^{64}Zn(α,α') 1988Ba71,1970Al16,2019Bu26

History

Type	Author	Citation	Literature Cutoff Date
Full Evaluation	Balraj Singh and Jun Chen	NDS 178, 41 (2021).	12-Nov-2021

Includes (α,α).

1988Ba71: E=25 MeV, $\sigma(\theta)$, coupled-channel calculations. FWHM=100-200 keV. Data for eight levels up to 3 MeV. See also 1982En04 for ^{64}Zn(α,α) E=25 MeV.

1970Al16: E=31 MeV; FWHM=80-120 keV, $\sigma(\theta)$ from 15° to 65°, DWBA calculations, deduced β and βR.

2019Bu26: E=240 MeV α particles were produced from the Texas A&M K500 superconducting cyclotron. Target was an enriched (>95%) 6.4 mg/cm^2 ^{64}Zn foil. Scattered particles were momentum-analyzed with the multipole-dipole-multipole (MDM) spectrometer. Measured $\sigma(E_\alpha,\theta)$, strength distributions. Deduced centroid energies, widths, and fractions of energy weighted sum rule (EWSR) for isoscalar giant monopole (ISGMR), dipole (ISGDR) and quadrupole (ISGQR) resonances from DWBA analysis and Gaussian fits. Comparisons with theoretical predictions.

2016Or09: (α,α),(α,α'),E=12.1, 16.1 MeV. Measured $\sigma(\theta)$, σ for excited states, and total reaction σ. Comparison with statistical model calculations.

Other measurements:

1990Fi07: E=57 MeV.
1989Ai02: E=29-50 MeV, $\sigma(\theta)$.
1981Yo04: E=99-129 MeV.
1981Co16: E=160 MeV.
1980Lu06: E=129 MeV.
1978Ro12: E=15, 18, 19 MeV; $\sigma(\theta)$, DWBA.
1978Pi03, 1975Bo02: E=48 MeV.
1978Lu06, 1975Al06: E=18 MeV, reaction mechanism.
1975Ba77: E=29, 38, 50.5 MeV; $\sigma(\theta)$, DWBA.
1971Al11, 1968Al20, 1968Al19: E=27 MeV; $\sigma(\theta)$, DWBA.
1971Go36, 1971Go28, 1968Go35: E=40 MeV; $\sigma(\theta)$.
1970Br07: E=44 MeV; $\sigma(\theta)$.
1968Fu01 (E=21 MeV); 1965Wi04 (E=22 MeV); 1962Br37, 1961Ch21 (E=43 MeV); 1960Mc14 (E=41 MeV); 1959Fu62 (E=20 MeV).

Additional information 1.

Data for giant resonances (levels above 6 MeV) are from 2019Bu26.

^{64}Zn Levels

Uncertainties in values of βR and transition strengths from 1970Al16 are estimated to be about 5% (1970Al16).

E(level)[†]	J$^\pi$	L[†]	βR (fm)[†]	Comments
0				
990 *30*		2	1.19	B(E2)=0.124-0.185 (1978Ro12); 0.11 (1968Al20); B(E2)(W.u.)=24 (1970Al16), 15.6 (1970Br07). βR (fm): from 1988Ba71. Others: 1.07 (1988Ba71), 1.2 (1970Al16). β_2=0.19-0.22 (1978Ro12); 0.22 (1975Ba77); 0.15 (1975Al34); 0.19 (1971Go36); 0.22 (1971Al11); 0.21 (1970Br07); 0.19 (1970Al16); 0.18 (1968Go35); 0.20 (1968Fu01); 0.22 (1965Wi04); 0.19 (1960Mc14). 1991Ku30 give β_2=−0.20 from an analysis of (α,α') data. Angle integrated σ=33 mb *3* at 12.1 MeV, 28 mb *1* at 16.1 MeV (2016Or09).
1810 *30*		2[@]		Angle integrated σ=3.1 mb *5* at 12.1 MeV, 0.6 mb *2* at 16.1 MeV (2016Or09).
1910	0$^+$			E(level),J$^\pi$: level from 2016Or09. Angle integrated σ=10.2 mb *5* at 12.1 MeV, 13.6 mb *5* at 16.1 MeV (2016Or09).
2320 *30*		4[@]		Angle integrated σ=3.2 mb *5* at 12.1 MeV, 0.9 mb *1* at 16.1 MeV (2016Or09).
2780 *30*		4	0.35	B(E4)(W.u.)=2.0, β_4=0.053 (1970Al16).
3020 *30*		3	1.01	B(E3)(W.u.)=27 (1970Al16), 8.6 (1970Br07). βR (fm): from 1988Ba71. Other: 1.3 (1970Al16).

