^{9}Be(^{34}Mg,^{33}Mgγ),(^{34}Al,^{33}Mgγ) 2021Ba28

History

Type	Author	Citation	Literature Cutoff Date
Full Evaluation	Jun Chen and Balraj Singh	NDS 199,1 (2025)	30-Sep-2024

Adapted from a dataset in the XUNDL database compiled from 2021Ba28 by S. Zhu (NNDC, BNL), August 09, 2021.

2021Ba28: E=242.5 MeV/nucleon ^{34}Mg and 229.6 MeV/nucleon ^{34}Al beams were produced by fragmentation of a 345 MeV/nucleon ^{48}Ca primary beam from RIBF at RIKEN, on a 15-mm-thick ^{9}Be production target. Fragments were separated by the BigRIPS fragment separator. The secondary target was 1032 mg/cm^2 ^{9}Be. γ rays were detected by the DALI2 array of NaI(Tl) detectors and reaction residues were detected and analyzed by the ZeroDegree spectrometer (ZDS). Measured Eγ, Iγ, parallel momentum distributions, inclusive and partial cross sections. Deduced levels, J, π. Comparison with shell-model calculations using IMSRG-derived interaction with an ^{20}O core, and effective interactions of SDPF-μ, SDPF-U-Si and SDPF-U-MIX with an ^{16}O core in *sdpf* model space.

^{33}Mg Levels

Cross-section data under comments are for one-neutron knockout reaction ^{9}Be(^{34}Mg,^{33}Mgγ) in 2021Ba28.

E(level)[†]	J$^\pi$[#]	L[‡]	Comments
0	3/2$^-$	1	Inclusive σ=93 mb *2*, partial σ=27 mb *4* (one-proton knock out); inclusive σ=3.1 mb *2* (one-neutron knock out).
154? *9*	7/2$^-$	3	This is a speculative isomeric state, as proposed by 2021Ba28 based on the hypothetical placement of 549γ from 703 level. No decay associated with this level is observed. The reported partial σ=18 mb *4* is from intensity of 549γ and transferred L=3 is from a fit to measured momentum distribution assuming a L=3 component. This level is considered uncertain by the evaluators due to the questionable placement of 549γ from 703 level. See comments for 549γ.
484 *5*	(3/2$^+$,5/2$^+$)	(2)	Partial σ<3 mb *1*.
703 *6*	(3/2)$^-$	1	Partial σ>20 mb *3*. But it is also stated in 2021Ba28 that both p-wave (L=1) and d-wave (L=2) components are present. 2021Ba28 attribute the L=2 component most likely to cross-contamination from the 779-keV d-wave component, which the evaluators consider is a rather weak argument to rule out L=2 and adopt L=1 for 703 level. The evaluators consider the shape of $\gamma(\theta)$ distribution as ambiguous with L=(1,2), as also stated in 2021Ba28.
779 *7*	(3/2,5/2)$^+$	2	Partial σ=21 mb *1*.
1258 *15*	(1/2,3/2$^-$)	0,1	Partial σ=1.3 mb *5*.
1850 *40*	(1/2,3/2$^-$)	0,1	Partial σ=0.7 mb *5*.

[†] From a least-squares fit to γ-ray energies.

[‡] From Table I in 2021Ba28, based on gated momentum distributions, and fits to the inclusive momentum distributions.

[#] Proposed in 2021Ba28, based on measured parallel momentum distributions and theoretical predictions.

