1 mg/cm^2 LiF evaporated on a C foil	10% statistical and systematic	Tabular
[4]	Original paper	135° 145°	0.65-1.80	-	-	Graphical
[5]	EXFOR	95.0° 123.0° 137.0°	1.80-2.68	-	-	Tabular
[6]	Original paper	122.7° 148.5° 161.1°	2.00-3.40	C_2F_6 gas target (2÷8 Torr)	10%	Graphical

[7]	IBANDL	165°	0.85-1.01	85 μg/cm^2 LuF_3, deposited on polycarbonate film	2% statistical, 3-4% reproducibility	Tabular
	IBANDL	153°	1.00-1.88	137.9 μg/cm^2 LiF, deposited on 38 μg/cm^2 Cu, deposited on 50 μg/cm^2 C	2% statistical, 3-4% reproducibility	Tabular
[8]	IBANDL	150°	2.50-4.79	158.5 μg/cm^2 CeF_3	8%	Tabular
[9]	EXFOR	165°	1.40-2.71	69, 45 and 78 μg/cm^2 GdF_3 on thin C foil	5%	Tabular
[10]	IBANDL	150°	3.0-7.2	50 μg/cm^2 LiF on 30 μg/cm^2 C, coated with 20 μg/cm^2 Au	5%	Tabular

Table 1: Available data in the literature on $^{19}F(p,p_0)^{19}F$ 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.

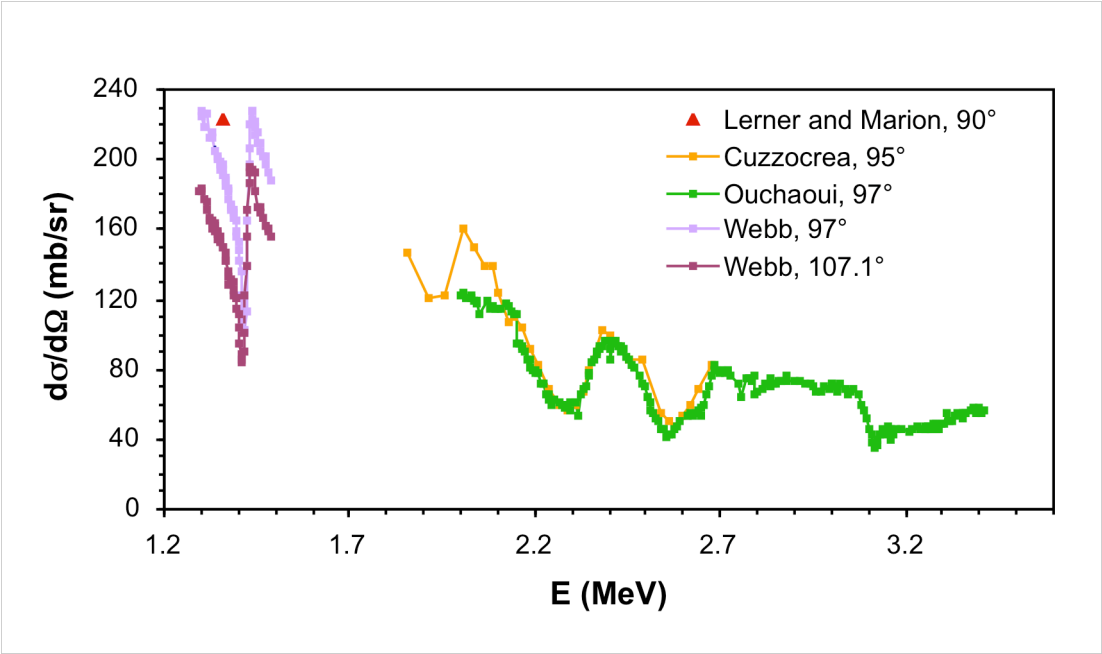

Figure 1: Cross-section values of proton elastic scattering on ^{19}F versus proton energy at scattering angles in the 90°-107° range. All the quantities are given in the laboratory frame of reference.

