

$^1\text{H}(^{32}\text{Mg}, ^{32}\text{Mg}'\gamma)$ 2009Ta08

Type	Author	History Citation	Literature Cutoff Date
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2009Ta08: E=46.5 MeV/nucleon ^{32}Mg beam was produced by fragmentation of a 94 MeV/nucleon ^{40}Ar primary beam provided by the K=540 ring cyclotron on a 370 mg/cm² ^9Be production target at RIKEN. Fragments were analyzed using the RIPS fragment separator and identified using time-of-flight and energy loss measurements taken by two plastic scintillators and a silicon detector. Scattered particles from the reaction were analyzed with the spectrometer TOMBEE and identified using a plastic scintillator, a silicon detector, and a NaI(Tl) scintillator array. γ rays were detected using the DALI2 array consisting of 160 NaI(Tl) crystals. Measured E_γ , I_γ , $\gamma\gamma$ -coin, $\sigma(\theta)$. Deduced levels, J, π , L-transfers, deformation parameters. Comparisons with coupled-channel calculations. See also [2006Ta31](#) with E=57 MeV/nucleon.

Others:

2014Mi09: E=58.9 MeV/nucleon ^{32}Mg beam was produced by fragmentation of a 63 MeV/nucleon ^{48}Ca primary beam with ^{181}Ta and enriched ^{64}Ni target foils of 150 μm and 200 μm thicknesses, respectively at RFQ-RILAC-CSM-RRC accelerator at RIKEN facility. The fragments were separated and identified by RIPS fragment separator and identified using measurements of magnetic rigidity ($B\rho$), time-of-flight (tof), and energy loss (ΔE -E). The secondary target was liquid hydrogen (CRYPTA). Scattered particles were analyzed by the TOMBEE spectrometer. γ rays were detected with the DALI2 array of 160 NaI(Tl) crystals. Measured E_γ , I_γ , $\gamma\gamma$ -coin, cross section. Deduced deformation parameter from the analysis of measured angle-integrated cross section by coupled-channel calculations. Comparison with shell-model (SDPF-M) calculations, and with previous experimental results.

2012Li45: E \approx 215 MeV/nucleon (\approx 190 MeV/nucleon at the center of the target) ^{32}Mg beam with an intensity of about 10^3 particle/s was produced by bombarding a primary beam of ^{48}Ca at E=345 MeV with an intensity of 2 pA on a 15-mm-thick Be target at the BigRIPS facility at RIKEN. The fragments were analyzed and separated with the ΔE - $B\rho$ -tof method. The secondary target is a 2.13 g/cm² polyethylene foil. The scattering angles were measured by two parallel-plate avalanche counters (PPAC); scattered particles were analyzed by the ZeroDegree Spectrometer consisting of an ionization chamber and two plastic scintillators; γ rays were detected by the DALI2 array of 177 NaI(Tl) scintillators. Measured E_γ , I_γ , $\sigma(\theta)$. Deduced deformation length and β_2 deformation parameter of the first 2^+ excited state in ^{32}Mg from a comparison of measured differential cross-section with the coupled-channel calculations. Comparison with available data.

2002Mo35: E=49.5 MeV/nucleon ^{32}Mg beam at RIKEN. γ rays were detected with the DALI array of 66 NaI(Tl) crystals. Measured E_γ , I_γ . Only the first excited state reported.

 ^{32}Mg Levels

Deformation parameter β_L and σ given under comments are from [2009Ta08](#), unless otherwise noted.

