^{168}Er(pol t,α) 1979Lo02

History

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

1979Lo02: E(t)=17 MeV with polarization of 0.78 (average value). Target=97.7% enriched ^{168}Er. Measured α spectra, $\sigma(\theta)$ and analyzing powers $A_y(\theta)$ from 10° to 50°, absolute σ using Q3D magnetic spectrograph with a helical cathode position-sensitive proportional counter at the FN tandem Van de Graaff accelerator of Los Alamos National Laboratory. FWHM≈16 keV. DWBA analysis of $\sigma(\theta)$ and $A_y(\theta)$ data. The uncertainties in the absolute σ values estimated at 20%, and in relative σ values at 5%. ^{167}Ho level structure interpreted in terms of Nilsson model, including pairing and Coriolis-coupling effects.

^{167}Ho Levels

Note about L-transfers: 1979Lo02 state, "The fit to the measured analyzing powers was good, but the cross section angular distributions were not well described in these calculations. In particular, the experimental cross sections tended to be larger at forward angles than predicted, especially for L=4 and L=5". As 1979Lo02 do not specify L values explicitly, except L=2 for the 1403 level, evaluators list implicit L values in comments, based on assigned J^π values in 1979Lo02.

E(level)	J^π[‡]	Nuclear Structure Factor[&]	Comments
0[a]	7/2$^-$	0.056	Implicit L=3 from J^π assignment based on $A_y(\theta)$ distributions. The $\sigma(\theta)$ distribution in Fig. 3a of 1979Lo02 is in poor agreement with L=3. dσ/dΩ (30°)=19 μb/sr, A_y (30°)=+0.50 *10*.
100[a] *4*	9/2$^-$	0.090	Implicit L=5 from J^π assignment based on $A_y(\theta)$ distributions. The $\sigma(\theta)$ distribution in Fig. 3a of 1979Lo02 is in reasonable agreement with L=5. dσ/dΩ (30°)=14 μb/sr, A_y (30°)=−0.73 *10*.
221[a] *4*	11/2$^-$	1.43	Implicit L=5 from J^π assignment based on $A_y(\theta)$ distributions. The $\sigma(\theta)$ distribution in Fig. 3a of 1979Lo02 is in good agreement with L=5. dσ/dΩ (30°)=221 μb/sr, A_y (30°)=+0.52 *3*. Large spectroscopic factor consistent with origin of π7/2[523] orbital in the $\pi h_{11/2}$ shell-model state.
259[b] *4*	3/2$^+$	0.11	Implicit L=2 from J^π assignment based on $A_y(\theta)$ distributions. The $\sigma(\theta)$ distribution in Fig. 3a of 1979Lo02 is in approximate agreement with L=2. dσ/dΩ (30°)=29 μb/sr, A_y (30°)=−0.76 *7*.
321[b] *4*	5/2$^+$	0.70	Implicit L=2 from J^π assignment based on $A_y(\theta)$ distributions. The $\sigma(\theta)$ distribution in Fig. 3a of 1979Lo02 is in approximate agreement with L=2. dσ/dΩ (30°)=288 μb/sr, A_y (30°)=+0.43 *3*.
409[c] *4*	3/2$^+$	0.26	Implicit L=2 from J^π assignment based on $A_y(\theta)$ distributions. The $\sigma(\theta)$ distribution in Fig. 3a of 1979Lo02 is in reasonable agreement with L=2. dσ/dΩ (30°)=97 μb/sr, A_y (30°)=−0.51 *4*. E(level): includes possible component from 7/2$^+$, π3/2[411] state.
507[b] *4*	(9/2$^+$)[#]	0.32	Implicit L=(4) from J^π assignment based on $A_y(\theta)$ distributions. The $\sigma(\theta)$ distribution in Fig. 3a of 1979Lo02 is in reasonable agreement with L=4. dσ/dΩ (30°)=44 μb/sr, A_y (30°)=+0.10 *7*.
541[c] *4*	(7/2$^+$)[#]	0.12	Implicit L=(4) from J^π assignment based on $A_y(\theta)$ distributions. The $\sigma(\theta)$ distribution in Fig. 3a of 1979Lo02 is not in good agreement with L=4. dσ/dΩ (30°)=22 μb/sr, A_y (30°)=−0.40 *10*.
702[†] *4*			dσ/dΩ (30°)=8 μb/sr, A_y (30°)=+0.13 *16*.
804[†] *4*			dσ/dΩ (30°)=7 μb/sr, A_y (30°)=+0.16 *17*.
974[d] *4*	7/2$^+$	0.26	Implicit L=4 from J^π assignment based on $A_y(\theta)$ distributions. The $\sigma(\theta)$ distribution in Fig. 3a of 1979Lo02 is in approximate agreement with L=4. dσ/dΩ (30°)=42 μb/sr, A_y (30°)=−0.65 *6*.
1006[e] *4*	(9/2$^-$)[@]	0.060	Implicit L=(5) from J^π assignment based on $A_y(\theta)$ distributions. The $\sigma(\theta)$ distribution in Fig. 3a of 1979Lo02 is in poor agreement with L=5. dσ/dΩ (30°)=9 μb/sr, A_y (30°)=−0.37 *15*.

