C(^{31}Mg,^{30}Mgγ) 2020Ki19,2018Fe05

History

Type	Author	Citation	Literature Cutoff Date
Full Evaluation	M. S. Basunia, A. Chakraborty	NDS 197,1 (2024)	31-May-2024

2020Ki19: ^{31}Mg beam, E=97.9 MeV/nucleon, was obtained from of ^{48}Ca primary beam, E=140 MeV/nucleon, fragmentation on a ^{9}Be target at NSCL facility. A1900 fragment separator, two plastic scintillators, an ionization chamber, GRETINA array of seven modules, each housing four crystals of high-purity germanium. ^{31}Mg bombarded a ^{9}Be target and populate the states in ^{30}Mg by 1n knock-out reaction. Measured Eγ, Iγ, γγ coin. The Doppler correction was performed with the mid-target velocity of the residue. Results were compared with those from large scale shell model calculations.

2018Fe05: 55.1 MeV/nucleon ^{31}Mg beam was produced at GANIL accelerator facility from 77.5 MeV/nucleon ^{36}S primary beam. Beam-like residues were analyzed by SPEG magnetic spectrometer in mass and charge using ΔE-E-tof technique. Gamma rays were detected using an array of eight EXOGAM Ge clovers. Measured Eγ, Iγ, (particle)γ-coin, exclusive cross sections, and longitudinal momentum distributions. Deduced levels, L-transfers, J^π, spectroscopic factors, and configurations. Comparison with eikonel -model predictions, and shell-model calculations using the EEdf1 and SDPF-U-MIX interactions.

J^π(^{31}Mg g.s.)=1/2$^+$.

^{30}Mg Levels

E(level)[†]	J^π[@]	L[&]	C^2S[a]	Comments
0.0	0$^+$	0	0.42[b] *8*	Inclusive cross section for single-neutron removal from ^{31}Mg=90 mb *12* (2018Fe05) and 97 mb *3* (2020Ki19 – including 8.4 mb *5* for states 4683, 4967, 5022, 5095, 5414, 5897, and 6064). Exclusive population σ_{1n}<25.5 mb *48* (2018Fe05), σ_{exp} < 17.2 mb *30* (2020Ki19). C^2S: other: < 0.33 *6* (2020Ki19).
1483.5 *12*	2$^+$	2	0.44[b] *13*	Population σ_{1n}<11.0 mb *33* (2018Fe05), 10.2 mb *5* (2020Ki19). C^2S: other: 0.46 *2* (2020Ki19).
1788.6 *14*	0$^+$	0	0.20 *4*	Population σ_{1n}=7.7 mb *15* (2018Fe05), 13.8 mb *19* (2020Ki19). C^2S: other: 0.39 *5* (2020Ki19).
2468.2 *14*	2$^+$	2	0.43 *2*	J^π: From 2020Ki19. Other: (2)$^-$ (2018Fe05). L,C^2S: from 2020Ki19. Other: L=1, χ^2/ν=1.0 for L=1 and 1.6 for L=2, C^2S=0.21 *3* (2018Fe05). Population σ_{1n}=7.6 mb *11* (2018Fe05), 8.4 mb *4* (2020Ki19). C^2S: other: 0.43 *2* (2020Ki19).
3300.5 *23*	3$^-$	3	0.35 *6*	J^π: 3$^-$ in 2020Ki19, (3)$^-$ in 2018Fe05. L: χ^2/ν=1.9 for L=3 and 2.8 for L=2, thus L=3 preferred (2018Fe05). Population σ_{1n}=6.8 mb *11* (2018Fe05), 7.9 mb *4* (2020Ki19). C^2S: other: 0.46 *2* (2020Ki19).
3381.5 *23*	4$^+$			J^π: also supported by authors of 2020Ki19. Population σ_{1n}=2.5 mb *5* (2018Fe05), 3.1 mb *2* (2020Ki19).
3459.5 *23*	(2)$^+$	2	0.48 *7*	L: χ^2/ν=0.8 for L=2 and 2.2 for L=1, thus L=2 preferred (2018Fe05). Population σ_{1n}=9.5 mb *13* (2018Fe05), 12.0 mb *5* (assuming single state) and 5.8 mb *6* for $1d_{3/2}$ and 6.2 mb *6* for $2p_{3/2}$ (assuming doublet) (2020Ki19). C^2S: other: 0.67 *3* (assuming single state) and 0.32 *3* for $1d_{3/2}$ and 0.27 *3* for $2p_{3/2}$ (assuming doublet) (2020Ki19).
3539 *3*	1$^-$	1	0.35 *5*	J^π: from 2020Ki19, compatible to the γ branching to 0$^+$ g.s. 2$^+$ 1st excited state. (1$^-$) in 2018Fe05. L: χ^2/ν=1.9 for L=1 and 2.0 for L=2, thus L=1 preferred (2018Fe05). Population σ_{1n}=11.1 mb *16* (2018Fe05), 6.2 mb *3* (2020Ki19). C^2S: other: 0.27 *1* (2020Ki19).
4184 *4*	5			Population σ_{1n}=1.3 mb *2* (2018Fe05), 1.5 mb *1* (2020Ki19).
4257 *3*	(4)$^-$	3	0.27 *4*	L: χ^2/ν=1.4 for L=3 and 1.6 for L=2, thus L=3 preferred, but L=2 is not ruled out (2018Fe05). Population σ_{1n}=4.9 mb *7* (2018Fe05), 5.7 mb *3* (2020Ki19).

