^{165}Ho(^{3}He,d),(α,t)   1993Li12,1979Pa15

	Type	Author	History Citation	Literature Cutoff Date
	Full Evaluation	Coral M. Baglin	NDS 109, 1103 (2008)	1-Mar-2008

Target J^π=7/2$^-$.

Other measurements: 1974Ka02, 1969Bu01.

1993Li12:

E(^{3}He)=25 MeV, Eα=40 MeV; Q3d magnetic spectrometer with position sensitive detector In focal plane, FWHM≈20 keV; θ(lab)=40° and 65° for (^{3}He,d), 20° and 30° for (α,t); measured E(level) and dσ/dΩ; DWBA calculations.

1979Pa15:

E(^{3}He)=24 MeV and E(^{4}He)=27 MeV; Enge split-pole magnetic spectrograph, photographic emulsions (FWHM=13-15 keV); measured E(level), dσ/dΩ.

^{166}Er Levels

E(level)[†]	J$^\pi$[‡]	dσ/dΩ(60°) (α,t) μb/sr[#]	Comments
0[a]	0$^+$	<1.0	dσ/dΩ(μb/sr) In (^{3}He,d) At E(^{3}He)=24 MeV (1979Pa15): <1.0 At 45°.
80[a]	2$^+$	6.1	dσ/dΩ(μb/sr) In (^{3}He,d) At E(^{3}He)=24 MeV (1979Pa15): 2.2 At 45°, 1.6 At 60°.
264[a]	4$^+$	24	other E: 258 In 1993Li12.
			dσ/dΩ(μb/sr) In (^{3}He,d) At E(^{3}He)=24 MeV (1979Pa15): 6.4 At 45°, 5.2 At 60°.
545[a]	6$^+$	10.7	dσ/dΩ(μb/sr) In (^{3}He,d) At E(^{3}He)=24 MeV (1979Pa15): 2.8 At 45°, 2.6 At 60°.
786[b]	2$^+$	<1.0	dσ/dΩ(μb/sr) In (^{3}He,d) At E(^{3}He)=24 MeV (1979Pa15): <1.0 At 45° and 60°.
859[b]	3$^+$	1.0	E(level): absent In (^{3}He,d) (1979Pa15).
910[a]	8$^+$	1.0	dσ/dΩ(μb/sr) In (^{3}He,d) At E(^{3}He)=24 MeV (1979Pa15): <1.0 At 45°.
955[b]	4$^+$	1.0	dσ/dΩ(μb/sr) In (^{3}He,d) At E(^{3}He)=24 MeV (1979Pa15): <1.0 At 45° and 60°.
1076[b]	5$^+$	1.0	dσ/dΩ(μb/sr) In (^{3}He,d) At E(^{3}He)=24 MeV (1979Pa15): <1.0 At 45° and 60°.
1215[b]	6$^+$		E(level): absent In (α,t) (1979Pa15) and In 1993Li12.
			dσ/dΩ(μb/sr) In (^{3}He,d) At E(^{3}He)=24 MeV (1979Pa15): <1.0 At 45° and 60°.
1452		<1.0	E(level): absent In (^{3}He,d) (1979Pa15).
1529		1.6	E(level): absent In (^{3}He,d) (1979Pa15).
1557[&b]	8$^+$		
1572[c]	(4$^-$)	29	dσ/dΩ(μb/sr) In (^{3}He,d) At E(^{3}He)=24 MeV (1979Pa15): 27 At 45°, 17.7 At 60°.
1595[c]	4$^-$	3.0	dσ/dΩ(μb/sr) In (^{3}He,d) At E(^{3}He)=24 MeV (1979Pa15): 1.9 At 45°, 1.7 At 60°.
1651[&]			
1665[c]	(5$^-$)	13.5	dσ/dΩ(μb/sr) In (^{3}He,d) At E(^{3}He)=24 MeV (1979Pa15): 9.8 At 45°, 7.2 At 60°.
1680[c]		≈1.0	dσ/dΩ(μb/sr) In (^{3}He,d) At E(^{3}He)=24 MeV (1979Pa15): 3.0 At 45°, 2.6 At 60°.
1692	(5$^-$)	≈12.8	dσ/dΩ(μb/sr) In (^{3}He,d) At E(^{3}He)=24 MeV (1979Pa15): 8.2 At 45°, 5.0 At 60°.
1720		2.6	dσ/dΩ(μb/sr) In (^{3}He,d) At E(^{3}He)=24 MeV (1979Pa15): 1.2 At 45°, 1.4 At 60°.
1757		2.2	dσ/dΩ(μb/sr) In (^{3}He,d) At E(^{3}He)=24 MeV (1979Pa15): <1.0 At 45° and 60°.
1785[c]	(6$^-$)	2.5	dσ/dΩ(μb/sr) In (^{3}He,d) At E(^{3}He)=24 MeV (1979Pa15): 1.9 At 45°, 1.7