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^{167}Ho Levels (continued)

E(level)	Jπ‡	Nuclear Structure Factor&	Comments
1092 *4*	(7/2+)#	0.47	Implicit L=(4) from J^π assignment based on $A_y(\theta)$ distributions. The $\sigma(\theta)$ distribution in Fig. 3b of 1979Lo02 is in good agreement with L=4, but poor agreement of $A_y(\theta)$ for L-1/2. $d\sigma/d\Omega$ (30°)=69 μb/sr, A_y (30°)=−0.21 *6*. J^π: possible 7/2 member of a γ-vibration band built on the 1/2+, π1/2[411] state.
1165[g] *4*	7/2+	0.48	Implicit L=4 from J^π assignment based on $A_y(\theta)$ distributions. The $\sigma(\theta)$ distribution in Fig. 3b of 1979Lo02 is in good agreement with L=4. $d\sigma/d\Omega$ (30°)=67 μb/sr, A_y (30°)=−0.73 *5*.
1275[g] *4*	(9/2+)#	0.14	Implicit L=(4) from J^π assignment based on $A_y(\theta)$ distributions. The $\sigma(\theta)$ distribution in Fig. 3b of 1979Lo02 is in reasonable agreement with L=4. $d\sigma/d\Omega$ (30°)=23 μb/sr, A_y (30°)=+0.31 *10*.
1403[f] *4*	(5/2+)#	0.063	L=2 assigned by 1979Lo02 from $\sigma(\theta)$ distribution. J^π: agreement with L+1/2 for $A_y(\theta)$ is poor in Fig. 3b. $d\sigma/d\Omega$ (30°)=22 μb/sr, A_y (30°)=+0.08 *10*.
1464[h] *4*	7/2−	0.12	Implicit L=3 from J^π assignment based on $A_y(\theta)$ distributions. The $\sigma(\theta)$ distribution in Fig. 3b of 1979Lo02 is in approximate agreement with L=3. $d\sigma/d\Omega$ (30°)=52μb/sr, A_y (30°)=+0.45 *6*.
1666[h] *4*	11/2−	1.01	Implicit L=5 from J^π assignment based on $A_y(\theta)$ distributions. The $\sigma(\theta)$ distribution in Fig. 3b of 1979Lo02 is in good agreement with L=5. $d\sigma/d\Omega$ (30°)=108 μb/sr, A_y (30°)=+0.36 *4*.
1707 *4*			$d\sigma/d\Omega$ (30°)=23 μb/sr, A_y (30°)=+0.05 *10*.
1775† *4*			$d\sigma/d\Omega$ (30°)=28 μb/sr, A_y (30°)=+0.34 *9*.
1858[i] *4*	(1/2+)@	0.12	Implicit L=0 from J^π assignment based on $A_y(\theta)$ distributions. The $\sigma(\theta)$ distribution in Fig. 3b of 1979Lo02 is in good agreement with L=0. $d\sigma/d\Omega$ (30°)=70 μb/sr, A_y (30°)=−0.15 *6*.
1938[i] *4*	5/2+	≤0.29	Implicit L=2 from J^π assignment based on $A_y(\theta)$ distributions. The $\sigma(\theta)$ distribution in Fig. 3b of 1979Lo02 is in poor agreement with L=2. $d\sigma/d\Omega$ (30°)=131 μb/sr, A_y (30°)=+0.19 *4*. E(level): doublet from a wider peak than normal, although $\sigma(\theta)$ and $A_y(\theta)$ distributions consistent with 5/2+ for most of the peak (1979Lo02).