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C(^{31}Mg,^{30}Mgγ) 2020Ki19,2018Fe05 (continued)

^{30}Mg Levels (continued)

E(level)[†]	J$^{\pi}$[@]	Comments
		C^{2}S: other: 0.35 *2* (2020Ki19).
4263 *3*		E(level): From 2020Ki19. Population σ_{1n}=0.9 mb *1* (2020Ki19).
4684[‡] *6*		
4687[‡] *6*		E(level): possibly the same level at 4684. In 2020Ki19, level energy 4683 is quoted from 2014Sh01, however, 2020Ni05 supersede their 2014Sh01 data (^{30}Na β- decay). In 2020Ni05, 2226.6γ from 4695 keV level statistically comparable to 2219 keV *5* γ transition (2020Ki19). 2216γ reported in 2014Sh01 is not confirmed in 2020Ni05.
4967[#]		
5023[#]		
5096[#]		
5209 *5*	(2)$^-$	Population σ_{1n}=2.2 mb *3* (2018Fe05), 1.5 mb *1* (2020Ki19). C^{2}S: 0.08 *1* (2020Ki19). E(level),J$^{\pi}$: from 2020Ki19. Parallel momentum distributions measurements fit for 2p$_{3/2}$ orbital.
5414[#]		
5899[#]		
5919[‡] *13*		E(level): in 2020Ki19, level energy 5095 from 2014Sh01 was proposed, however, 2020Ni05 superseded their 2014Sh01 data (^{30}Na β- decay). In 2020Ni05, 2618.0γ from 5922 keV level is same as the 2618 keV *12* γ transition (2020Ki19). Statistically this Eγ is in agreement with 2627.1 (2020Ki19) and 2627 (2014Sh01), and can be placed from 5095 keV level as well. However, the evaluators propose 5922 based on the better fit of the centroid value of 2618 keV *12* γ.
6066[#]		

[†] From a least-squares fit to Eγ, except where otherwise noted. Levels if reported only in one reference, noted in comments.
[‡] Level based on the placement of Eγ proposed in 2014Sh01. However, 2020Ni05 superseded their 2014Sh01 data in ^{30}Na β-decay. Evaluators noted the changes, if any.
[#] Level based on the placement of Eγ as in 2014Sh01.
[@] As assigned by 2018Fe05, except where otherwise noted, based on L-transfer for removal of s$_{1/2}$ neutron from ^{31}Mg g.s.
[&] From exclusive longitudinal momentum distribution with comparison to eikonal-model predictions (2018Fe05).
[a] Systematic uncertainty of ≈10% from reaction modelling is not included in the listed uncertainties (2018Fe05).
[b] Value is an upper limit from the observed yields (2018Fe05).

γ(^{30}Mg)

2018Fe05 report no evidence for 990 and 1060 γ rays as reported in 2010De26 (^{18}O,2pγ) from the 3455, 4$^+$ and 2541, (2$^-$,3$^-$) levels, respectively.

E$_{\gamma}$[†]	I$_{\gamma}$[a]	E$_i$(level)	J$^{\pi}_i$	E$_f$	J$^{\pi}_f$	Comments
300[‡] *5*	26.8 *17*	1788.6	0$^+$	1483.5	2$^+$	I$_{\gamma}$: The uncertainty contains an additional systematic uncertainty of 10% arising from the half-life determination (3.9 ns *4* [2005Ma96]). Other: 15.1 *23* from 8.6 *13* (2018Fe05, if Iγ(1482)=100).
[x]373[#] *1*	0.9 *1*					
802[‡] *3*	2.8 *1*	4184	5	3381.5	4$^+$	E$_{\gamma}$: unweighted average of 799 *2* (2018Fe05) and 804 *1* (2020Ki19). I$_{\gamma}$: other: 2.5 *2* from 1.4 *1* (2018Fe05, if Iγ(1482)=100).
881 *1*	1.6 *1*	4263		3381.5	4$^+$	E$_{\gamma}$: From 2020Ki19.
956[‡] *1*	10.2 *1*	4257	(4)$^-$	3300.5	3$^-$	E$_{\gamma}$: weighted average of 954 *2* (2018Fe05) and 956 *1* (2020Ki19). I$_{\gamma}$: other: 9.5 *5* from 5.4 *3* (2018Fe05, if Iγ(1482)=100).