^{165}Ho(^{3}He,d),(α,t)   **1993Li12,1979Pa15 (continued)**

^{166}Er Levels (continued)

E(level)[†]	J$^{\pi}$[‡]	dσ/dΩ(60°) (α,t) μb/sr[#]	Comments
			At 60°.
1813			E(level): absent In (α,t) (1979Pa15) and In 1993Li12.
			dσ/dΩ(μb/sr) In (^{3}He,d) At E(^{3}He)=24 MeV (1979Pa15): <1.0 At 45°.
1828[c]	(6$^-$)	5.7	dσ/dΩ(μb/sr) In (^{3}He,d) At E(^{3}He)=24 MeV (1979Pa15): 6.4 At 45°, 4.9 At 60°.
1864		4.5	dσ/dΩ(μb/sr) In (^{3}He,d) At E(^{3}He)=24 MeV (1979Pa15): 4.4 At 45°, 3.5 At 60°.
1916[d]	(3$^-$)	13.8	dσ/dΩ(μb/sr) In (^{3}He,d) At E(^{3}He)=24 MeV (1979Pa15): 18.0 At 45°, 11.9 At 60°.
1938		4.5	dσ/dΩ(μb/sr) In (^{3}He,d) At E(^{3}He)=24 MeV (1979Pa15): 1.4 At 45°, 2.0 At 60°.
1976[e]	4$^+$[@]	11.2	dσ/dΩ(μb/sr) In (^{3}He,d) At E(^{3}He)=24 MeV (1979Pa15): 13.2 At 45°, 9.2 At 60°.
1989[f]	(7$^-$)	35	dσ/dΩ(μb/sr) In (^{3}He,d) At E(^{3}He)=24 MeV (1979Pa15): 19.4 At 45°, 16.9 At 60°.
2002[d]	(4$^-$)	12.7	dσ/dΩ(μb/sr) In (^{3}He,d) At E(^{3}He)=24 MeV (1979Pa15): 14.9 At 45°, 10.3 At 60°.
2022		10.4	dσ/dΩ(μb/sr) In (^{3}He,d) At E(^{3}He)=24 MeV (1979Pa15): 11.7 At 45°, 7.3 At 60°.
2045[e]	5$^+$[@]	19.0	dσ/dΩ(μb/sr) In (^{3}He,d) At E(^{3}He)=24 MeV (1979Pa15): 14.9 At 45°, 15.8 At 60°.
2057[k]	(1$^-$)	17.2	E(level): doublet; J=1, K$^{\pi}$=1$^-$ and J=2, K$^{\pi}$=2$^-$.
			dσ/dΩ(μb/sr) In (^{3}He,d) At E(^{3}He)=24 MeV (1979Pa15): 33 At 45°, 19.1 At 60° for presumed doublet.
