^{152}Sm(x,x′)

Type	Author	History Citation	Literature Cutoff Date
Full Evaluation	M. J. Martin	NDS 114, 1497 (2013)	31-Aug-2013

1985Fe04: E=2.47,2.75 MeV, $\sigma(\theta)$; coupled-channel analysis; levels: 122, 366, 1086.
1977Co26, 1976Co25: E=2.47 MeV; levels; 0, 122, 366.
e:
1988Ph01: E=251, 500 MeV, σ(E,θ); levels: 0, 121.8, 366.5, 706.7.
1977Na01: E=250 MeV, σ(E,θ); levels: 0, 122, 366, 707. Additional analysis: 1981Mo16, 1978Ca18.
1972Be26: E=50-105 MeV; levels 0, 122, 360.
Others: 1976Co08, 1973Ca33.
p, pol p:
1993Pe16: (pol p) E=20.4 MeV, $\sigma(\theta)$, analyzing power, extended optical model − rotational model; levels: 0, 122, 366, 707, 963, 1041, 1221.
1989Ob02: E=24 MeV, σ(E,θ), FWHM=18 keV; coupled-channel analysis, rotation-vibration model; levels: 0, 122, 369, 712.
1987Ic04 (1988Ic02,1986Ic02,1983Oh02): (pol p) E=65 MeV, FWHM=20-26 keV; $\sigma(\theta)$, analyzing power; coupled-channel analysis, γ-vibrational model, asymmetric-rotor model; levels: 0, 122, 366, 707, 963, 1041, 1086, 1220, 1372,
1983Pa08: E=25.6, FWHM=23 keV, σ(E,θ); extended optical-model coupled channel; axially symmetric rigid-rotator model; levels: 0, 123, 369, 711.
1982Pu01: E=50 MeV; coupled-channel analysis.
1971Kr10: E=16 MeV, FWHM=40 keV; optical model, coupled channel, DWBA analysis; levels: 0, 122, 366.
1971Ba19: (pol p), E=24.5 MeV; 1971Ku23, 1972Ku32, 1973Ku11 reanalyze these data. Levels: 0, 122, 366.
Others: 1972Wo03, 1964Ke08.
d, pol d:
1983Ha16: pol d: E=56 MeV; $\sigma(\theta)$, analyzing power, FWHM≈25 keV, θ=12°−75°; coupled-channel analysis; symmetric-rotator model; levels: 0, 122, 367.
1975Ba64: pol d; E=15 MeV; $\sigma(\theta)$ FWHM=20 keV, $\theta\leq$165°; levels: 0, 122.
1974Ba78: E=3-16 MeV, coupled-channel analysis; levels: 0, 122, 366.
1973Tr03: E-12 MeV; $\sigma(\theta)$ FWHM≈10 keV, $\theta\leq$150°; levels: 0, 122, 366.
1968Ve01: E=12.1 MeV; σ(E,θ) FWHM=7-10 keV, θ=60-155.
1966Ze03: E=12.0 MeV, $\sigma(\theta)$; levels: 0, 122, 366, 1042, 1585.
Other: 1966El07.
^{3}He:
1979Pa08: E=40.9 MeV, σ(E,θ), FWHM=40-80 keV; strong coupling approach (SCA), symmetric-rotor and asymmetric-rotor models; levels: 0, 123, 367, 711.
1977Ea01: E=53.4 MeV, σ(E,θ); DWBA, SCA analysis; level: 122.
α:
1989Ob02: E=36 MeV; $\sigma(\theta)$ FWHM=25 keV, θ=20-75°; coupled-channel calc, rotation-vibration model; levels: 0, 122, 366.
1968He24, 1967Ha05: E=50 MeV, FWHM≈45 keV; levels: 0, 122, 366, 685+712, 811?, 963, 1045, 1087, 1236.
Others: 1987Ic01, 1985ToZX, 1974Br31, 1968Ve01.
^{12}C:
1994Zh09, 1991Zh30: E=63.2 MeV; measured $\sigma(\theta)$; levels: 0, 122, 366.
1975Br19: E=40-63 MeV; levels: 0, 122.
^{16}O: 1979Ki01: E=72 MeV; $\sigma(\theta)$, θ=40°−115°; levels: 0, 122, 366.
π^-mesons:
1983Mo18: measured: σ(E), σ(E,θ), vector-analyzing power; DWIA, coupled-channel analysis.
Theory: pion-nucleus scattering: 1994Ba26, 1994Li14, 1993Pe09, 1992Ba64, 1992Zh27.
K+ -mesons:
1987Ab01: E=800 MeV/c.

