^{100}Mo(p,t) 2012Th07,2012ThZZ,1973Sh09

History

Type	Author	Citation	Literature Cutoff Date
Full Evaluation	Jun Chen, Balraj Singh	NDS 164, 1 (2020)	15-Feb-2020

2012Th07, 2012ThZZ: E=24 MeV from MP tandem at MLL-LMU and TU, Munich facility. Target=97.39% enriched ^{100}Mo. Measured triton spectra and σ at lab angles of 6° and 12° using Q3D magnetic spectrograph at TU, Munich. Multiwire gas proportional counter backed by a scintillator provided focal position, energy loss and residual energy of charged particles. FWHM ≈ 7 keV. Main aim of this study was to study excitation of 0^+ states with relevance to matrix elements for $0\nu\beta^-\beta^-$ decay of ^{100}Mo to ^{100}Ru. DWBA analysis of $\sigma(\theta)$ data.

1973Sh09: E=19 MeV proton beam was produced from an MP tandem. Target was Mo metal (97.43% enriched in ^{100}Mo). Reaction products were momentum-analyzed with an Engel split-pole magnetic spectrometer (FWHM=10-15 keV). Measured $\sigma(\theta)$ from 10° to 60° extending to 90° for the first three states. Deduced levels, J, π, L-transfers from DWBA analysis. Comparisons with available data. Uncertainty on absolute cross sections is 10-15%.

Others:

1985Mi06: E=52 MeV, measured g.s. transition strength. DWBA and IBA model calculations.

1982Na06: E=52 MeV. Wide structures observed near 8.8 MeV.

1971Ta16: E=52 MeV. Measured $\sigma(\theta)$ for the first three states. DWBA calculations. Integrated σ (6° to 55°) are given.

Additional information 1.

^{98}Mo Levels

Uncertainties in listed cross sections from 2012ThZZ are statistical only, systematic uncertainty is estimated by 2012Th07 as ≈5%.

E(level)[†]	Jπ[#]	L[@]	dσ/dΩ (at 30°) μb/sr[b]	Comments
0.0	0^+	0	1296[c] *31*	dσ/dΩ=3.44 mb/sr *1* at 6°, 0.885 mb/sr *4* at 15°. σ(6°)/σ(15°)>2 (2012ThZZ). Relative strength=79.4 (2012Th07) at 6°.
734.7 *1*	0^+	0	219 *13*	E(level): others: 734.6 *9* in 2012Th07, 737 *10* in 1973Sh09. dσ/dΩ=0.643 mb/sr *5* at 6°, 0.150 mb/sr *2* at 15°. σ(6°)/σ(15°)>2 (2012ThZZ). Relative strength=13.5 (2012Th07) at 6°.
787.5 *2*		(2)[&]	74 *8*	E(level): other: 790 *10* (1973Sh09). dσ/dΩ=0.070 mb/sr *1* at 6°, 0.094 mb/sr *1* at 15° (2012ThZZ).
1435.9 *6*		(2)[&]	2.4 *4*	E(level): other: 1431 *10* (1973Sh09). dσ/dΩ=0.0021 mb/sr *2* at 6°, 0.0047 mb/sr *2* at 15° (2012ThZZ).
1511.3 *6*		(4+2)[&]	7.6 *9*	E(level): other: 1515 *10* (1973Sh09). dσ/dΩ=0.0056 mb/sr *3* at 6°, 0.0076 mb/sr *4* at 15° (2012ThZZ).
1758.2 *5*		(2)[&]	6.9 *12*	E(level): other: 1768 *10* (1973Sh09). dσ/dΩ=0.0039 mb/sr *3* at 6°, 0.0140 mb/sr *5* at 15° (2012ThZZ).
1962.3 *3*	0^+	0	13.7 *12*	E(level): other: 1964 *10* (1973Sh09). dσ/dΩ=0.0457 mb/sr *9* at 6°, 0.0083 mb/sr *4* at 15° (2012ThZZ) σ(6°)/σ(15°)>2. Relative strength=0.883 (2012Th07) at 6°.
2013.0 *4*		3	40.1 *20*	E(level): other: 2021 *10* (1973Sh09). dσ/dΩ=0.0052 mb/sr *4* at 6°, 0.0228 mb/sr *7* at 15° (2012ThZZ).
2034.7 *5*	0^+			dσ/dΩ=0.0137 mb/sr *5* at 6°, 0.0038 mb/sr *4* at 15° (2012ThZZ) σ(6°)/σ(15°)>2. Relative strength=0.264 (2012Th07) at 6°.
2199.9 *2*		2	46 *3*	E(level): other: 2211 *10* (1973Sh09). dσ/dΩ=0.062 mb/sr *1* at 6°, 0.128 mb/sr *2* at 15° (2012ThZZ).
2216.1 *3*				E(level): other: 2227 *10* (1973Sh09). dσ/dΩ=0.0136 mb/sr *6* at 6°, 0.0207 mb/sr *6* at 15° (2012ThZZ).
2328.2 *2*		2	35.6 *16*	E(level): other: 2336 *10* (1973Sh09). dσ/dΩ=0.033 mb/sr *1* at 6°, 0.0682 mb/sr *8* at 15° (2012ThZZ).

