Inelastic scattering

Type	Author	History Citation	Literature Cutoff Date
Full Evaluation	Jun Chen	NDS 140, 1 (2017)	30-Sep-2015

Includes elastic scattering: (HI,HI).
HI=^{6}Li, ^{7}Li, ^{9}Be, ^{10}B, ^{11}B, ^{12}C, ^{13}C, ^{14}C, ^{14}N, ^{16}O, ^{17}O, ^{18}O, ^{20}Ne, ^{28}Si, ^{32}S, ^{37}Cl, ^{40}Ar, ^{40}Ca, ^{48}Ca, ^{86}Kr.

(^{6}Li,^{6}Li′):
2010Kr06: E=240 MeV. Measured $\sigma(\theta)$, double-folding model analysis, deduced B(E3) for 3737 level.
1982Co12: E=30 MeV. Measured $\sigma(\theta)$, θ(cm)=9° − 78°; DWBA double-folding model analysis, deduced deformation lengths. Levels at 0, 3740, 3900, 4490.
1977Bo21: E=30 MeV. Measured $\sigma(\theta)$, coupled-channel analysis, Hauser-Feshbach calculations.
1987Va31: E=34 MeV. Also ^{6}Li(^{40}Ca,^{40}Ca′) E=227 MeV. Measured $\sigma(\theta)$, DWBA analysis.
Additional information 1.
(^{6}Li,^{6}Li):
1989Na02: E=210 MeV. Measured $\sigma(\theta)$.
1980An16: E=28, 32 MeV.
1981Fu04: E=88 MeV. DWBA and coupled-channel analysis.
1981Sc16: E=99 MeV. Measured $\sigma(\theta)$, optical-model analysis.
1977Cu02: E=28, 34 MeV. Deduced optical-model parameters; $\sigma(\theta)$.
1976Ch27: E=50.6 MeV. Measured $\sigma(\theta)$.
1971Da33: E=30 MeV. Measured $\sigma(\theta)$.
1969Be90: E=20 MeV. Measured $\sigma(\theta)$.

(^{7}Li,^{7}Li′):
1985Sa25: E=34 MeV. Measured $\sigma(\theta)$, θ(cm)=10° − 135°; DWBA coupled-channel analysis. Levels at 3740, 3900, 4490, 6290.
1982Ec01: E=45 MeV. Measured $\sigma(\theta)$, θ(cm)=12° − 80°; double folding model.
(^{7}Li,^{7}Li):
1980CuZZ, 1977Cu02: E=28, 34 MeV. Deduced optical-model parameters from $\sigma(\theta)$.
1969Be90: E=20 MeV. Measured $\sigma(\theta)$.

(^{9}Be,^{9}Be′):
1980Ec04: E=45, 60 MeV. Measured $\sigma(\theta)$; DWBA analysis for 3^{-},5^{-} levels; double folding model. Levels at 3730, 3900, 4490, 5900, 6400, 6940, 7300.
(^{9}Be,^{9}Be):
1980Ec01: E=45, 60 MeV. Measured $\sigma(\theta)$.
1983Ec01: E=35-60 MeV. Measured $\sigma(\theta)$.
1984Fu10: E=158 MeV. Measured $\sigma(\theta)$.
1985Wi18: E=30, 45 MeV. Measured $\sigma(\theta)$.

(^{10}B,^{10}B):
1983BoZU: E=31 MeV. Measured $\sigma(\theta)$.
1981GlZY, 1980Gl03: E=46.6 MeV. Measured $\sigma(\theta)$.

(^{11}B,^{11}B′):
1981Hn01: E=51.5 MeV. Measured $\sigma(\theta)$, θ(cm)=10° − 60°; DWBA coupled-channel, double-folding model analysis. Levels at 3740, 3900, 4490. Deduced deformation lengths.
1981Hn04: E=40 MeV. Measured $\sigma(\theta)$, DWBA analysis; deduced deformation lengths.
(^{11}B,^{11}B):
1983BoZU: E=32, 68 MeV. Measured $\sigma(\theta)$.
1981GlZY, 1980Gl03: E=51.5 MeV. Measured $\sigma(\theta)$.
1980Ma31: E=32 MeV. Measured $\sigma(\theta)$, DWBA analysis.