γ(^{33}Mg)

E$_\gamma$[†]	I$_\gamma$[†]	E$_i$(level)	J$_i^\pi$	E$_f$	J$_f^\pi$	Comments
219 *8*		703	(3/2)$^-$	484	(3/2$^+$,5/2$^+$)	
295 *7*	19 *1*	779	(3/2,5/2)$^+$	484	(3/2$^+$,5/2$^+$)	
484 *6*	23 *1*	484	(3/2$^+$,5/2$^+$)	0	3/2$^-$	
549[‡] *7*	15 *1*	703	(3/2)$^-$	154?	7/2$^-$	Placement of this γ is adopted by 2021Ba28 from the hypothesis of 2001Nu02 in ^{33}Na β^- decay, who considered different scenarios for the placement of 546γ and proposed the placement from 705 level to a 159 level as the probable one and the placement from a 546 level as less likely based on rather weak arguments. 2006El03 observed a 561 *17* γ in ^{1}H(^{34}Mg,^{33}Mgγ),

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^{9}Be(^{34}Mg,^{33}Mgγ),(^{34}Al,^{33}Mgγ) 2021Ba28 (continued)

γ(^{33}Mg) (continued)

E_γ †	I_γ †	E_i(level)	J_i^π	E_f	J_f^π	Comments
						which they suggested was most likely the same as 546.2γ in decay work, but no 704.9γ was seen in that study, which may imply that 546.2γ and 704.9γ de-excite different levels. Moreover, the non-observation of this 546γ and observations of 220γ and 703γ from 703 level by 2017Ri06 in ^{9}Be(^{46}Ar,^{33}Mgγ), and the observations of all those three transitions by 2021Ba28 with 546γ much stronger than 703γ further support that 546γ and 703γ deexcite different levels. Therefore a level at 546.2 keV has been defined in Adopted Levels by the evaluators and the placement from 705 level is considered as questionable.
703 *8*	7 *2*	703	$(3/2)^-$	0	$3/2^-$	
779 *12*	4 *1*	779	$(3/2,5/2)^+$	0	$3/2^-$	
780‡		1258	$(1/2,3/2^-)$	484	$(3/2^+,5/2^+)$	E_γ: seen in the coincidence spectrum with 484γ in (^{34}Mg,^{33}Mgγ), but not in (^{34}Al,^{33}Mgγ).
1258 *15*	1.4 *5*	1258	$(1/2,3/2^-)$	0	$3/2^-$	
1850 *40*	0.8 *5*	1850	$(1/2,3/2^-)$	0	$3/2^-$	

† From 2021Ba28.
‡ Placement of transition in the level scheme is uncertain.

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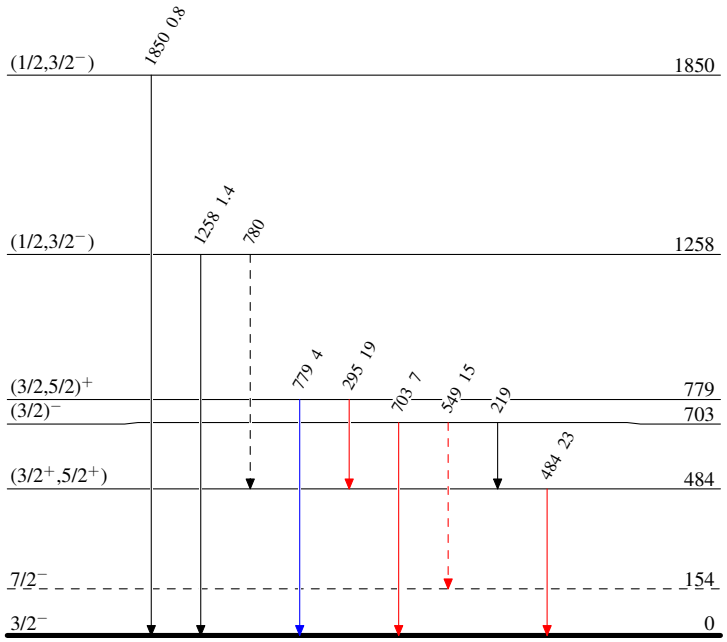
Level Scheme

Intensities: Relative I_γ

Legend

$I_\gamma < 2\% \times I_\gamma^{max}$
$I_\gamma < 10\% \times I_\gamma^{max}$
$I_\gamma > 10\% \times I_\gamma^{max}$
γ Decay (Uncertain)



$^{33}_{12}Mg_{21}$