^{30}Si(n,γ) E=thermal 1992Ra19,1972Dz13,1990Is02

History

Type	Author	Citation	Literature Cutoff Date
Full Evaluation	Jun Chen and Balraj Singh	NDS 184,29 (2022)	24-Jun-2022

1992Ra19: thermal neutrons were from Los Alamos Omega West Reactor. Targets were natural silicon powder and SiO_2 (95.28% enriched). γ rays were detected with a 30-cm^3 coaxial intrinsic Ge detector inside a NaI(Tl) annulus. Measured Eγ, Iγ, $\gamma\gamma$-coin. Deduced levels.

1990Is02: thermal neutrons from McMaster University Nuclear Reactor, pair spectrometer detection (FWHM=5.0 at 8.3 MeV), measured Eγ, Iγ high purity quartz SiO_2 target.

1972Dz13 (also 1970JaZO): thermal neutrons from IRT reactor at the Baghdad Nuclear Research Institute. Measured Eγ, Iγ.

2007ChZX: Compilation of Eγ, Iγ from neutron capture for nuclei of Z=1-92.

Others: 1970Be48, 1970Sp02, 2001Pa52.

The γ-ray energies and cross section data have been measured at Budapest reactor facility with very low (neutron) background during 1999-2003. Detailed reports of this work are available on the following (IAEA) websites: www-nds.iaea.org/pgaa/pgaa7/index.html. See also IAEA publication 2007ChZX, and a book by G. Molnar: Handbook of Prompt Gamma Activation Analysis with Neutron Beams (Springer, 2004).

^{31}Si Levels

E(level)†	J$^\pi$‡	Comments
0.0	3/2$^+$	
752.23 *3*	1/2$^+$	
1694.92 *4*	5/2$^+$	
2316.94 *9*	3/2$^+$	
2788.03 *6*	5/2$^+$	
3532.92 *3*	3/2$^-$	
4382.37 *3*	3/2$^-$	
5281.36 *4*	(1/2)$^-$	
5873.15 *6*	1/2$^-$,3/2$^-$	
5957.91 *18*	(1/2$^-$,3/2,5/2$^+$)	
(6587.40 *3*)	1/2$^+$	E(level): S(n)=6587.39 *4* (2021Wa16). J$^\pi$: s-wave neutron capture in 0$^+$ spin target.

† From a least-squares fit to γ-ray energies.
‡ From Adopted Levels, except as noted.

γ(^{31}Si)

Iγ normalization: From 1992Ra19, to obtain Iγ per 100 neutron captures.
Total capture cross section (mb): 107.7 *25* (1992Ra19), 107 *2* 1990Is02.

E$_\gamma$†	I$_\gamma$†‡	E$_i$(level)	J$_i^\pi$	E$_f$	J$_f^\pi$	Comments
622.19 *20*	0.13 *3*	2316.94	3/2$^+$	1694.92	5/2$^+$	
629.43 *19*	0.21 *3*	(6587.40)	1/2$^+$	5957.91	(1/2$^-$,3/2,5/2$^+$)	E$_\gamma$: other: Eγ=629.48 *18*, 0.227 *32* (Budapest data).
714.22 *6*	0.93 *6*	(6587.40)	1/2$^+$	5873.15	1/2$^-$,3/2$^-$	E$_\gamma$: other: Eγ=714.24 *6*, 1.01 *7* (Budapest data).
745.1 *9*	0.03 *1*	3532.92	3/2$^-$	2788.03	5/2$^+$	Other: Eγ=744.87 *6*, Iγ=0.032 *10* (Budapest data).
752.22 *3*	94 *3*	752.23	1/2$^+$	0.0	3/2$^+$	E$_\gamma$: others: 752.44 *15* (1972Dz13), 752.4 *2* (1970Sp02), 753.0 *10* (1970Be48), 752.215 *23* (Budapest data). I$_\gamma$: others: 94 *10* (1972Dz13), 94 *17* (1970Be48), 102 *3* (Budapest data).
849.45 *15*	0.44 *5*	4382.37	3/2$^-$	3532.92	3/2$^-$	E$_\gamma$: other: Eγ=849.44 *3*, 0.48 *6* (Budapest data).
898.6 *7*	0.07 *2*	5281.36	(1/2)$^-$	4382.37	3/2$^-$	E$_\gamma$: other: Eγ=898.98 *3*, 0.075 *23* (Budapest data).
943.2 *7*	0.04 *1*	1694.92	5/2$^+$	752.23	1/2$^+$	Others: Eγ=942.67 *4*, Iγ=0.042 *10* (Budapest data).

