^{33}Si β^- decay (6.11 s) 1973Go33

History

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

Parent: ^{33}Si: E=0.0; $J^\pi=(3/2)^+$; $T_{1/2}$=6.11 s *21*; Q(β^-)=5823.0 *13*; %β^- decay=100

^{33}Si-Q(β^-): From 2021Wa16.

^{33}Si-J^π,$T_{1/2}$: From ^{33}Si Adopted Levels.

Additional information 1.

1973Go33 (also 1972Go09): ^{33}Si was produced in ^{18}O(^{18}O,2pn) reaction at E(^{18}O)=42 MeV, bombarding a 3 mg/cm^2 Ta_2O_5 target, enriched to 99% in ^{18}O at BNL. The target was then transferred to a remotely located counting station. γ rays were detected with a 7.6 cm diameter by 5.1 cm deep Ne 102 detector and a 60 cm^3 Ge(Li) detector. Measured Eγ, Iγ. Deduced levels.

2002Mo29: ^{33}Mg and ^{33}Al produced by projectile fragmentation of 140 MeV/nucleon $^{40}Ar^{18+}$ in a 1455 mg/cm^2 ^{9}Be target using new Coupled Cyclotron Facility at NSCL. A double-sided silicon strip detector (DSSD) was used as a monitor of β-decay activity and two HPGe counters for detecting γ-rays, FWHM=3.5 keV at 1.33 MeV. Measured Eγ, Iγ, $T_{1/2}$. Deduced levels.

2002Mo29 give the absolute intensity of the 1847.5 γ-ray as 5.1% *5* in equilibrium with ^{33}Al decay, but it is not clear how this intensity was obtained.

^{33}P Levels

E(level)‡	J^π†	$T_{1/2}$†	E(level)‡	J^π†	$T_{1/2}$†
0.0	$1/2^+$	25.38 d *6*	4048.3	$5/2^+$	59 fs *21*
1431.7	$3/2^+$	0.43 ps *7*	4192.3	$5/2^+$	104 fs *35*
1847.7	$5/2^+$	0.78 ps *11*	4226.2	$7/2^-$	0.32 ps *7*
2538.6	$3/2^+$	35 fs *14*	4856.0	$3/2,5/2^{(+)}$	<76 fs
3276.2	$3/2^+$	0.14 ps *3*	5053.4	$3/2^+$	<62 fs
3490.6	$5/2^+$	63 fs *14*	5190.5	$(5/2^+)$	<0.13 ps
3627.9	$7/2^+$	151 fs *28*			

† From the Adopted Levels.

‡ Rounded-off values from the Adopted Levels.

γ(^{33}P)

Iγ normalization: In March 2011 update (and in 2011Ch49, Nuclear Data Sheets publication), gamma normalization factor of 0.051 *5* was used from 2002Mo29, who stated that the absolute intensity of the 1847.5 γ-ray as 5.1% *5* in equilibrium with ^{33}Al decay. But this normalization factor is now rejected as there are no details available as to how the absolute intensity was obtained. Communication with the authors at NSCL-MSU in April 2017 (by B. Singh) did not produce any clarification of this issue. Furthermore, 2017LiZZ (priv. comm.), from their on-going work at CERN-ISOLDE facility suggest a preliminary value for absolute Iγ(1847γ)=78% *16* and nearly zero β feeding to the g.s., implying gamma-normalization factor of 0.78 *16*.

Note that the list of Eγ and Iγ values reported in Table III of 1973Go33 from their work is incomplete, as compared to transitions in the level scheme in Fig. 2 taken from 1973Po02 in (t,pγ) by 1973Go33. The strongest transitions: 1429γ from 3275 level and 5048γ from 5048 level as shown in the level scheme in Fig. 2, are not reported in the list.

E$_\gamma$†	I$_\gamma$‡	E$_i$(level)	J_i^π	E$_f$	J_f^π	Mult.#	δ#	Comments
415.8	6.7 *6*	1847.7	$5/2^+$	1431.7	$3/2^+$	M1(+E2)	+0.09 *18*	E$_\gamma$: from 1973Go33.
1431.5	13.1 *10*	1431.7	$3/2^+$	0.0	$1/2^+$	M1+E2	−0.58 *11*	E$_\gamma$: from 2002Mo29.
1642.7	<1.5	3490.6	$5/2^+$	1847.7	$5/2^+$	(M1(+E2))	+0.9 *12*	
1847.0	100 *1*	1847.7	$5/2^+$	0.0	$1/2^+$	E2		E$_\gamma$: from 2002Mo29. I$_\gamma$: in 2017LiZZ (priv. comm.), absolute Iγ=78 *16* in contrast to 5.1% *5* in 2002Mo29.
2058.8	<1.3	3490.6	$5/2^+$	1431.7	$3/2^+$	M1+E2	−0.17 *10*	
2196.1	<0.5	3627.9	$7/2^+$	1431.7	$3/2^+$	E2		

Continued on next page (footnotes at end of table)

^{33}Si β^- decay (6.11 s) 1973Go33 (continued)

$\gamma(^{33}P)$ (continued)