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$^{64}Zn(\alpha,\alpha')$ 1988Ba71,1970Al16,2019Bu26 (continued)

^{64}Zn Levels (continued)

E(level)[†]	J^π	Γ	L[†]	βR (fm)[†]	Comments
					β_3=0.21 (1975Ba77); 0.11 (1975Al34); 0.22 (1971Al11); 0.15 (1970Br07); 0.20 (1970Al16); 0.16 (1968Go35); 0.10 (1960Mc14).
3080 *30*			4	0.55	B(E4)(W.u.)=5.1, β_4=0.084 (1970Al16).
3720 *30*			3	0.37	B(E3)(W.u.)=2.2, β_3=0.057 (1970Al16).
3950 *30*					
4190 *30*			5	0.48	B(E5)(W.u.)=4.3, β_5=0.074 (1970Al16).
4370 *30*			3	0.39	B(E3)(W.u.)=2.4, β_3=0.059 (1970Al16).
4640 *30*					
4760? *30*					
5040 *45*					
5370 *45*			3	0.29	B(E3)(W.u.)=1.3, β_3=0.044 (1970Al16).
5800 *45*			5	0.28	B(E5)(W.u.)=1.4, β_5=0.042 (1970Al16).
15.42×10^3[‡#] *94*	1^-	4.6[‡#] MeV *+16−15*			E(level): 15.42 MeV *+97−90* (2019Bu26). %EWSR=19 for E1 isoscalar giant dipole resonance (ISGDR) strength.
15.7×10^3[‡] *5*	2^+	6.43[‡] MeV *65*			Centroid=15.81×10^3 *+35−27* with %EWSR=120 *13* and rms width=4.7 MeV *+22−18* from experimental moments. %EWSR=113 for E2 isoscalar giant quadrupole resonance (ISGQR) strength.
18.34×10^3[‡] *70*	0^+	9.21[‡] MeV *114*			Centroid=18.5×10^3 *+12−4* with %EWSR=70 *+14−11* and rms width=5.8 MeV *+26−11* from experimental moments. %EWSR=64 for E0 isoscalar giant monopole resonance (ISGMR) strength.
25.6×10^3[‡#] *12*	1^-	12.6[‡#] MeV *32*			Centroid=23.3×10^3 *+17−10* with %EWSR=108 *+27−20* and rms width=8.7 MeV *+29−19* from experimental moments. %EWSR=68 for E1 isoscalar giant dipole resonance (ISGDR) strength.

[†] From 1970Al16, unless otherwise stated. The L-transfer assignments are from comparison of $\sigma(\theta)$ distributions with DWBA calculations.

[‡] From Gaussian fits to measured strength distributions with quoted values of widths for FWHM. Values from moments of measured strength distributions are given under comments (2019Bu26).

[#] %EWSR=108 *+27−20* and rms width=8.7 MeV *+30−19* for the sum of two peaks with centroid energy=23.3×10^3 *+18−11*, from moments determined from experimental strength distributions (2019Bu26).

[@] DWBA fit out of phase with that expected for 2^+ and 4^+ states.