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C(^{31}Mg,^{30}Mgγ) 2020Ki19,2018Fe05 (continued)

γ(^{30}Mg) (continued)

Eγ[†]	Iγ[a]	Ei(level)	J^π_i	E_f	J^π_f	Comments
985[‡] *1*	18.0 *2*	2468.2	2+	1483.5	2+	Eγ: from 2020Ki19. Other: 985 *2* (2018Fe05). Iγ: other: 14.7 *9* from 8.4 *5* (2018Fe05, if Iγ(1482)=100).
1482[‡] *2*	100.0 *2*	1483.5	2+	0.0	0+	Iγ: other: 100 *5* from 57.0 *28* (2018Fe05, if Iγ(1482)=100).
1670 *3*	2.7 *1*	5209	(2)−	3539	1−	Eγ: from 2020Ki19. 1660 *2* (unplaced in 2018Fe05). Iγ: other: 4.2 *4* from 2.4 *2* (2018Fe05, if Iγ(1482)=100).
1817[‡] *2*	24.3 *2*	3300.5	3−	1483.5	2+	Eγ: weighted average of 1816 *2* (2018Fe05) and 1820 *3* (2020Ki19). Iγ: other: 22.8 *14* from 13.0 *8* (2018Fe05, if Iγ(1482)=100).
1898[‡] *2*	9.9 *2*	3381.5	4+	1483.5	2+	Eγ: other: 1897 *3* (2020Ki19). Iγ: other: 7.4 *7* from 4.2 *4* (2018Fe05, if Iγ(1482)=100).
1976[‡] *2*	21.5 *2*	3459.5	(2)+	1483.5	2+	Eγ: weighted average of 1975 *2* (2018Fe05) and 1979 *3* (2020Ki19). Iγ: other: 18.6 *11* from 10.6 *6* (2018Fe05, if Iγ(1482)=100).
2057 *3*	2.6 *1*	3539	1−	1483.5	2+	Eγ,Iγ: from 2020Ki19.
2219[@] *5*	0.6 *1*	4687		2468.2	2+	
[x]2453[#] *4*	1.3 *1*					
2618[@] *12*	0.7 *2*	5919		3300.5	3−	
[x]2648[#] *11*	0.9 *2*					
3200[@] *5*	2.7 *2*	4684		1483.5	2+	
3431[&]	1.9 *2*	5899		2468.2	2+	
3534[‡] *6*	12.7 *2*	3539	1−	0.0	0+	Eγ: other: 3541 *5* (2020Ki19). Iγ: other: 21.6 *16* from 12.3 *9* (2018Fe05, if Iγ(1482)=100).
3625[&]	2.4 *2*	5414		1788.6	0+	
3930[&]	1.6 *2*	5414		1483.5	2+	
[x]4293[#] *7*	1.9 *1*					
4415[&]	1.4 *2*	5899		1483.5	2+	
4582[&]	0.4 *2*	6066		1483.5	2+	
4967[&]	0.4 *2*	4967		0.0	0+	
5022[&]	1.4 *2*	5023		0.0	0+	
5095[&]	0.8 *2*	5096		0.0	0+	
5414[&]	2.7 *2*	5414		0.0	0+	

[†] From 2018Fe05, except where otherwise noted.
[‡] Also reported in 2020Ki19 and same placement as of 2018Fe05.
[#] Unplaced Eγ in 2020Ki19.
[@] From 2020Ki19. Due to low counting statistics γγ coin measurement was not possible. Placement of Eγ in 2020Ki19 was proposed as that in 2014Sh01, however, 2020Ni05 superseded their 2014Sh01 data in ^{30}Na β- decay. Evaluators noted the changes, if applicable.
[&] Listed for Iγ, 2020Ki19 quote Eγ from 2014Sh01.
[a] From 2020Ki19, except where otherwise noted. 2018Fe05 report %Iγ, however not clear whether for 100 1n knock-out from ^{31}Mg or not. Comparison of 2020Ki19 data with those in 2018Fe05 is listed in the comments, if Iγ(1482)=100 (2018Fe05).
[x] γ ray not placed in level scheme.

C(^{31}Mg,^{30}Mgγ) 2020Ki19,2018Fe05

Level Scheme

Intensities: Relative I_γ