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^{100}Mo(p,t) 2012Th07,2012ThZZ,1973Sh09 (continued)

^{98}Mo Levels (continued)

E(level)[†]	J$^{\pi}$[#]	L[@]	dσ/dΩ (at 30°) μb/sr[b]	Comments
2417 *1*		3	3.1 *5*	E(level): other: 2423 *10* (1973Sh09). dσ/dΩ=0.0048 mb/sr *4* at 6°, 0.0052 mb/sr *2* at 15° (2012ThZZ).
2489 *3*		(3)[a]		E(level): other: 2504 *10* (1973Sh09); probably corresponds to 2489+2502 in 2012Th07. dσ/dΩ=0.0007 mb/sr *1* at 15° (2012ThZZ).
2502.1 *10*				dσ/dΩ=0.0016 mb/sr *2* at 6°, 0.0017 mb/sr *1* at 15° (2012ThZZ).
2520.4 *4*				dσ/dΩ=0.0045 mb/sr *3* at 6°, 0.0119 mb/sr *3* at 15° (2012ThZZ).
2568.7 *2*		4	45 *3*	E(level): other: 2579 *10* (1973Sh09). dσ/dΩ=0.0486 mb/sr *10* at 6°, 0.0508 mb/sr *7* at 15° (2012ThZZ).
2611.3 *2*	0^{+}	0	56 *4*	E(level): other: 2617 *10* (1973Sh09). dσ/dΩ=0.165 mb/sr *3* at 6°, 0.0298 mb/sr *8* at 15° (2012ThZZ) σ(6°)/σ(15°)>2. Relative strength=3.17 (2012Th07) at 6°.
2646[‡] *10*				E(level): level not reported by 2012Th07.
2678 *1*				dσ/dΩ=0.0019 mb/sr *3* at 6°, 0.0027 mb/sr *2* at 15° (2012ThZZ).
2699.6 *2*		2	16.8 *19*	E(level): other: 2708 *10* (1973Sh09). dσ/dΩ=0.032 mb/sr *1* at 6°, 0.060 mb/sr *1* at 15° (2012ThZZ).
2731.6 *3*		2		E(level): other: 2740 *10* (1973Sh09). dσ/dΩ=0.0150 mb/sr *8* at 6°, 0.0367 mb/sr *8* at 15° (2012ThZZ).
2799.6 *5*	0^{+}	0		E(level): other: 2803 *10* (1973Sh09). dσ/dΩ=0.025 mb/sr *1* at 6°, 0.0046 mb/sr *10* at 15° (2012ThZZ) σ(6°)/σ(15°)>2. Relative strength=0.49 (2012Th07) at 6°.
2811.1 *8*				dσ/dΩ=0.0042 mb/sr *6* at 6°, 0.0066 mb/sr *4* at 15° (2012ThZZ).
2835.3 *9*		4		E(level): other: 2840 *10* (1973Sh09). dσ/dΩ=0.0022 mb/sr *3* at 6°, 0.0058 mb/sr *3* at 15° (2012ThZZ).
2868 *2*				dσ/dΩ=0.0037 mb/sr *4* at 6°, 0.0040 mb/sr *3* at 15° (2012ThZZ).
2902.2 *7*				dσ/dΩ=0.0099 mb/sr *4* at 15° (2012ThZZ).
2914.4 *3*				E(level): other: 2920 *10* (1973Sh09). dσ/dΩ=0.0217 mb/sr *9* at 6°, 0.0476 mb/sr *10* at 15° (2012ThZZ).
2963 *1*				dσ/dΩ=0.0013 mb/sr *3* at 6°, 0.0018 mb/sr *2* at 15° (2012ThZZ).
2977.4 *4*		4	17.2 *19*	E(level): other: 2978 *10* (1973Sh09). dσ/dΩ=0.020 mb/sr *2* at 6°, 0.0191 mb/sr *6* at 15° (2012ThZZ).
3021 *1*		4	7.9 *13*	E(level): other: 3025 *10* (1973Sh09). dσ/dΩ=0.0032 mb/sr *4* at 6°, 0.0029 mb/sr *2* at 15° (2012ThZZ).
3050 *2*				dσ/dΩ=0.0018 mb/sr *2* at 15° (2012ThZZ).
3067.8 *9*		3	5.1 *11*	E(level): other: 3073 *10* (1973Sh09). dσ/dΩ=0.0031 mb/sr *3* at 6°, 0.0052 mb/sr *3* at 15° (2012ThZZ).
3105.3 *5*		2	4.3 *5*	E(level): other: 3110 *10* (1973Sh09). dσ/dΩ=0.0086 mb/sr *6* at 6°, 0.0201 mb/sr *6* at 15° (2012ThZZ).
3150 *2*				dσ/dΩ=0.0018 mb/sr *2* at 15° (2012ThZZ).
3167 *3*				dσ/dΩ=0.0006 mb/sr *1* at 15° (2012ThZZ).
3197 *1*				dσ/dΩ=0.0021 mb/sr *5* at 6°, 0.0017 mb/sr *2* at 15° (2012ThZZ).
3211.6 *7*		4	7.3 *9*	E(level): other: 3215 *10* (1973Sh09). dσ/dΩ=0.0045 mb/sr *6* at 6°, 0.0077 mb/sr *4* at 15° (2012ThZZ).
3239.1 *9*				dσ/dΩ=0.0060 mb/sr *3* at 15° (2012ThZZ).
3264.9 *5*	0^{+}	0	19.9 *14*	E(level): other: 3270 *10* (1973Sh09). dσ/dΩ=0.048 mb/sr *1* at 6°, 0.0045 mb/sr *3* at 15° (2012ThZZ) σ(6°)/σ(15°)>2. Relative strength=0.94 (2012Th07) at 6°.
3302.9 *6*				E(level): other: 3302 *10* (1973Sh09). dσ/dΩ=0.0046 mb/sr *4* at 6°, 0.0117 mb/sr *5* at 15° (2012ThZZ).
3326 *2*				dσ/dΩ=0.0013 mb/sr *2* at 15° (2012ThZZ).
3343 *2*				dσ/dΩ=0.0016 mb/sr *2* at 15° (2012ThZZ).
3386.2 *10*				dσ/dΩ=0.0020 mb/sr *3* at 6°, 0.0045 mb/sr *3* at 15° (2012ThZZ).
3421 *1*				dσ/dΩ=0.0033 mb/sr *4* at 6°, 0.0030 mb/sr *2* at 15° (2012ThZZ).

