Adopted Levels, Gammas

History

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

Q(β^-)=5823.0 *13*; S(n)=4508.0 *8*; S(p)=16704 *7*; Q(α)=−12326.9 *8* 2021Wa16
S(2n)=13707.9 *7*, S(2p)=31970 *3* (2021Wa16).
Identification: 1971Ar32: ^{232}Th(^{40}Ar,X) E=290 MeV, measured fragment isotopic yield.
Mass measurement: 2009Kw02 (mass excess=−20514.30 *70*).
Later studies of production and decay studies of ^{33}Si: 1972Go32, 1972Go09, 1973Go33, 1991Zh24, 1991Or01, 1995ReZZ, 2002Mo29.
Other measurements:
2006Kh08: cross-section measurement in Si(^{33}Si,X) E=30-65 MeV/nucleon, deduced reduced strong absorption radius= 1.0200 fm^2 *15*. ^{33}Si beam was obtained from fragmentation of a ^{48}Ca beam with ^{181}Ta target at GANIL facility.
1999Ai02: cross-section measurement in Si(^{33}Si,X) E=38-80 MeV/nucleon at NSCL facility. Deduced strong absorption radius. Additional information 1.
Structure calculations:
2017Sa48: calculated magnetic-dipole and electric-quadrupole moments for ground state.
2017Ta18: calculated levels, J, π, configurations.
2013Li39: calculated β-decay half-life, β-delayed neutron emission probabilities.

^{33}Si Levels

Cross Reference (XREF) Flags

A	^{33}Al β^- decay (41.5 ms)	E	^{34}S(^{13}C,^{14}O)	I	^{198}Pt(^{37}Cl,Xγ)
B	^{34}Al β^-n decay:mixed	F	^{36}S(^{11}B,^{14}N)	J	^{208}Pb(^{36}S,Xγ)
C	^{2}H(^{32}Si,p)	G	^{36}S(^{14}C,^{17}O)	K	Coulomb excitation
D	^{9}Be(^{34}Si,^{33}Siγ)	H	^{160}Gd(^{34}S,X),(^{36}S,X)		

E(level)[†]	J$^\pi$	T$_{1/2}$	XREF	Comments
0.0	(3/2)$^+$[‡]	6.11 s *21*	ABCDEFGHIJK	%β^-=100 μ=1.21 *3* (1992Ma52,2019StZV) J$^\pi$: L(d,p)=L(^{9}Be(^{34}Si,^{33}Si))=2 from 0$^+$. T$_{1/2}$: from γ-multi-scaling (1973Go33). Other: 6.3 s *3* (1972Go09, same group as 1973Go33). μ: from g-factor=0.803 *21* (preliminary value from NMR of nuclei polarized by optical pumping with β-asymmetry detection) (1992Sh31, 1992Ma52; also 1992MaZS, 1992Sh23, 1992ShZL).
1009.92 *40*	1/2$^+$[‡]		ABCDEFGH JK	B(E2)↑=0.00165 *32* (2000Pr09) XREF: B(?)E(1040?)F(1060)G(1040). J$^\pi$: L(d,p)=L(^{9}Be(^{34}Si,^{33}Si))=0 from 0$^+$. B(E2)↑: from Coulomb excitation (2000Pr09).
1434.9 *5*	7/2$^-$	10.2 ns *3*	BCDE HIJ	XREF: E(1470). J$^\pi$: 1434.9γ M2 to 3/2$^+$. T$_{1/2}$: from (fragment)γ(t) in ^{198}Pt(^{37}Cl,Xγ) (2002AsZY).
1980.9 *11*	(3/2)$^-$[‡]		CDE J	XREF: E(2000). J$^\pi$: L(d,p)=L(^{9}Be(^{34}Si,^{33}Si))=1 from 0$^+$.
3159.0 *16*	(9/2$^-$)		CDE J	XREF: C(3190)E(3190). J$^\pi$: 1724γ to 7/2$^-$; 9/2$^-$ from shell-model predictions (2010Wa20,2020Jo06). Other: L(d,p)=(3) giving (5/2$^-$,7/2$^-$) for a group at 3190 *20* is in disagreement, which may indicate a separate level.
3580 *20*	1/2$^-$,3/2$^-$		C	J$^\pi$: L(d,p)=1 from 0$^+$. 2024Ch33 state that the sum-rule analysis strongly supports 1/2$^-$ since it almost exhausts the full 1p$_{1/2}$ orbital single-particle strength.

Continued on next page (footnotes at end of table)

Adopted Levels, Gammas (continued)

^{33}Si Levels (continued)

E(level)[†]	J^π	XREF	Comments
4090.0 *16*	$(11/2^-)$	DE J	XREF: E(4130). J^π: 2655γ to $7/2^-$, 931γ to $(9/2^-)$; $11/2^-$ from shell-model prediction (2010Wa20).
4268.3 *40*	$(5/2^+)$[‡]	D k	XREF: k(4300). J^π: L(^{9}Be(^{34}Si,^{33}Si))=(2) from 0^+ (2020Jo06). B(E2)↑=0.0069 *13* for a level at 4300 in Coulomb excitation (2000Pr09).
4346.3 *40*	$(5/2^+)$[‡]	A DEF k	XREF: E(4320)F(4320)k(4300). J^π: L(^{9}Be(^{34}Si,^{33}Si))=(2) from 0^+ (2020Jo06). B(E2)↑=0.0069 *13* for a level at 4300 in Coulomb excitation (2000Pr09).
4520 *40*	$(1/2^-,3/2,5/2^+)$	C	J^π: L(d,p)=(1,2) from 0^+.
4932.1 *26*	$(11/2^-)$	D J	XREF: J(4931?). J^π: 1773γ to $(9/2^-)$; $11/2^-$ from shell-model predictions (2010Wa20).
5443 *6*	$(5/2^+)$[‡]	CDE	XREF: C(5430)E(5480). J^π: L(^{9}Be(^{34}Si,^{33}Si))=(2) from 0^+ (2020Jo06). Other: L(d,p)=(3) in ^{2}H(^{32}Si,p) giving $(5/2^-,7/2^-)$ for a group at 5430 *40* (2024Ch33) is in disagreement, which may indicate a separate level.

