^{166}Er(α,t) 1974Ch44

History

Type	Author	Citation	Literature Cutoff Date
Full Evaluation	Balraj Singh and Jun Chen	NDS 191,1 (2023)	22-Aug-2023

1974Ch44: E(α)=27 MeV. Targets of 96.24% enriched ^{166}Er oxide. Analyzed deuterons using Enge split-pole magnetic spectrograph, and analyzed particles recorded on nuclear emulsion plates at the McMaster University FM Tandem accelerator facility. FWHM=16-18 keV. Deduced differential cross sections and (^{3}He,d)/(α,t) cross-section ratios. Interpreted level structure in terms of Nilsson orbitals using 'fingerprint' method of comparison of spectroscopic factors from DWBA analysis with Nilsson-model predictions, with pairing corrections and Coriolis couplings. Uncertainties in measured absolute cross sections are stated by 1974Ch44 as ≈20%, whereas relative intensities within a spectrum are ≈10%, and relative uncertainty for a peak at different angles is ≈15%.

^{167}Tm Levels

E(level)	J^π[‡]	Nuclear Structure Factor[#]	Comments
0[@]	1/2$^+$		E(level): obscured by strongly populated 10-keV level. Measured dσ/dΩ(μb/sr)=29.3 (45°), 20.2 (60°) for 0+10 levels. σ(^{3}He,d)(60°)/(α,t)(60°)=2.2 for 0+10 levels.
10[@] 2	3/2$^+$		E(level): doublet of 0+10 levels, with dominant population of the 10−keV level. S=0.57 if total dσ/dΩ for 0+10 levels is assigned to 10−keV level. Measured dσ/dΩ(μb/sr)=29.3 (45°), 20.2 (60°) for 0+10 levels. σ(^{3}He,d)(60°)/(α,t)(60°)=2.2 for 0+10 levels.
116[@] 2	5/2$^+$	0.29	Nuclear Structure Factor: 1974Ch44 noted that this value was two to three times larger than the predicted value for the 5/2$^+$,π1/2[411] configuration, as also is the case for ^{165}Tm, ^{169}Tm and ^{171}Tm. Authors further stated that their Coriolis mixing calculations could not explain this strength in terms of admixtures of other Nilsson states. Measured dσ/dΩ(μb/sr)=12.8 (45°), 10.7 (60°). σ(^{3}He,d)(60°)/(α,t)(60°)=2.6.
142[@] 2	7/2$^+$	0.12	Measured dσ/dΩ(μb/sr)=2.8 (45°), 2.6 (60°). σ(^{3}He,d)(60°)/(α,t)(60°)=1.5.
183 2			E(level),J$^\pi$: complex peak, J^π=7/2$^+$ and 5/2$^-$. S=1.76 if total dσ/dΩ is assigned to the 7/2$^+$,π7/2[404] configuration. S=0.82 if entire cross section is assumed to be for the 5/2$^-$,π1/2[541] level. Measured dσ/dΩ(μb/sr)=52.4 (45°), 37.4 (60°). σ(^{3}He,d)(60°)/(α,t)(60°)=1.8.
290 2			E(level),J$^\pi$: complex peak, J^π=1/2$^-$, 1/2$^-$ and 7/2$^-$. S=0.52 if total dσ/dΩ is assigned to the 3/2$^-$,π1/2[541] configuration; 1.07 if assigned to the 9/2$^-$,π1/2[541] configuration; 0.46 if assigned to the 7/2$^-$,π7/2[523] configuration. Measured dσ/dΩ(μb/sr)=40.2 (45°), 23.0 (60°). σ(^{3}He,d)(60°)/(α,t)(60°)=1.1.
≈325[@]	9/2$^+$		Measured dσ/dΩ(μb/sr)≈1 (45°), ≈1 (60°). σ(^{3}He,d)(60°)/(α,t)(60°)≈2.
462 2	7/2$^-$	0.12	Proposed configuration=π1/2[541] band member; large decoupling parameter (≈3) leads to strongly perturbed level order. Measured dσ/dΩ(μb/sr)=7.9 (45°), 5.3 (60°). σ(^{3}He,d)(60°)/(α,t)(60°)=1.5.
471[&] 2	3/2$^+$	0.05	Measured dσ/dΩ(μb/sr)=1.6 (45°), 1.2 (60°). σ(^{3}He,d)(60°)/(α,t)(60°)=2.7.
496 2	11/2$^-$	0.50	Proposed configuration=π7/2[523] (1974Ch44). Measured dσ/dΩ(μb/sr)=25.5 (45°), 13.0 (60°). σ(^{3}He,d)(60°)/(α,t)(60°)=1.1.
521[†] 2	5/2$^+$	0.85	Proposed configuration=π5/2[402], strongly mixed with π3/2[411] configuration