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^{100}Mo(p,t) 2012Th07,2012ThZZ,1973Sh09 (continued)

^{98}Mo Levels (continued)

E(level)[†]	Comments
3457 *1*	dσ/dΩ=0.0023 mb/sr *3* at 6°, 0.0014 mb/sr *2* at 15° (2012ThZZ).
3474 *2*	dσ/dΩ=0.0009 mb/sr *1* at 15° (2012ThZZ).
3489 *1*	E(level): other: 3487 *10* (1973Sh09). dσ/dΩ=0.0018 mb/sr *3* at 6°, 0.0037 mb/sr *3* at 15° (2012ThZZ).
3515.7 *10*	dσ/dΩ=0.0051 mb/sr *4* at 6°, 0.0030 mb/sr *2* at 15° (2012ThZZ).
3634[‡] *10*	
3685[‡] *10*	
3796[‡] *10*	
3851[‡] *10*	
3951[‡] *10*	
4169[‡] *10*	
4253[‡] *10*	
4356[‡] *10*	
≈8800[‡]	E(level): wide structure at 8.8 MeV with Γ=4.5 MeV reported by 1982Na06. This is interpreted as due to 2-hole states from pick up of two neutrons from $1g_{9/2}$, $2p_{1/2}$, $2p_{1/2}$ and $1f_{5/2}$ orbits, with dσ/dΩ (12.5°)=230 μb/sr.

[†] From 2012ThZZ, unless otherwise stated. Values for 0^+ levels are also listed in 2012Th07.
[‡] Level from 1973Sh09 only.
[#] 0^+ assignment from σ(6°)/σ(15°)>2 (2012Th07,2012ThZZ).
[@] From comparison with DWBA calculations (1973Sh09).
[&] σ(θ) agreement between experiment and DWBA calculations is poor, probably due to two-step processes. L assignment is based on comparison with σ(θ) data from other experiments (1973Sh09).
[a] 1973Sh09 give L=3 in table but no σ(θ) data and cross sections are given for this state.
[b] Relative integrated σ (10° to 50°) are also given by 1973Sh09.
[c] σ(absolute) (52 MeV)=271 μb/sr *5* (1985Mi06).