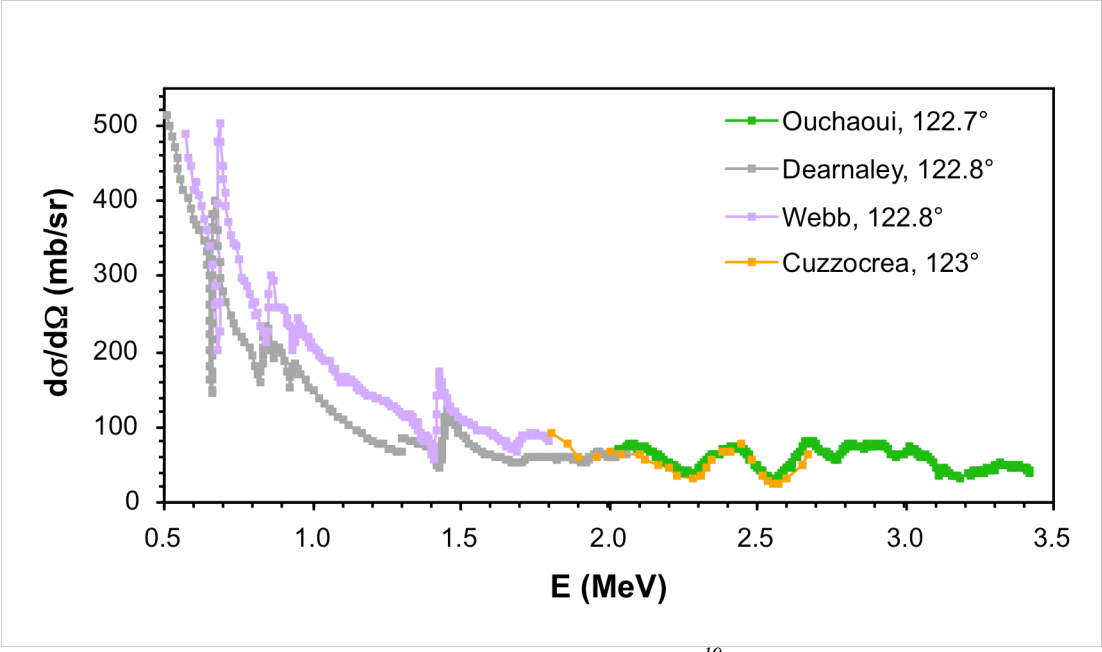

Figure 2: Cross-section values of proton elastic scattering on ^{19}F versus proton energy at scattering angles in the 122°-123° range. All the quantities are given in the laboratory frame of reference.