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

[‡] From L(n)-transfers deduced from measured momentum distribution in ^{9}Be(^{34}Si,^{33}Si) as given under comments and shell-model predictions for spin (2020Jo06).

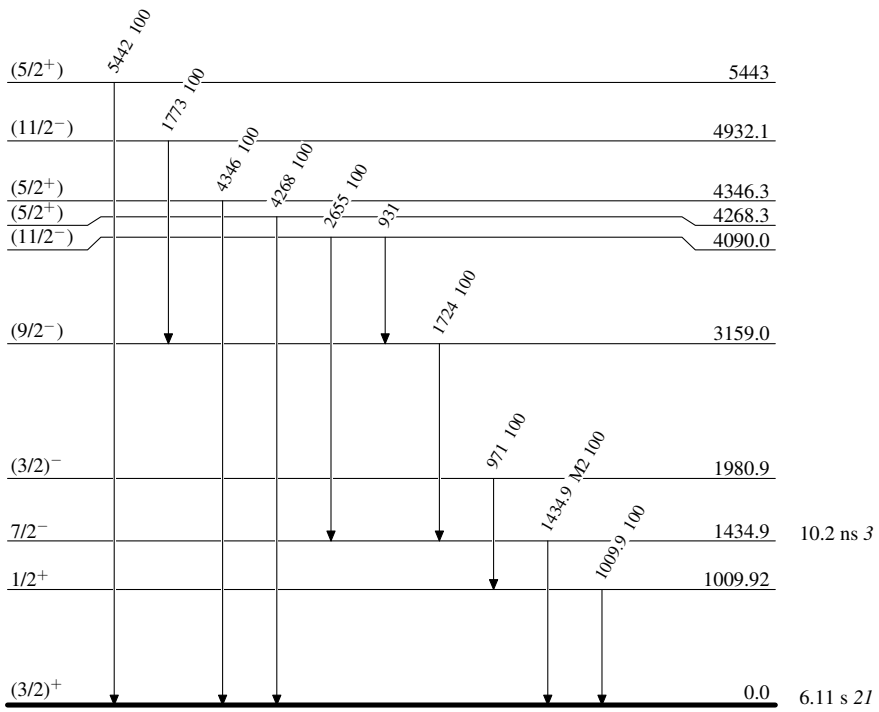
$\gamma(^{33}Si)$

E_i(level)	J_i^π	E_γ	I_γ	E_f	J_f^π	Mult.	Comments
1009.92	$1/2^+$	1009.9 *4*	100	0.0	$(3/2)^+$		E_γ: weighted average of 1010.2 *5* from ^{33}Al β^- decay, 1009.7 *4* from ^{34}Al β^-n decay, 1010 *1* from (^{34}Si,^{33}Siγ), and 1010 *1* from (^{36}S,Xγ). Other: 1010 *7* from Coulomb excitation.
1434.9	$7/2^-$	1434.9 *5*	100	0.0	$(3/2)^+$	M2	B(M2)(W.u.)=0.0486 *15* E_γ: from ^{34}Al β^-n decay. Other: 1435 *2* from (^{36}S,Xγ). Mult.: from analysis of in-plane to out-of-plane γ asymmetry in ^{198}Pt(^{37}Cl,Xγ) (2002AsZY).
1980.9	$(3/2)^-$	971 *1*	100	1009.92	$1/2^+$		E_γ: from (^{34}Si,^{33}Siγ) and (^{36}S,Xγ).
3159.0	$(9/2^-)$	1724 *2*	100	1434.9	$7/2^-$		E_γ: from (^{34}Si,^{33}Siγ) and (^{36}S,Xγ).
4090.0	$(11/2^-)$	931 *1*		3159.0	$(9/2^-)$		E_γ: from (^{34}Si,^{33}Siγ) only.
		2655 *2*	100	1434.9	$7/2^-$		E_γ: from (^{36}S,Xγ). Other: 2655 *3* from (^{34}Si,^{33}Siγ).
4268.3	$(5/2^+)$	4268 *4*	100	0.0	$(3/2)^+$		E_γ: from (^{34}Si,^{33}Siγ) only.
4346.3	$(5/2^+)$	4346 *4*	100	0.0	$(3/2)^+$		E_γ: weighted average of 4341 *11* from ^{33}Al β^- decay and 4347 *4* from (^{34}Si,^{33}Siγ).
4932.1	$(11/2^-)$	1773 *2*	100	3159.0	$(9/2^-)$		E_γ: from (^{34}Si,^{33}Siγ). Other: 1772 *2* from (^{36}S,Xγ).
5443	$(5/2^+)$	5442 *6*	100	0.0	$(3/2)^+$		E_γ: from (^{34}Si,^{33}Siγ) only.

Adopted Levels, Gammas

Level Scheme

Intensities: Relative photon branching from each level



$^{33}_{14}Si_{19}$