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^{30}Si(n,γ) E=thermal 1992Ra19,1972Dz13,1990Is02 (continued)

$\gamma(^{31}Si)$ (continued)

E_γ[†]	I_γ[†‡]	E_i(level)	J_i^π	E_f	J_f^π	Comments
1216.0[#] *5*	<0.05	3532.92	$3/2^-$	2316.94	$3/2^+$	Other: Eγ=1215.96 *9*, Iγ=0.026 *26* (Budapest data).
1305.99 *4*	18.2 *6*	(6587.40)	$1/2^+$	5281.36	$(1/2)^-$	E_γ: others: 1306.1 *3* (1972Dz13), 1307 *2* (1970Be48), 1306.01 *3* (Budapest data). I_γ: others: 16.9 *19* (1972Dz13); 6.9 *7* (1970Be48, discrepant data), 19.8 *39* (Budapest data).
1564.2 *4*	0.16 *4*	2316.94	$3/2^+$	752.23	$1/2^+$	Other: Eγ=1564.66 *9*, Iγ=0.17 *5* (Budapest data).
1594.30 *6*	1.03 *6*	4382.37	$3/2^-$	2788.03	$5/2^+$	E_γ: other: Eγ=1594.29 *5*, 1.12 *8* (Budapest data).
1694.87 *5*	3.96 *20*	1694.92	$5/2^+$	0.0	$3/2^+$	E_γ: Others: 1695.6 *5* (1972Dz13), 1694.8 *10* (1970Be48), 1694.87 *4* (Budapest data). I_γ: others: 2.2 *8* (1972Dz13), 2.7 *7* (1970Be48), 4.31 *26* (Budapest data).
1748.38 *6*	1.37 *7*	5281.36	$(1/2)^-$	3532.92	$3/2^-$	E_γ: other: Eγ=1748.39 *3*, 1.49 *10* (Budapest data).
1837.92 *5*	2.19 *12*	3532.92	$3/2^-$	1694.92	$5/2^+$	E_γ: other: 1837.3 *8* (1972Dz13), 1837.94 *4* (Budapest data). I_γ: other: 2.4 *8* (1972Dz13), 2.36 *16* (Budapest data).
2065.6 *6*	0.12 *3*	4382.37	$3/2^-$	2316.94	$3/2^+$	E_γ: other: Eγ=2065.36 *10*, 0.13 *3* (Budapest data).
2204.95 *3*	13.6 *5*	(6587.40)	$1/2^+$	4382.37	$3/2^-$	E_γ: others: 2205.14 *21* (1990Is02), 2204.6 *8* (1972Dz13), 2206.9 *6* (1970Be48), 2205.2 *3* (1970Sp02), 2204.945 *25* (Budapest data). I_γ: others: 13.9 *21* (1990Is02), 11.3 *19* (1972Dz13), 9.4 *34* (1970Be48), 14.9 *36* (Budapest data).
2316.80 *14*	0.72 *6*	2316.94	$3/2^+$	0.0	$3/2^+$	E_γ: others: 2316.7 *10* (1972Dz13), 2316.84 *9* (Budapest data). I_γ: others: 2.6 *6* (1972Dz13), 0.78 *7* (Budapest data).
2493.2[#] *10*	<0.08	5281.36	$(1/2)^-$	2788.03	$5/2^+$	E_γ: other: Eγ=2493.22 *6*, 0.04 *4* (Budapest data).
