Adopted Levels, Gammas

History

Type	Author	Citation	Literature Cutoff Date
Full Evaluation	Jun Chen and Balraj Singh	NDS 112,1393 (2011)	31-Mar-2011

Q(β^-)=1.343×10^4 *8*; S(n)=2280 *5*; S(p)=2.114×10^4 *12*; Q(α)=−1.586×10^4 *10* 2012Wa38
Note: Current evaluation has used the following Q record 13477 76 *2212* 292.141E4 36-1.554E327 2009AuZZ.
Q(β^-): 13420 *80* from 2003Au03. 13477 *73* from Mass excess(^{33}Mg)= 4947 *22* (2006Ga04) and Mass excess(^{33}Al)=−8530 *70* (2003Au03).
S(n): 2222 *26* from 2003Au03.
S(p): 21460 (I360) from 2003Au03.
Q(α): −15590 *270* from 2003Au03.
Q(β^-n)=7937 *89* (2009AuZZ), 7880 *90* (2003Au03).
Identification: 1984Gu19: In(p,X) E=10 GeV, measured γ, isotopic half-life.
Later studies of ^{33}Mg isotope (mass measurements and decay properties): 1991Zh24, 1991Or01, 2001Nu02, 2002Ra16, 2002Mo29, 2006Ga04.
Measured mass excess=4947 *22* keV (radio-frequency mass spectrometer, MISTRAL at ISOLDE facility: 2006Ga04,2006Lu09).
2007Yo06: ^{33}Mg and ^{31}Mg produced by bombarding a uranium carbide target with 1.4 GeV proton beam at ISOLDE-CERN facility followed by laser ionization to select Mg isotopes The radioactive beam of Mg ions was accelerated to 40 keV, sent through a mass analyzer and then to a collinear laser spectroscopy arrangement for the measurement of spin and magnetic moment by laser spectrometry and nuclear magnetic resonance. Measurements are made relative to ^{31}Mg.
2006Kh08: Cross section measurement in Si(^{33}Mg,X) E=30-65 MeV/nucleon, deduced 'reduced strong absorption radius= 1.260 fm^2 *19*. The ^{33}Mg beam obtained from fragmentation of ^{48}Ca beam with ^{181}Ta target at GANIL facility.
Nearly pure 2p-2h configuration deduced from g-factor, evidence for this nucleus being in the middle of the "island of inversion".
Structure calculations: 1994Po05.
2010Ka05: Measured the longitudinal momentum distribution of one neutron removal from ^{33}Mg in ground state and the one-neutron removal cross-section, 74 *4* mb.
2010Yo08: ^{33}Mg produced at ISOLDE-CERN by 1.4 GeV protons impinging on a thick uranium-carbide target. Measured hyperfine structure and nuclear gyromagnetic ratio by combining laser spectroscopy with nuclear magnetic resonance.
2010Yo01, 2010Tr03: comments on 2008Tr07 for ground state parity of ^{33}Mg.
Additional information 1.

^{33}Mg Levels

Cross Reference (XREF) Flags

A	^{33}Na β^- decay (8.0 ms)	D	^{9}Be(^{36}Si,^{33}Mgγ)
B	^{34}Na β^-n decay (5.5 ms)	E	^{197}Au(^{33}Mg,^{33}Mg$'\gamma$)
C	^{1}H(^{33}Mg,^{33}Mg$'\gamma$),(^{34}Mg,^{33}Mgγ)		

E(level)	J$^\pi$‡	T$_{1/2}$	XREF	Comments
0	3/2$^-$	90.5 ms *16*	ABCDE	%β^-=100; %β^-n=14 *2* (2006AnZW) μ=−0.7456 *5* (2007Yo06) Other %β^-n=17 *5* (1984La03). μ: from g factor=−0.4971 *4* (2007Yo06), hyperfine structure and NMR measurements. J$^\pi$: spin from hyperfine and NMR measurements of 2007Yo06. Parity is from measured negative β-asymmetry in NMR experiment (2010Yo08). Negative parity is also supported by the comparison of experimental magnetic moment of −0.7456 *5* (2007Yo06) and theoretical prediction of −0.88 for 3/2$^-$ member of 1/2[330] configuration with β_2=0.25, −0.39 for 3/2[321] configuration and +0.91 for 3/2[202] (2010Ha07). Negative parity is suggested in reaction spectroscopy work on the ground state of ^{33}Mg by 2010Ka05 who measured the longitudinal momentum distribution from the one-neutron removal. The observed narrow distribution clearly supports significant occupancy in low angular momentum orbitals and could be explained with a large spectroscopic factor strength for the 2p$_{3/2}$ orbital which thereby confirms that the