† $\sigma(\theta)$ and $A_y(\theta)$ distributions shown in Figs. 3a and 3b of 1979Lo02, but no J^π assignment made.

‡ From angular distributions and analyzing powers.

Assignment by 1979Lo02 considered tentative because of poor fit to $A_y(\theta)$ for a weakly populated level.

@ Possible assignment to a band (1979Lo02).

& Empirical nuclear structure factor=$d\sigma/d\Omega$(exp)/[2N×$d\sigma/d\Omega$(DWBA)], where normalization factor for the DWBA cross sections, N=32.5.

[a] Band(A): π7/2[523] band. As expected from the original $h_{11/2}$ orbital for the 7/2[523] Nilsson configuration, the 11/2− member has the dominant strength (1979Lo02).

[b] Band(B): π3/2[411] band. The 7/2+ member is not seen, as it is probably obscured by the strongly excited 1/2[411] state at 409 keV (1979Lo02).

[c] Band(C): π1/2[411] band. As expected from the original $2d_{3/2}$ orbital for the 1/2[411] Nilsson configuration, the 3/2+ member has the dominant strength, while the 1/2+ bandhead reported at 392.5 keV in β^- decay, would be obscured in this work by a strong α-particle group, and 5/2+ member would be populated weakly (1979Lo02).

[d] Band(D): π7/2[404]. As expected from the original $1g_{7/2}$ orbital for the 7/2[404] Nilsson configuration, the 7/2+ member should have the dominant strength, while 9/2+ member is expected to be populated weakly, and would be obscured by larger peaks in the spectrum (1979Lo02).

[e] Band(E): π1/2[541] (?). Tentative assignment.

[f] Band(F): π5/2[402] (?) Tentative assignment.

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^{167}Ho Levels (continued)

[g] Band(G): π5/2[413] band.
[h] Band(H): π5/2[532] band. As expected from the original $h_{11/2}$ orbital for the 5/2[532] Nilsson configuration, the $11/2^-$ member is strongly populated (1979Lo02).
[i] Band(I): π1/2[420] band.

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Band(F): π5/2[402] (?)
Tentative assignment

(5/2$^+$) 1403

Band(E): π1/2[541] (?)

(9/2$^-$) 1006

Band(D): π7/2[404]

7/2$^+$ 974

Band(C): π1/2[411] band

(7/2$^+$) 541

Band(B): π3/2[411] band

(9/2$^+$) 507

3/2$^+$ 409

5/2$^+$ 321

3/2$^+$ 259

Band(A): π7/2[523] band

11/2$^-$ 221

9/2$^-$ 100

7/2$^-$ 0

$^{167}_{67}Ho_{100}$

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Band(I): π1/2[420] band

5/2$^+$ 1938

(1/2$^+$) 1858

Band(H): π5/2[532] band

11/2$^-$ 1666

7/2$^-$ 1464

Band(G): π5/2[413] band

(9/2$^+$) 1275

7/2$^+$ 1165

$^{167}_{67}Ho_{100}$