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^{166}Er(α,t) 1974Ch44 (continued)

^{167}Tm Levels (continued)

E(level)	J^{π}[‡]	L	Nuclear Structure Factor[#]	Comments
				(1974Ch44).
				Measured dσ/dΩ(μb/sr)=25.1 (45°), 23.2 (60°).
				σ(^{3}He,d)(60°)/(α,t)(60°)=4.5.
557[†&] *2*	$5/2^+$		0.29	Measured dσ/dΩ(μb/sr)=9.7 (45°), 7.8 (60°).
				σ(^{3}He,d)(60°)/(α,t)(60°)=3.8.
602 *2*				Measured dσ/dΩ(μb/sr)≈1 (45°), ≈1 (60°).
700 *2*				Measured dσ/dΩ(μb/sr)=1.8 (45°), 2.4 (60°).
717 *2*				Measured dσ/dΩ(μb/sr)=≈1 (45°).
770 *2*				Measured dσ/dΩ(μb/sr)=1.7 (45°), 2.5 (60°).
1043 *2*	$11/2^-$		0.73	Proposed configuration=π9/2[514] (1974Ch44).
				Measured dσ/dΩ(μb/sr)=20.2 (45°), 14.1 (60°).
				σ(^{3}He,d)(60°)/(α,t)(60°)=1.2.
≈1125				Measured dσ/dΩ(μb/sr)≈1 (45°), ≈1 (60°).
				σ(^{3}He,d)(60°)/(α,t)(60°)≈39.
≈1403				Measured dσ/dΩ(μb/sr)≈1 (45°), ≈1 (60°).
				σ(^{3}He,d)(60°)/(α,t)(60°)≈73.
1527 *2*		(3)		1974Ch44 suggested that 1527 level might be $7/2^-$,π1/2[530] state. See ^{167}Tm Adopted Levels for $(5/2^-)$ assignment to state at 1527.5 keV.
				Measured dσ/dΩ(μb/sr)=7.3 (45°), 8.0 (60°).
				L: from σ(^{3}He,d)(60°)/(α,t)(60°)=5.9.
≈1549				Measured dσ/dΩ(μb/sr)≈2 (45°).
≈1582				Measured dσ/dΩ(μb/sr)≈1 (45°).
≈1597				Measured dσ/dΩ(μb/sr)≈1 (45°).
≈1630				Measured dσ/dΩ(μb/sr)≈1 (45°).

[†] Note that in (α,2nγ) study, 1980Ol05 assigned reversed configurations: π3/2[411] for the 522, $5/2^+$ level and π5/2[402] for the 578, $5/2^+$ level, based on initial proposed assignments in decay study by 1971Fu10. This reversal was adopted in the 2000 evaluation. Present evaluators adopt assignments for these two levels from 1974Ch44, considering that 'finger-print' method in particle-transfer reaction is more sensitive to the configuration assignment than the γ-ray studies by 1980Ol05 and 1971Fu10. Additionally, 1980Ol05 point out that the two $5/2^+$ levels likely have a mixed configuration (π3/2[411]+π5/2[402]), thus assignment of a single configuration to each of these two levels is not meaningful.

[‡] From 1974Ch44, based on $\sigma(\theta)$ distributions in (^{3}He,d) and (^{3}He,d)/(α,t) cross-section ratios, 'finger-print' method.

[#] $(\Sigma a_i C^l_{ji} U_i)^2$, with normalization factor N=50.

[@] Band(A): π1/2[411] band.

[&] Band(B): π3/2[411] band. Strongly mixed with π5/2[402] configuration.

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Band(B): π3/2[411] band

5/2$^+$ 557

3/2$^+$ 471

Band(A): π1/2[411] band

9/2$^+$ ≈325

7/2$^+$ 142

5/2$^+$ 116

3/2$^+$ 10

1/2$^+$ 0

$^{167}_{69}Tm_{98}$