^{152}Sm(x,x′) (continued)

^{152}Sm Levels

E(level)[†‡]	J$^{\pi}$[#]	Comments
0.0[a]	0$^+$	
122.78[a]	2$^+$[de]	(e,e′): β_2=0.286 *2* (1977Na01), 0.287 *3* (1972Be26). (p,p′): β_2=0.22 (1993Pe16), 0.241 *12* (1989Ob02), 0.251 (1983Pa08), 0.25 *2* (1971Ba19), 0.250 (1971Kr10). (d,d′): β_2=0.236 (1983Ha16), 0.25 (1975Ba64), 0.26 (1974Ba78), 0.25 (1973Tr03). (^{3}He,^{3}He′): β_2=0.238 (1979Pa08), 0.302 (1977Ea01). (α,α′): β_2=0.200 *10* (1989Ob02), 0.25 (1968He24). B(E2)=3.45 *6* (1977Na01). B(E2)=3.43 *4* from (e,e′) and muonic quadrupole hyperfine splitting (1983Re04).
366.48	4$^+$[de]	(e,e′): β_4=0.092 *2* (1977Na01), 0.070 *3* (1972Be26). (p,p′): β_4=0.074 (1993Pe16), 0.062 *6* (1989Ob02), 0.048 (1983Pa08), 0.050 *16* (1971Ba19). (d,d′): β_4=0.041 (1983Ha16), 0.048 (1974Ba78), 0.047 (1973Tr03). (^{3}He,^{3}He′): β_4=0.048 (1979Pa08), 0.038 (1977Ea01). (α,α′): β_4=0.040 *4* (1989Ob02), 0.048 (1968He24). B(E4)=0.210 *13* (1977Na01). Not observed in (^{12}C,^{12}C′).
684.70	0$^+$[e]	Projectiles: p, d, α.
706.88	6$^+$[de]	(e,e′): β_6=0.010 *2* (1977Na01). (p,p′): β_6=−0.030 (1993Pe16), −0.005 *1* (1989Ob02), −0.011 (1983Pa08). (^{3}He,^{3}He′): β_6=−0.009 (1979Pa08). (α,α′): β_6=−0.011 *1* (1989Ob02), −0.012 (1968He24). B(E6)=0.0114 *7* (1977Na01). Projectiles: e, p, d, ^{3}He, α.
810.45	2$^+$[e]	Projectiles: p, d, α?
939[&c] *5*		
963.35	1$^-$[de]	Projectiles: p, d, α.
988[&c] *5*		
1022.97	4$^+$[e]	
1041.11	3$^-$[de]	(p,p′): β_3=0.072 *4* (1989Ob02). Projectiles: p, d, α.
1085.88	2$^+$[de]	Projectiles: n, p, d, α.
1125.35[b]	8$^+$	
1221.48	5$^-$[de]	
1226	(2$^+$)	E(level),J$^{\pi}$: unresolved from 1221-keV J^{π}=5$^-$ state. DWBA analysis suggests 2$^+$ state at 1226-keV (1989Ob02). Seen only in (α,α′) (1989Ob02).
1233.86	3$^+$	Projectiles: p, α.
1292.76[b]	2$^+$	E=1298 *10* (1964Ke08).
1371.74	4$^+$[de]	
1440[&c] *10*		
1510.79	1$^-$[e]	
1579.43	3$^-$[e]	
1612.79	4$^+$	
1680.57[&]	1$^-$	
1730 *10*		E from (p p′), E=1726 from (d,d′). Two levels are known from decay: 1728.27-keV J^{π}=6$^+$ and 1730.205-keV J^{π}=3$^-$. Both experiments are probably exciting both known levels.
1757.03[&]	4$^+$	
1765[@]		Multiple line from (d,d′), suggested as J^{π}=3$^-$ & 4$^+$ (1968Ve01); possibly the 1764.32-keV J^{π}=5$^-$ level.
1776.24[b]	(2$^+$)	
1901 *2*	(2$^+$)	
1960[@]		
2038[@]		
2142[@]		
2194[@]		

Continued on next page (footnotes at end of table)

^{152}Sm(x,x′) (continued)

^{152}Sm Levels (continued)

† Rounded-off adopted values, unless noted otherwise.
‡ Seen in (p,p′) and (d,d′), unless noted otherwise.
# From Adopted Levels. Assignments from this dataset are noted.
@ From 1968Ve01, seen only in (d,d′).
& From 1964Ke08, seen only in (p,p′).
a Seen in all reactions.
b Seen in (p,p′) only.
c Seen only in inelastic scattering; not included in Adopted Levels.
d $\sigma(\theta)$, analyzing power (1988Ic02).
e Deduced from $\sigma(\theta)$ (1968Ve01).