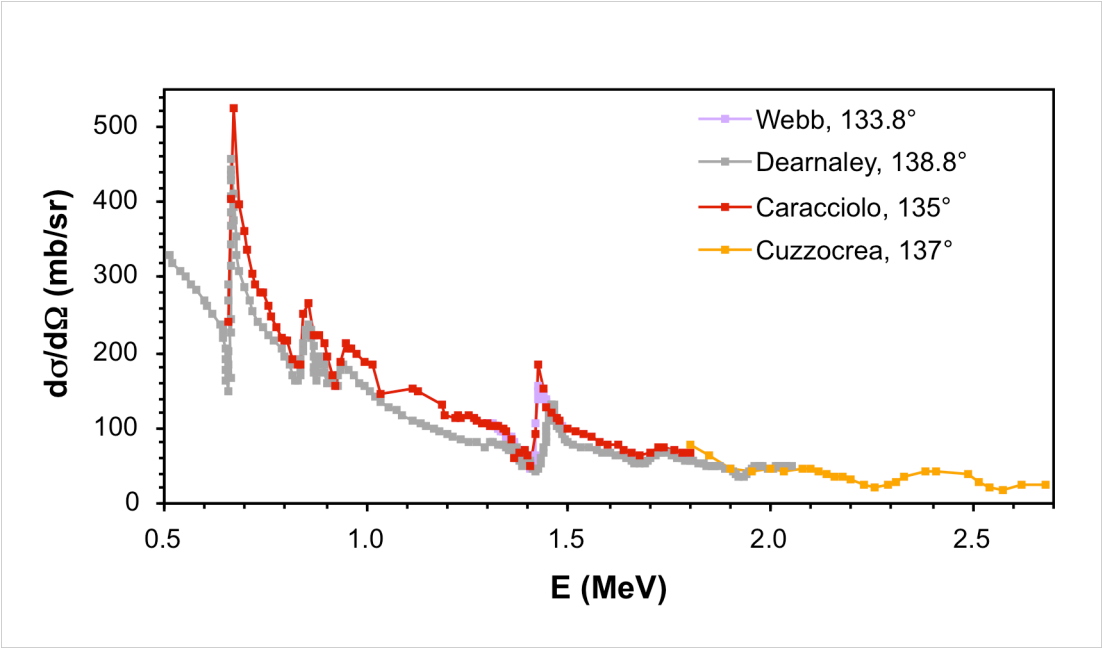

Figure 3: Cross-section values of proton elastic scattering on ^{19}F versus proton energy at scattering angles in the 134°-140° range. All the quantities are given in the laboratory frame of reference.

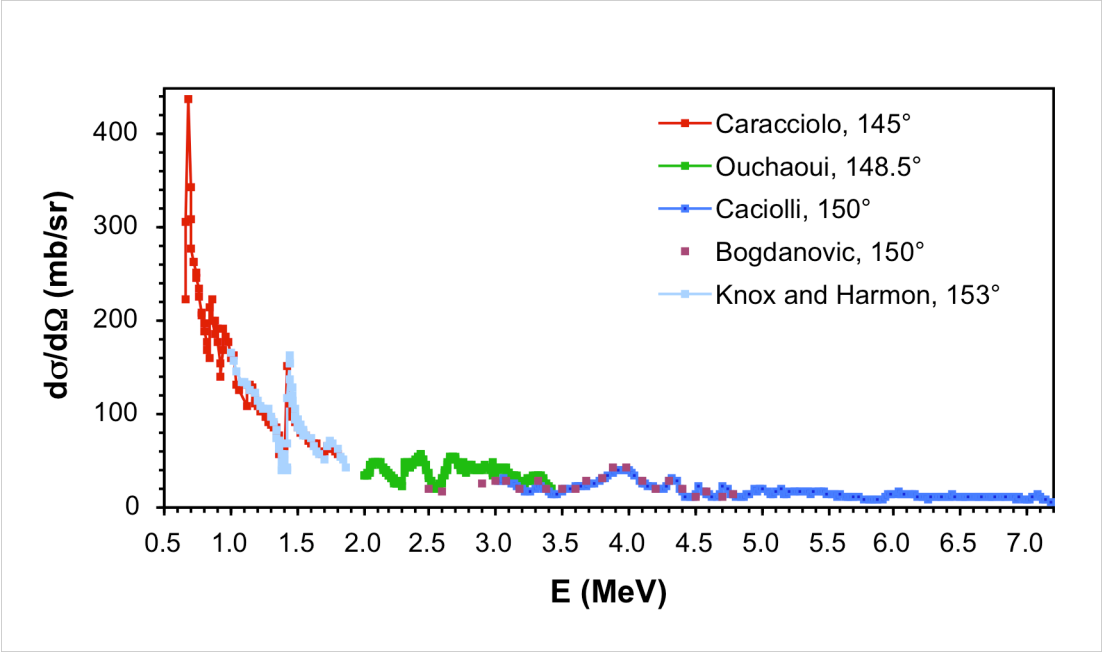

Figure 4: Cross-section values of proton elastic scattering on ^{19}F versus proton energy at scattering angles in the 145°-153° range. All the quantities are given in the laboratory frame of reference.