2057[g]	(2$^-$)		
2074	(2$^-$)	3.5	dσ/dΩ(μb/sr) In (^{3}He,d) At E(^{3}He)=24 MeV (1979Pa15): 2.0 At 45°, 2.9 At 60°.
2116	(6$^+$)	2.2	dσ/dΩ(μb/sr) In (^{3}He,d) At E(^{3}He)=24 MeV (1979Pa15): 2.2 At 45°, 1.9 At 60°.
2132[e]	(6$^+$)	38	E(level): triplet; J=3, K$^{\pi}$=3$^+$ and J=6, K$^{\pi}$=4$^+$ and J=3, K$^{\pi}$=2$^-$.
			dσ/dΩ(μb/sr) In (^{3}He,d) At E(^{3}He)=24 MeV (1979Pa15): 36 At 45°, 26 At 60° for presumed triplet.
2132[h]	3$^+$[@]		
2132[g]	3$^-$[@]		
2152[k]	(2$^-$)	≈8	dσ/dΩ(μb/sr) In (^{3}He,d) At E(^{3}He)=24 MeV (1979Pa15): 13.0 At 45°, 11.3 At 60°.
2167	(2$^-$)	2.0	E(level): absent In 1993Li12.
			dσ/dΩ(μb/sr) In (^{3}He,d) At E(^{3}He)=24 MeV (1979Pa15): 3.5 At 45°, 1.8 At 60°.
2204		11.6	dσ/dΩ(μb/sr) In (^{3}He,d) At E(^{3}He)=24 MeV (1979Pa15): 5.0 At 45°, 6 At 60°.
2217		8.0	E(level): absent In 1993Li12.
			dσ/dΩ(μb/sr) In (^{3}He,d) At E(^{3}He)=24 MeV (1979Pa15): 8.7 At 45°, 6.2 At 60°.
2226[k]	(3$^-$)	≈5	E(level): doublet. J=3, K$^{\pi}$=1$^-$ and J=4, K$^{\pi}$=2$^-$.
			dσ/dΩ(μb/sr) In (^{3}He,d) At E(^{3}He)=24 MeV (1979Pa15): 11.7 At 45°, 9.8 At 60°.
2226[g]	(4$^-$)		
2239[h]	4$^+$[@]	12.9	dσ/dΩ(μb/sr) In (^{3}He,d) At E(^{3}He)=24 MeV (1979Pa15): 11.2 At 45°, 8.5 At 60°.
2266[e]	7$^+$[@]	3.6	dσ/dΩ(μb/sr) In (^{3}He,d) At E(^{3}He)=24 MeV (1979Pa15): 4.3 At 45°, 3.2 At 60°.