2687.35 *8*	1.65 *10*	4382.37	$3/2^-$	1694.92	$5/2^+$	E_γ: other: Eγ=2687.32 *4*, 1.78 *13* (Budapest data).
2780.56 *3*	71.7 *24*	3532.92	$3/2^-$	752.23	$1/2^+$	E_γ: others: 2780.57 *5* (1990Is02), 2781.10 *15* (1972Dz13), 2781.0 *2* (1970Be48), 2780.8 *4* (1970Sp02), 2780.552 *22* (Budapest data). I_γ: others: 74.4 *21* (1990Is02), 62 *7* (1972Dz13), 66 *7* (1970Be48), 78 *4* (Budapest data).
2787.90 *12*	1.16 *9*	2788.03	$5/2^+$	0.0	$3/2^+$	Other: Eγ=2787.89 *6*, Iγ=1.26 *10* (Budapest data).
2964.26 *18*	0.72 *7*	5281.36	$(1/2)^-$	2316.94	$3/2^+$	E_γ: other: Eγ=2964.28 *9*, 0.78 *8* (Budapest data).
3054.33 *3*	72.8 *23*	(6587.40)	$1/2^+$	3532.92	$3/2^-$	E_γ: others: 3054.32 *5* (1990Is02), 3054.76 *20* (1972Dz13), 3055.0 *4* (1970Be48), 3054.3 *5* (1970Sp02), 3054.321 *23* (Budapest data). I_γ: others: 76.3 *19* (1990Is02), 67 *7* (1972Dz13), 62 *6* (1970Be48), 79.4 *45* (Budapest data).
3532.74 *8*	1.78 *10*	3532.92	$3/2^-$	0.0	$3/2^+$	E_γ: others: 3534 *1* (1972Dz13), 3534.0 *10* (1970Be48), 3532.69 *3* (Budapest data). I_γ: others: 4.7 *7* (1972Dz13), 1.9 *4* (1970Be48), 1.94 *13* (Budapest data).
3586.2[#] *10*	<0.10	5281.36	$(1/2)^-$	1694.92	$5/2^+$	E_γ: other: Eγ=3586.22 *4*, 7.5 *20* (Budapest data). Value of σ_γ seems in serious disagreement with that from 1992Ra19, perhaps due to incorrect assignment of γ ray in these data.
3629.90 *4*	8.1 *3*	4382.37	$3/2^-$	752.23	$1/2^+$	E_γ: others: 3629.73 *16* (1990Is02), 3630.7 *4* (1972Dz13), 3630.2 *3* (1970Be48), 3629.91 *3* (Budapest data). I_γ: others: 8.0 *8* (1990Is02), 5.9 *8* (1972Dz13), 6.5 *7* (1970Be48), 8.8 *4* (Budapest data).
3640.2 *9*	0.04 *2*	5957.91	$(1/2^-,3/2,5/2^+)$	2316.94	$3/2^+$	E_γ: other: Eγ=3640.75 *20*, 0.042 *23* (Budapest data).
3798.2 *8*	0.14 *4*	(6587.40)	$1/2^+$	2788.03	$5/2^+$	E_γ: other: Eγ=3799.12 *6*, 0.15 *4* (Budapest data).
4270.1[#]	<0.07	(6587.40)	$1/2^+$	2316.94	$3/2^+$	E_γ: other: Eγ=4270.15 *9*, 0.04 *4* (Budapest data). 1970Be48 report a γ with Eγ=4259 *2*, Iγ=0.34 *17*.