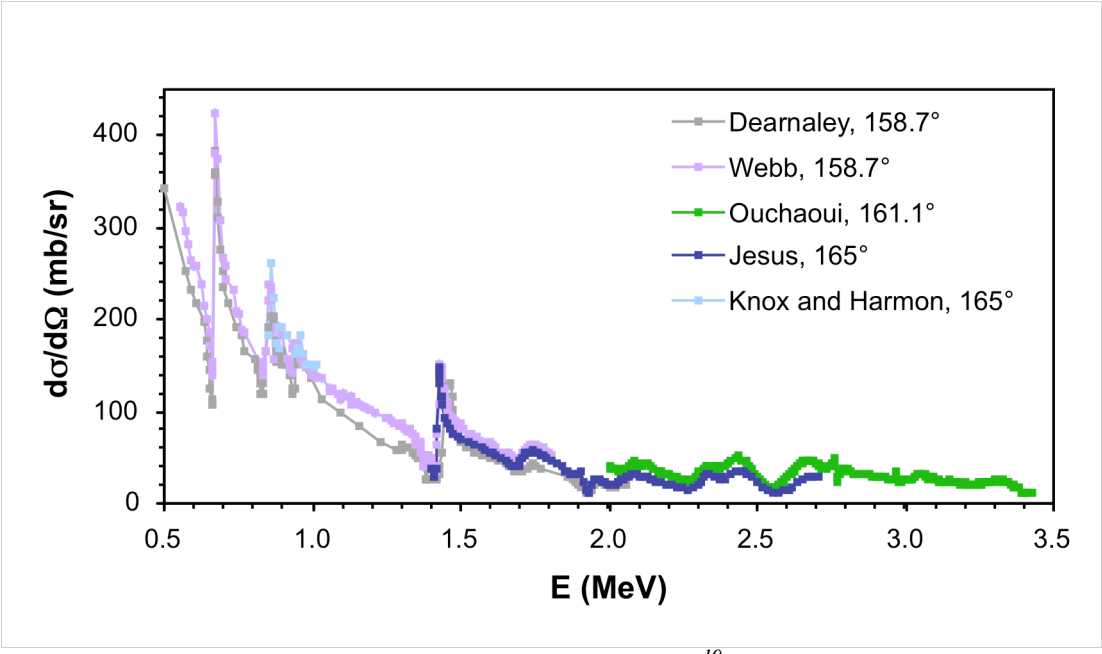

Figure 5: Cross-section values of proton elastic scattering on ^{19}F versus proton energy at scattering angles in the 159°-165° range. All the quantities are given in the laboratory frame of reference.

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

In particular, data from Ouchaoui [6] appear systematically higher (up to 40%) than the other data at similar angles [5,8,9,10], Cuzzocrea's data at 97° being the only exception.

Remarkable discrepancies appear in the data from Dearnaley [2] as well, when compared to the other data [1,4,7,9], especially in correspondence of the 1.42 MeV resonance which appears also shifted in energy; an abrupt change in the cross-section values at 1.3 MeV energy is clear too, e.g. in Figures 2 and 5 (actually, this might be an effect of the digitizing process since the cross-section curves as a function of proton energy are shown in two panels, in the original reference data). For these reasons data from Dearnaley should be used critically.

References

[1] T.S. Webb et al., Phys. Rev. 99 (1955) 138

[2] G. Dearnaley, Philos. Mag. ser. 8, 1 (1956) 821

[3] G.M. Lerner and J.B. Marion, Nucl. Instr. Meth. 69 (1969) 115

[4] R. Caracciolo et al., Lettere al Nuovo Cimento 11 (1974) 33

[5] P. Cuzzocrea et al., Lettere al Nuovo Cimento 28 (1980) 515

[6] S. Ouichaoui et al., Nuovo Cimento 94 (1986) 133

[7] J.M. Knox and J.F. Harmon, Nucl. Instr. Meth. B44 (1989) 40

[8] I. Bogdanović et al., Nucl. Instr. Meth. B79 (1993) 524

[9] A.P. Jesus et al., Nucl. Instr. Meth. B174 (2001) 229

[10] A. Caciolli et al., Nucl. Instr. Meth. B249 (2006) 95

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