Inelastic scattering (continued)

(^{12}C,^{12}C′):
1981Bu08: E=1032 MeV. Measured $\sigma(\theta)$, θ=4° − 16°. Data for g.s.
1986Sa29: E=10-35 MeV. Measured $\sigma(\theta)$.
1980Ku03, 1979Ku02: ^{12}C(^{40}Ca,^{40}Ca) E=18-40 MeV; 80-178 MeV. Measured $\sigma(\theta)$.
1978Re06, 1979Re03: E=135-150 MeV; 51 MeV. Measured σ at 180°. Optical-model analysis.
1976MoYU: E=45 MeV. Measured $\sigma(\theta)$.
1972Sc21: E=114 MeV.

(^{13}C,^{13}C′):
1977Bo17: E=68 MeV. Measured $\sigma(\theta)$, θ=8° − 40°; CCBA analysis; levels at 3740, 3900, 4490. Deduced deformation lengths relative to those from (p,p′), normalized to 1.0 for 3900 level.

(^{14}C,^{14}C′):
1981Ha23: E=51 MeV. Measured $\sigma(\theta)$; θ(cm)=13° − 53°; DWBA and CCBA analysis. Levels at 3740, 3900, 4480.

(^{14}N,^{14}N′):
1978Bu10: E=161 MeV. Measured $\sigma(\theta)$, θ(cm)=12°. Levels at 6900 and 7900. Deduced giant resonances.
1975Wi02: (^{14}N,^{14}N) E=24-54 MeV. Measured $\sigma(\theta)$.

(^{16}O,^{16}O′):
1982Re03, 1978Re02: E=60 MeV. Measured $\sigma(\theta)$, θ(cm)=10° − 65°; energy uncertainty ≈100 keV; DWBA fits with coupled channels analysis. Levels at 3740, 3900, 4490.
1981Al12: E=51.5, 54 MeV. Measured $\sigma(\theta)$.
1981Ku10: E=50-70 MeV. Measured $\sigma(\theta)$, coupled-channel analysis.
1973Be13: E=60 MeV. Measured $\sigma(\theta)$.
(^{16}O,^{16}O):
1985Me14: E=1503 MeV.
1988Ro01: E=94 MeV. Measured $\sigma(\theta)$.
1979Vi13: E=40-214 MeV. Measured fusion σ.
1979Ku02: E=50 MeV. Also ^{16}O(^{40}Ca,^{40}Ca) E=80-178 MeV. Measured $\sigma(\theta)$.
1973Ch10: E=47, 49 MeV.
1972Gr25: E=25-45 MeV. Measured $\sigma(\theta)$.
1971Be26: E=20-40 MeV. Measured $\sigma(\theta)$.
1971Or02: E=36-48 MeV. Measured $\sigma(\theta)$.
1969Ec01: E=23-42 MeV. Measured $\sigma(\theta)$.

(^{17}O,^{17}O′):
1989AlZQ: E=1428 MeV. Measured σ, θ(cm)=small. Energy uncertainty <400 keV. Levels at 3740, 3900, 4490.

(^{18}O,^{18}O′):
1982Re14, 1982Re03: E=62.14 MeV. Measured $\sigma(\theta)$, θ(cm)=10° − 65°; DWBA fits with coupled channels in ^{40}Ca and ^{18}O. Levels at 3740, 3900, 4490. Deduced deformation lengths.
1972Ei07: (^{18}O,^{18}O) E=25-42 MeV. Measured $\sigma(\theta)$.

(^{20}Ne,^{20}Ne′):
1978Ng01: E=36-95 MeV. Measured $\sigma(\theta)$; optical-model, DWBA, coupled-channel analysis.
1980Se06: (^{20}Ne,^{20}Ne) E=151 MeV. Measured $\sigma(\theta)$, optical-model parameters.

(^{28}Si,^{28}Si′):
1986Vi02: E=225 MeV. Measured $\sigma(\theta)$, θ(cm)=4° − 30°; DWBA analysis; energy uncertainty ≈400 keV. Unresolved doublet: 3740+3900. Deduced deformation length.