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^{30}Si(n,γ) E=thermal 1992Ra19,1972Dz13,1990Is02 (continued)

$\gamma(^{31}Si)$ (continued)

E_γ [†]	I_γ [†‡]	E_i(level)	J_i^π	E_f	J_f^π	Comments
4382.04 *14*	1.85 *14*	4382.37	$3/2^-$	0.0	$3/2^+$	E_γ: others: 4382 *2*(1972Dz13), 4381.5 *4* (1970Be48), 4382.03 *3* (Budapest data). I_γ: others: 1.6 *3* (1972Dz13), 1.54 *15* (1970Be48), 2.01 *16* (Budapest data).
4528.77 *4*	15.7 *5*	5281.36	$(1/2)^-$	752.23	$1/2^+$	E_γ: others: 4528.75 *7* (1990Is02), 4529.3 *3* (1972Dz13), 4528.3 *2* (1970Be48), 4528.78 *3* (Budapest data). I_γ: others: 15.3 *6* (1990Is02), 13.2 *14* (1972Dz13), 11.1 *11* (1970Be48), 17.2 *33* (Budapest data).
4892.1[#]	<0.10	(6587.40)	$1/2^+$	1694.92	$5/2^+$	E_γ: other: Eγ=4892.06 *4*, 0.06 *6* (Budapest data). 1972Dz13 reported a 4903.1γ with Iγ=0.94 *19* but no such transition has been reported in any other study including 1992Ra19. It is possibly an impurity line in 1972Dz13.
5280.9 *6*	0.24 *4*	5281.36	$(1/2)^-$	0.0	$3/2^+$	E_γ: other: Eγ=5280.87 *4*, 0.26 *5* (Budapest data).
5834.2 *6*	0.25 *4*	(6587.40)	$1/2^+$	752.23	$1/2^+$	E_γ: other: Eγ=5834.58 *3*, 0.27 *5* (Budapest data).
5872.37 *18*	0.87 *9*	5873.15	$1/2^-$,$3/2^-$	0.0	$3/2^+$	E_γ: others: 5871.58 *75* (1990Is02), 5873.2 *5* (1970Be48), 5872.55 *6* (Budapest data). I_γ: others: 1.0 *3* (1990Is02), 0.94 *17* (1970Be48), 0.94 *10* (Budapest data).
5956.9 *8*	0.12 *3*	5957.91	$(1/2^-,3/2,5/2^+)$	0.0	$3/2^+$	E_γ: other: Eγ=5957.29 *18*, 0.130 *32* (Budapest data).
6586.71 *13*	1.57 *14*	(6587.40)	$1/2^+$	0.0	$3/2^+$	E_γ: others: 6586.39 *25* (1990Is02), 6587.6 *8* (1972Dz13), 6587.5 *8* (1970Sp02), 6588.7 *4* (1970Be48), 6586.64 *3* (Budapest data). I_γ: others: 1.6 *2* (1990Is02), 1.03 *19* (1972Dz13), 1.54 *15* (1970Be48), 1.72 *16* (Budapest data).

† From 1992Ra19, unless otherwise stated. Intensities represent absolute cross sections. To obtain intensities per 100 neutron captures, multiply by 0.934 (1992Ra19). Intensities are also available in 1972Dz13, 1970Be48, and they are reported as either relative intensities or intensities per 100 neutron captures. After being normalized to σ(752.22γ)=94 *3* mb from 1992Ra19, those values as given under comments are in a good agreement with values from 1992Ra19 but less precise. Intensities in 1990Is02 are given as intensity per 100 neutron capture and have been converted to absolute cross section in mb by multiplying 1.07 *2*. All values in the table have been compared with values from 2007ChZX and they are in a good agreement. Budapest data for measured Eγ and Iγ values listed in comments have been taken from IAEA-Nuclear Data Sheets webpage: https://www-nds.iaea.org/pgaa/pgaa7/isol/Si-30.htm.

‡ For intensity per 100 neutron captures, multiply by 0.934.

Placement of transition in the level scheme is uncertain.