Continued on next page (footnotes at end of table)

$^{165}\text{Ho}(^3\text{He,d}),(\alpha,\text{t})$ **1993Li12,1979Pa15 (continued)**

^{166}Er Levels (continued)

E(level)[†]	J[π‡]	$d\sigma/d\Omega(60°)$ (α,t) μb/sr[#]	Comments
2279		1.6	E(level): absent In $(^3\text{He,d})$ (1979Pa15). Other E: 2283 In 1993Li12.
2289			E(level): absent In (α,t) (1979Pa15).
			$d\sigma/d\Omega(\mu\text{b/sr})$ In $(^3\text{He,d})$ At E(^3He)=24 MeV (1979Pa15): 3.1 At 45°, 1.0 At 60°.
2313		2.0	$d\sigma/d\Omega(\mu\text{b/sr})$ In $(^3\text{He,d})$ At E(^3He)=24 MeV (1979Pa15): 4.2 At 45°, 2.6 At 60°.
2333		5.1	$d\sigma/d\Omega(\mu\text{b/sr})$ In $(^3\text{He,d})$ At E(^3He)=24 MeV (1979Pa15): 8.4 At 45°, 6.6 At 60°.
2347		3.4	E(level): absent In $(^3\text{He,d})$ (1979Pa15) and In 1993Li12.
2359[h]	5+ [@]	3.4	$d\sigma/d\Omega(\mu\text{b/sr})$ In $(^3\text{He,d})$ At E(^3He)=24 MeV (1979Pa15): 4.1 At 45°, 3.2 At 60°.
2368			E(level): absent In $(^3\text{He,d})$ (1979Pa15) and In 1993Li12.
2388		≈2	absent In 1993Li12.
			$d\sigma/d\Omega(\mu\text{b/sr})$ In $(^3\text{He,d})$ At E(^3He)=24 MeV (1979Pa15): 4 At 45°, 4.5 At 60°.
2402		≈6	$d\sigma/d\Omega(\mu\text{b/sr})$ In $(^3\text{He,d})$ At E(^3He)=24 MeV (1979Pa15): 6 At 45°, 6.3 At 60°.
2418		1.8	E(level): 1993Li12 report E=2430; possibly this a doublet consisting of the 2418 and 2438 levels reported by 1975Pa15.
			$d\sigma/d\Omega(\mu\text{b/sr})$ In $(^3\text{He,d})$ At E(^3He)=24 MeV (1979Pa15): 3 At 45°.
2438		2.5	E(level): see comment on 2418 level.
			$d\sigma/d\Omega(\mu\text{b/sr})$ In $(^3\text{He,d})$ At E(^3He)=24 MeV (1979Pa15): 3.4 At 45°, 2.3 At 60°.
2453		6.1	$d\sigma/d\Omega(\mu\text{b/sr})$ In $(^3\text{He,d})$ At E(^3He)=24 MeV (1979Pa15): 9.3 At 45°, 7.6 At 60°.
2476		6.2	$d\sigma/d\Omega(\mu\text{b/sr})$ In $(^3\text{He,d})$ At E(^3He)=24 MeV (1979Pa15): 7.0 At 45°, 7.1 At 60°.
2505		5.7	$d\sigma/d\Omega(\mu\text{b/sr})$ In $(^3\text{He,d})$ At E(^3He)=24 MeV (1979Pa15): 5.9 At 45°, 7.2 At 60°.
2537		3.4	$d\sigma/d\Omega(\mu\text{b/sr})$ In $(^3\text{He,d})$ At E(^3He)=24 MeV (1979Pa15): 3.0 At 45°, 5.7 At 60°.
2568[h]	6+ [@]	3.0	$d\sigma/d\Omega(\mu\text{b/sr})$ In $(^3\text{He,d})$ At E(^3He)=24 MeV (1979Pa15): <2 At 45°.
2583			E(level): absent In (α,t) (1979Pa15).
			$d\sigma/d\Omega(\mu\text{b/sr})$ In $(^3\text{He,d})$ At E(^3He)=24 MeV (1979Pa15): 7.7 At 45°, 7.0 At 60°.
2608	(6−)	34	possible configuration: $\pi^2(7/2[523]+5/2[402])$ (1993Li12).
			$d\sigma/d\Omega(\mu\text{b/sr})$ In $(^3\text{He,d})$ At E(^3He)=24 MeV (1979Pa15): 74 At 45°, 56 At 60°.
2632		9.8	$d\sigma/d\Omega(\mu\text{b/sr})$ In $(^3\text{He,d})$ At E(^3He)=24 MeV (1979Pa15): 11.9 At 45°, 9.5 At 60°.
2655		8.3	$d\sigma/d\Omega(\mu\text{b/sr})$ In $(^3\text{He,d})$ At E(^3He)=24 MeV (1979Pa15): 14.2 At 45°, 10.3 At 60°.
2671		2.1	absent In 1993Li12.
			$d\sigma/d\Omega(\mu\text{b/sr})$ In $(^3\text{He,d})$ At E(^3He)=24 MeV (1979Pa15): 5.2 At 45°, 3.6 At 60°.
2684[&]			
2713[&h]	7+ [@]		
2742[&]			
2766[&]			
2786[&]			
2808[&]			
2880[&]			