(^{32}S,^{32}S′):

Inelastic scattering (continued)

1986Bi02: E=100, 120, 151.5 MeV. Measured $\sigma(\theta)$; folding model analysis for 3740 level.
1975Re17: E=100 MeV. Measured $\sigma(\theta)$ for θ=20° – 60°; DWBA analysis for 3900 level.
(^{32}S,^{32}S):
1988Bi06: E=90, 100, 110, 120, 151.5 MeV. Measured $\sigma(\theta)$, folding-model analysis.
1984Ba27: E=100, 120, 151.5 MeV. Measured $\sigma(\theta)$; optical-model analysis.
1989Di06: E=90, 110 MeV. Measured $\sigma(\theta)$.
1977Ri03: E=58-130 MeV. Measured $\sigma(\theta)$.

(^{37}Cl,^{37}Cl′):
1997Wi17: E=97.3, 115.3 MeV. Measured $\sigma(\theta)$.
1990Fe03: (^{37}Cl,^{37}Cl) E=120.5 MeV. Measured $\sigma(\theta)$; folding model and DWBA analysis.

(^{40}Ar,^{40}Ar′):
1987Fr20: E=1760 MeV. Measured σ, θ(lab)=2.5°. Giant resonances at 8000 and 18000.
1978Wa18, 1979Wa06: (^{40}Ar,^{40}Ar) E=191, 236, 272 MeV. Measured $\sigma(\theta)$, optical-model parameters.

(^{40}Ca,^{40}Ca′):
1982Bl04: E=160, 280, 400 MeV. Measured $\sigma(\theta)$, DWBA analysis; FWHM=1.5 MeV. Levels and giant resonances at 3740, 7800, 10700, 14000, 17600, 26000. See also 1981Ro01, 1980Fr02, 1979Tr10, 1977Fr14 from the same group where ^{40}Ca(^{40}Ca,X) reaction was studied at E(^{40}Ca)=284 and 400 MeV.
2004Sc07, 1993Sc29: E=50 MeV/nucleon. Measured (^{40}Ca)(p) coin; deduced two-phonon double GQR and multi-phonon giant resonance features.
(^{40}Ca,^{40}Ca):
1977Do02: E=55-120 MeV. Measured $\sigma(\theta)$.
1977Ri03: E=58-130 MeV. Measured $\sigma(\theta)$.
1975Do07: (^{40}Ca,^{40}Ca) E=110-150, 170-200 MeV. Measured σ.

(^{48}Ca,^{48}Ca):
1990Ti04: E=132, 140 MeV. Measured $\sigma(\theta)$, coupled-channel analysis.

(^{86}Kr,^{86}Kr′):
1999Ot02: E=5160 MeV. Measured $\sigma(\theta)$, θ=1° – 6°; fitted elastic and inelastic channels from 13-25 MeV excitation. Energy uncertainty=1400 keV. Deduced E1 and E2 strength distributions.

^{40}Ca Levels

E(level)	J$^{\pi}$[†]	L[#]	Comments
0	0$^+$	0	
3740	3$^-$	3	B(E3)=0.0164 *17* (same for 3 sets), 0.0171 *17* (same for 2 sets), 0.0179 *18*, 0.0197 *20*, with different optical model parameter sets (2010Kr06). β_3R=0.49 (^{6}Li,1982Co12); 1.15 (^{11}B,1981Hn01); 1.29 *18* (^{28}Si,1986Vi02). β_3R(p,p′)/β_3R(^{13}C,^{13}C′)=1.3 (1977Bo17).
3900	2$^+$	2	β_2R=1.04 (^{6}Li,1982Co12); 0.44 (^{11}B,1981Hn01); 1.37 *14* (^{28}Si,1986Vi02).
4490	5$^-$	5	β_5R=0.53 (^{6}Li,1982Co12); 1.15 (^{11}B,1981Hn01). β_5R(p,p′)/β_5R(^{13}C,^{13}C′)=1.9 (1977Bo17).
5900			
6290			
6400			
6940			
7300			
7.8×10^3[‡] *10*			Probably lower excitation of the octupole resonance.
10.7×10^3[‡] *10*			

Continued on next page (footnotes at end of table)

Inelastic scattering (continued)

^{40}Ca Levels (continued)

E(level)	Comments
14.0×10^{3}‡ *10*	
17.6×10^{3}‡ *10*	GQR; wide structure.
26×10^{3}‡	E(level): wide structure.

† From Adopted Levels.
‡ Giant resonance.
# Based on adopted J^{π}.