E(level) [†]	J ^π	L [‡]	Comments
0	0 ⁺		
887 7	2 ⁺	2	$\sigma=48$ mb 5 (2009Ta08), 40 mb +9-8 (2014Mi09). Total excitation $\sigma=56$ mb +9-8 (2014Mi09) including feeding from higher states. Deformation parameter $\beta_2=0.43$ 3 and 0.48 3 for two optical model potentials (2009Ta08), 0.51 +6-5(stat) 2(syst) (2014Mi09). Deformation length $\delta_2=1.85$ fm 20(stat) 8(syst) (2014Mi09), 1.5 fm 1 (2012Li45).
2320 12	4 ⁺	4	L: 2009Ta08 examined fits to the angular distribution data for $J^\pi=0^+, 1^-, 2^+, 3^-$ and 4^+ . Minimum χ^2 is obtained for 4^+ by combining the two-step $0^+ \rightarrow 2^+ \rightarrow 4^+$ with one-step $0^+ \rightarrow 4^+$ excitations. The β_2 was set to 0.43 3. The deformation parameters for the fit are: $\beta_2=0.43$ 3 and $\beta_4=0.118$ 13 using KD02 potential and $\beta_2=0.47$ 3 and $\beta_4=0.126$ 15 using CH89 potential. $\sigma=3.7$ mb 6.
2551.1 10	(1 ⁻ , 2 ⁺)	#	$\sigma=0.6$ mb 3.
2860 7	(1,3)	(1,3)	$\beta_1=0.061$, $\beta_3=0.076$. $\sigma=0.9$ mb 3.
3117 16	(3,4)	(3,4)	$\beta_3=0.102$, $\beta_4=0.109$. B(E3)=0.6 from β_3 . $\sigma=1.7$ mb 3.

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$^1\text{H}(^{32}\text{Mg}, ^{32}\text{Mg}'\gamma)$ 2009Ta08 (continued) ^{32}Mg Levels (continued)

<u>E(level)[†]</u>	<u>J^π</u>	<u>L[‡]</u>	<u>Comments</u>
3490 18	(1,2)	(1,2)	$\beta_1=0.087, \beta_2=0.097.$ $\sigma=2.3$ mb 5.
3552 16	(3 ⁻ ,4 ⁻)	#	$\sigma=0.3$ mb 1.
4215 17	(3,4)	(3,4)	$\beta_3=0.076, \beta_4=0.089.$ $\sigma=1.1$ mb 3.
5169 24	(2,3)	(2,3)	$\beta_2=0.110, \beta_3=0.124.$ B(E3)=0.9 from $\beta_3.$ $\sigma=2.9$ mb 4.
5203 20	(2,3)	(2,3)	$\beta_2=0.109, \beta_3=0.122.$ B(E3)=0.9 from $\beta_3.$ $\sigma=2.7$ mb 4.

[†] From E_γ data.

[‡] From comparison of angular distribution data for ^{32}Mg particles with coupled-channel calculations (2009Ta08).

Determination of L-value from $\sigma(\theta)$ is ambiguous due to lack of statistics (2009Ta08).

 $\gamma(^{32}\text{Mg})$

<u>E_γ[†]</u>	<u>I_γ[†]</u>	<u>E_i(level)</u>	<u>J_i^π</u>	<u>E_f</u>	<u>J_f^π</u>	<u>Comments</u>
887 7	100	887	2 ⁺	0	0 ⁺	E _γ : other: 895 (2002Mo35), 887 (2014Mi09).
1232 11	0.4 2	3552	(3 ⁻ ,4 ⁻)	2320	4 ⁺	
1433 9	12.3 18	2320	4 ⁺	887	2 ⁺	
1895 13	1.7 4	4215	(3,4)	2320	4 ⁺	
1973 [‡]	1.4 4	2860	(1,3)	887	2 ⁺	
2230 14	2.7 5	3117	(3,4)	887	2 ⁺	
2551 [‡]	1.0 5	2551.1	(1 ⁻ ,2 ⁺)	0	0 ⁺	
2603 16	3.7 8	3490	(1,2)	887	2 ⁺	
2883 16	4.3 6	5203	(2,3)	2320	4 ⁺	
^x 3256 43						
4282 23	4.6 7	5169	(2,3)	887	2 ⁺	

[†] From 2009Ta08.

[‡] 2009Ta08 do not quote any uncertainty, at least 15 keV as estimated from other γ -ray uncertainties.




^x γ ray not placed in level scheme.

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Level Scheme

Intensities: Relative I_γ

Legend

-  $I_\gamma < 2\% \times I_\gamma^{\text{max}}$
-  $I_\gamma < 10\% \times I_\gamma^{\text{max}}$
-  $I_\gamma > 10\% \times I_\gamma^{\text{max}}$