^{165}Ho(^{3}He,d),(α,t)   **1993Li12,1979Pa15 (continued)**

^{166}Er Levels (continued)

E(level)[†]	J$^\pi$[‡]	L	dσ/dΩ(60°) (α,t) μb/sr[#]	Comments
2912			1.3	other E: 2920 In 1993Li12.
				dσ/dΩ(μb/sr) In (^{3}He,d) At E(^{3}He)=24 MeV (1979Pa15): 4.5 At 45°, 3.8 At 60°.
2954			2.1	other E: 2959 In 1993Li12.
				dσ/dΩ(μb/sr) In (^{3}He,d) At E(^{3}He)=24 MeV (1979Pa15): 10.9 At 45°, 10.0 At 60°.
2993			1.9	absent In 1993Li12.
				dσ/dΩ(μb/sr) In (^{3}He,d) At E(^{3}He)=24 MeV (1979Pa15): 10.8 At 45°, 8.7 At 60°.
3000[&]				
3043[&]				
3077[i]	(8$^+$)		6.9	dσ/dΩ(μb/sr) In (^{3}He,d) At E(^{3}He)=24 MeV (1979Pa15): 6.7 At 45°, 4 At 60°.
3087			2.8	other E: 3096 In 1993Li12.
				dσ/dΩ(μb/sr) In (^{3}He,d) At E(^{3}He)=24 MeV (1979Pa15): 5.0 At 45°, 7.5 At 60°.
3147			1.9	dσ/dΩ(μb/sr) In (^{3}He,d) At E(^{3}He)=24 MeV (1979Pa15): 12.4 At 45°.
3160			1.2	other E: 3168 In 1993Li12.
				dσ/dΩ(μb/sr) In (^{3}He,d) At E(^{3}He)=24 MeV (1979Pa15): 10.5 At 45°.
3211[&]				
3239			4.7	dσ/dΩ(μb/sr) In (^{3}He,d) At E(^{3}He)=24 MeV (1979Pa15): 11.7 At 45°.
3253[&]				
3273[i]	(9$^+$)		13.7	dσ/dΩ(μb/sr) In (^{3}He,d) At E(^{3}He)=24 MeV (1979Pa15): 11.2 At 45°, 6.1 At 60°.
3296[&]				
3322[&]				
3345[&]				
3371[&]				
3394[&]				
3429[&]				
3459[&]				
3476				E(level): absent In (α,t) (1979Pa15). other E: 3482 In 1993Li12.
				dσ/dΩ(μb/sr) In (^{3}He,d) At E(^{3}He)=24 MeV (1979Pa15): 15.1 At 45°.
3501		0	<2	E(level): absent In (α,t) (1979Pa15).
				L: based on dσ/dΩ(^{3}He,d)/dσ/dΩ(α,t) At 60°.
				dσ/dΩ(μb/sr) In (^{3}He,d) At E(^{3}He)=24 MeV (1979Pa15): 25.0 At 45°, 22 At 60°.
3554[&]				
3579[&]				
3600[&]				
3627[&]				
3663[&]				
3721[&]				
3751[&]				
3783[&]				
3808[&]				

^{165}Ho(^{3}He,d),(α,t)   **1993Li12,1979Pa15 (continued)**

^{166}Er Levels (continued)

E(level)[†]	E(level)[†]	E(level)[†]	E(level)[†]
3838[&]	4026[&]	4174[&]	4381[&]
3856[&]	4045[&]	4227[&]	4407[&]
3881[&]	4064[&]	4256[&]	4418[&]
3907[&]	4087[&,j]	4274[&]	4442[&]
3932[&]	4106[&]	4297[&]	
3978[&]	4126[&]	4329[&]	
4002[&,j]	4149[&]	4359[&]	

[†] From 1979Pa15, except As noted. if level is observed In both (^{3}He,d) and (α,t), the mean of the two energies is given.

[‡] Assignments based on (^{3}He,d) or (α,t) cross section and (^{3}He,d) to (α,t) cross section ratios.