E_γ[†]	I_γ[‡]	E_i(level)	J_i^π	E_f	J_f^π	Mult.[#]	δ[#]	Comments
2378.4	<0.32	4226.2	$7/2^-$	1847.7	$5/2^+$	(E1(+M2))	+0.01 *8*	
2538.7	9.3 *8*	2538.6	$3/2^+$	0.0	$1/2^+$	M1+E2	+0.16 *4*	
2616.5	<1.3	4048.3	$5/2^+$	1431.7	$3/2^+$	M1+E2	+0.19 *4*	
3008.3	<1.4	4856.0	$3/2,5/2^{(+)}$	1847.7	$5/2^+$	D+Q		
3206.0	<1.5	5053.4	$3/2^+$	1847.7	$5/2^+$	(M1(+E2))	−0.22 *65*	Note that the strongest transition from 5048 level as shown in Fig.2 of 1973Go33 taken from 1973Po02 is 5048γ to ground state, which is not reported by 1973Go33.
3275.1	<1.1	3276.2	$3/2^+$	0.0	$1/2^+$	(M1+E2)		Note that the strongest transition from 3275 level as shown in Fig.2 of 1973Go33 taken from 1973Po02 is 1429γ to 1848 level, which is not reported by 1973Go33.
3340.9	<1.2	5190.5	$(5/2^+)$	1847.7	$5/2^+$			
3758	<0.9	5190.5	$(5/2^+)$	1431.7	$3/2^+$	(M1(+E2))	0.0 *3*	
4193.5	<0.77	4192.3	$5/2^+$	0.0	$1/2^+$	E2(+M3)		

[†] Rounded-off values from the Adopted Gammas, unless otherwise noted. Those transitions are reported in 1973Go33, but no Eγ values from their measurement are listed except for 415.8γ.

[‡] From 1973Go33.

[#] From the Adopted Gammas.

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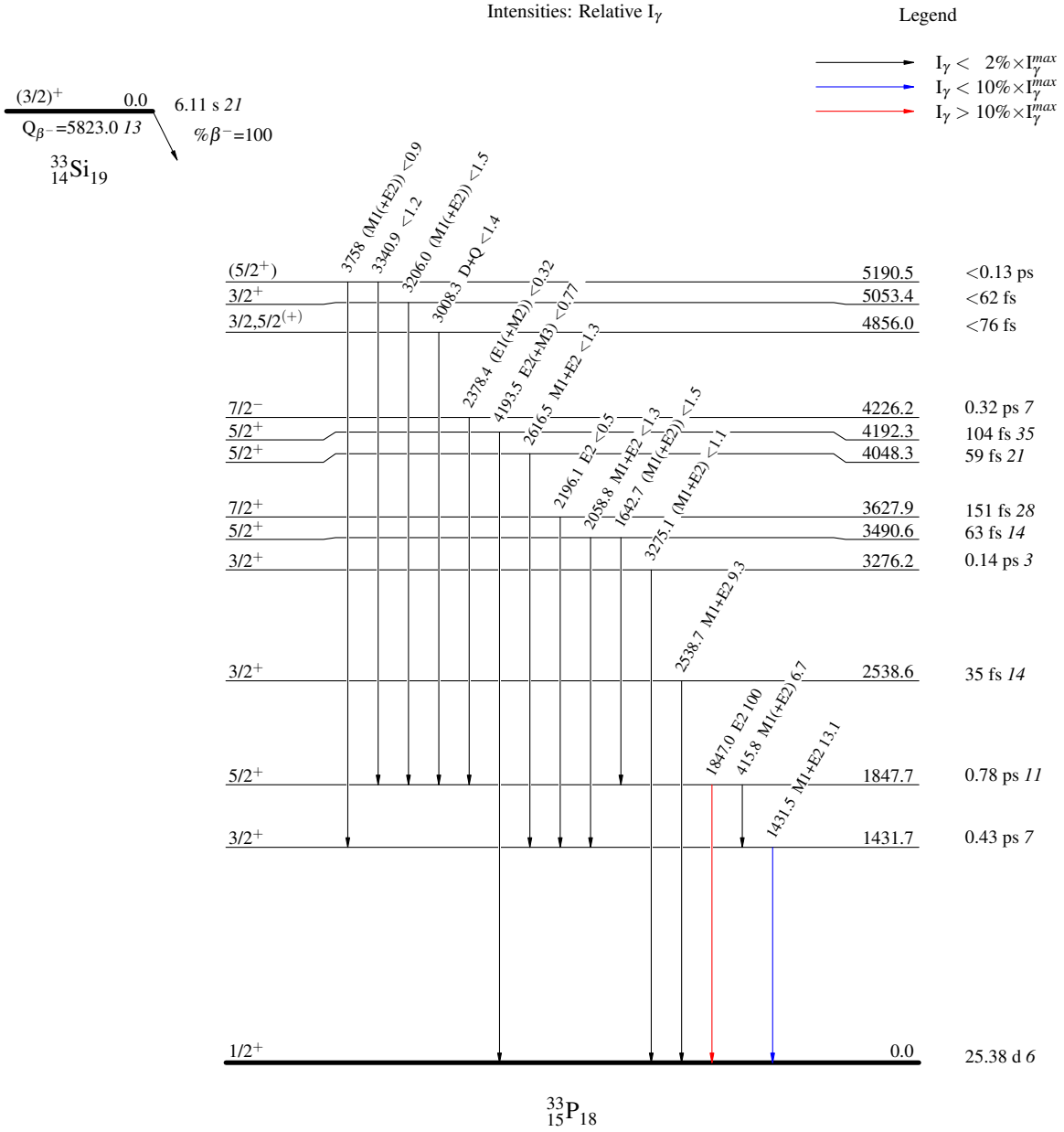
Decay Scheme

Intensities: Relative I_γ



$^{33}_{15}P_{18}$