^{30}Si(n,γ) E=thermal 1992Ra19,1972Dz13,1990Is02

Level Scheme

Intensities: Absolute γ-cross sections (mb)

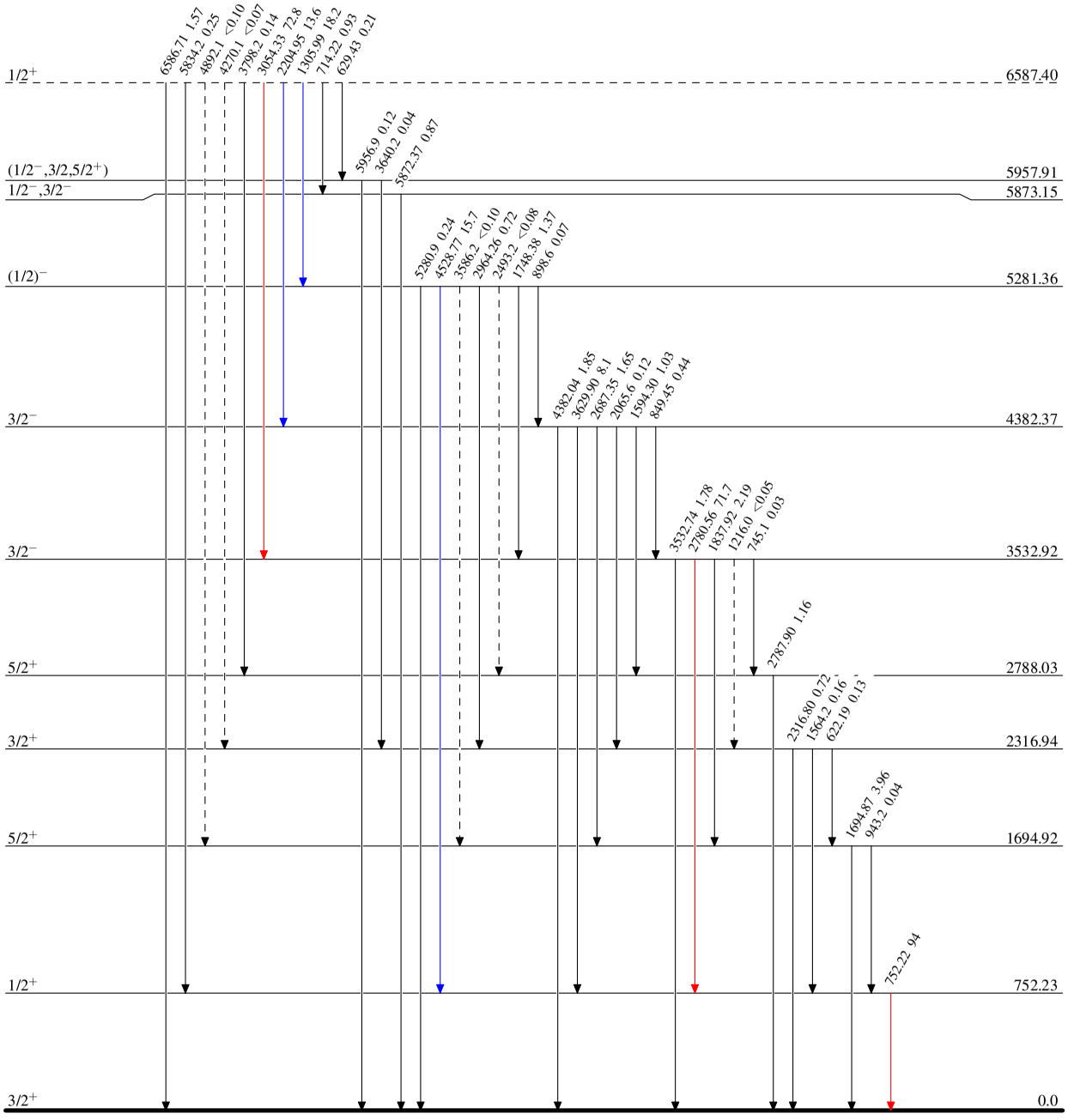
Legend

$I_\gamma < 2\% \times I_\gamma^{max}$

$I_\gamma < 10\% \times I_\gamma^{max}$

$I_\gamma > 10\% \times I_\gamma^{max}$

γ Decay (Uncertain)



$^{31}_{14}Si_{17}$