[#] $d\sigma/d\Omega$ At 60° and Eα=27 MeV for the (α,t) reaction (μb/sr) (1979Pa15).

[@] Definite J$^\pi$ assigned based on cross section fingerprint.

[&] From 1993Li12. uncertainty not stated by authors.

[a] Band(A): K$^\pi$=0$^+$ g.s. band. Configuration: 7/2[523]−7/2[523].

[b] Band(B): K$^\pi$=2$^+$ γ-vibrational band.

[c] Band(C): mixed K$^\pi$=2$^-$ and 4$^-$ bands. K=2 octupole-vibrational states are strongly Coriolis mixed with K$^\pi$=4$^-$ two-quasiproton 7/2[523]+1/2[411] states for J≥4. K=2 dominates in 1458, 1514, 1596, and 1692 levels, K=4 dominates in 1572 and 1666 levels and K=2 and K=4 amplitudes are comparable for the E>1692 levels (see mixing calculations In 1989Ad12).

[d] Band(D): K$^\pi$=3$^-$ band. Configuration: 7/2[523]−1/2[411].

[e] Band(E): K$^\pi$=4$^+$ band. Configuration: 7/2[523]+1/2[541]; established from (α,t), (^{3}He,d) cross section fingerprint for observed band members.

[f] Band(F): K$^\pi$=7$^-$ band. Configuration: 7/2[523]+7/2[404].

[g] Band(G): K$^\pi$=2$^-$ band. Configuration: 7/2[523]−3/2[411].

[h] Band(H): K$^\pi$=3$^+$ band. Configuration: 7/2[523]−1/2[541]; established from (α,t), (^{3}He,d) cross section fingerprint for observed band members.

[i] Band(I): K$^\pi$=8$^+$ band. Configuration: 7/2[523]+9/2[514].

[j] Band(J): K$^\pi$=1+? band. Possible configuration: 7/2[523]−9/2[514].

[k] Band(K): K$^\pi$=1$^-$ band. Configuration: 7/2[523]−5/2[402].

$^{165}\text{Ho}(^3\text{He,d}),(\alpha,t)$ **1993Li12,1979Pa15**

Band(E): $K^\pi=4^+$ band

7^+ 2266

(6^+) 2132

Band(D): $K^\pi=3^-$ band

5^+ 2045   **Band(F): $K^\pi=7^-$ band**

(4^-) 2002 4^+ 1976 (7^-) 1989

Band(C): Mixed $K^\pi=2^-$ and 4^- bands (3^-) 1916

(6^-) 1828
(6^-) 1785

Band(B): $K^\pi=2^+$ γ-vibrational band   1680
(5^-) 1665
4^- 1595
(4^-) 1572

8^+ 1557

6^+ 1215

5^+ 1076

Band(A): $K^\pi=0^+$ g.s. band

4^+ 955

8^+ 910

3^+ 859

2^+ 786

6^+ 545

4^+ 264

2^+ 80

0^+ 0

$^{166}_{68}\text{Er}_{98}$

^{165}Ho(^{3}He,d),(α,t)   1993Li12,1979Pa15 (continued)

Band(J): K$^\pi$=1+? band

_____ **4087**

_____ **4002**

Band(I): K$^\pi$=8$^+$ band

(9$^+$)   **3273**

(8$^+$)   **3077**

Band(H): K$^\pi$=3$^+$ band

7$^+$ **2713**

6$^+$ **2568**

5$^+$ **2359**

Band(G): K$^\pi$=2$^-$ band

(4$^-$)   **2226**   **4$^+$**   **2239**   **Band(K): K$^\pi$=1$^-$ band**

(3$^-$)   **2226**

(2$^-$)   **2152**

3$^-$ **2132**   **3$^+$**   **2132**

(2$^-$)   **2057**   **(1$^-$)**   **2057**

$^{166}_{68}$Er$_{98}$