Continued on next page (footnotes at end of table)

Adopted Levels, Gammas (continued)

^{33}Mg Levels (continued)

E(level)	J$^{\pi}$‡	XREF	Comments
			island of inversion is well pronounced beyond N=20. However log *ft*=5.22 to $(5/2)^+$ g.s. in ^{33}Al seems at variance with negative parity. 2008Tr07 proposed $(3/2^+)$ from β-decay of ^{33}Mg and the allowed β transition to $(5/2)^+$ g.s. in ^{33}Al. The 1p-1h and 3p-3h mixed configuration for g.s. of ^{33}Mg proposed by 2008Tr07 is consistent with all experimental evidence, including the negative magnetic moment from 2007Yo06. Low log *ft* for first-forbidden value may be due to ^{33}Mg nuclide being near N=20 closed shell. Earlier assignments were proposed as $(3/2)^+$ from ^{33}Na decay (2001Nu02) and $(5/2^+)$ from Coulomb excitation measurements (2002Pr09). $7/2^-$ was assumed in shell-model calculations by 2002Mo29. $T_{1/2}$: from 2002Mo29. Other: 90 ms *20* (1984La03). Matter radius (rms)=3.19 fm *3* (2011Ka01), deduced from the measured interaction cross section in C(^{33}Mg,X) and H(^{33}Mg,X) reactions at 900 MeV/nucleon with a $(CH_2)_n$ target, and using Glauber model analysis with Fermi densities. The ^{33}Mg secondary beam obtained from Be(^{48}Ca,X) primary reaction. Experiment used fragment separator (FRS) at GSI.
484.1 *1*	$(3/2^-)$	A CDE	J$^{\pi}$: proposed by 2001Nu02 on the basis of shell-model calculations. From Coulomb excitation data, 2002Pr09 propose that the 484γ is probably E2 rather than E1, thus this level should have the same parity as the g.s.
546.2 *1*		A C	
705.0 *1*	$(1/2^+,3/2^+,5/2^+)$	A	J$^{\pi}$: possible allowed β feeding from $(3/2^+)$; γ to $3/2^-$. 2001Nu02 propose $(5/2^+)$.
1242.4 *1*	$(1/2^+,3/2,5/2)$	A D	J$^{\pi}$: possible β feeding from $(3/2^+)$; gammas to $3/2^-$ and $(5/2^+)$ 2001Nu02 propose $(1/2^+)$.
3780†		A	
4000†		A	

† Decays to ^{32}Mg by neutron emission.
‡ All assignments are tentative.

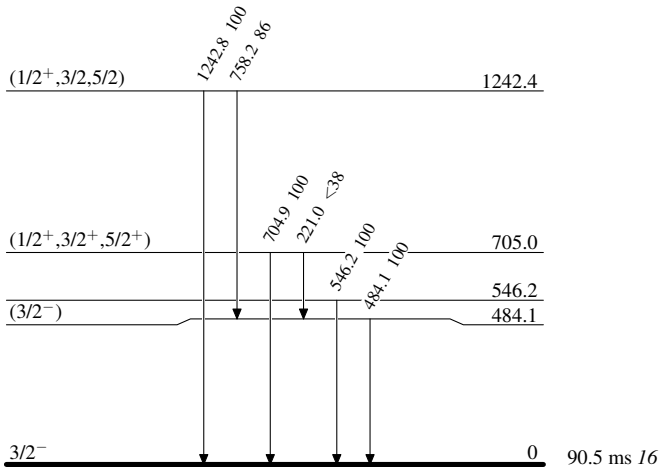
$\gamma(^{33}Mg)$

E$_i$(level)	J$_i^{\pi}$	E$_{\gamma}$	I$_{\gamma}$	E$_f$	J$_f^{\pi}$	Comments
484.1	$(3/2^-)$	484.1 *1*	100	0	$3/2^-$	
546.2		546.2 *1*	100	0	$3/2^-$	
705.0	$(1/2^+,3/2^+,5/2^+)$	221.0 *1*	<38	484.1	$(3/2^-)$	E$_{\gamma}$,I$_{\gamma}$: doublet. The second component is assigned to a transition in ^{31}Mg populated in ^{33}Na β^-2n decay.
		704.9 *1*	100 *9*	0	$3/2^-$	
1242.4	$(1/2^+,3/2,5/2)$	758.2 *1*	86 *10*	484.1	$(3/2^-)$	
		1242.8 *2*	100 *27*	0	$3/2^-$	

Adopted Levels, Gammas

Level Scheme

Intensities: Relative photon branching from each level



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