^{31}Na β^- decay (17.0 ms) 2019Ni04,1993Kl02,1984Gu19

History

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

Parent: ^{31}Na: E=0; J$^\pi$=3/2$^+$; $T_{1/2}$=17.0 ms *4*; Q(β^-)=15368 *14*; %β^- decay=100.0

^{31}Na-J$^\pi$,$T_{1/2}$: From Adopted Levels of ^{31}Na.

^{31}Na-Q(β^-): From 2021Wa16. For ^{31}Mg, S(n)=2312 *3* and S(2n)=8652 *3* (2021Wa16).

^{31}Na-%β^- decay: Adopted %β^-n=39 *5* and %β^-2n=0.7 *1*, from weighted average of the following values: %β^-2n=0.9 *2* and %β^-n=37.1 *59* deduced from %β^-n+%β^-2n=38 *6* (1984La03) and %β^-2n/(%β^-n+%β^-2n)=0.023 *5* (1980De26) by neutron counting; %β^-2n=0.7 *1* and %β^-n=40 *5* from 2019Ni04 by γ counting based on known absolute γ-ray intensities in the daughter nuclei ^{31}Al (2005Ma86), ^{30}Al (2008Hi05,2016Ol06), ^{29}Al (1984Gu19) of ^{31}Na β, βn and β2n decays, respectively. Others: %β^-n+%β^-2n=30 *8* (1974Ro31); %β^-n=40 *12* and %β^-2n<1.5 (1984Gu19); %β^-=40 *14* (2008ReZZ); %β^-3n<0.05 deduced by 1984Gu19.

2019Ni04,2017Ni02: ^{31}Na was produced in the fragmentation of Uranium Carbide target with 500-MeV protons at the ISAC-TRIUMF facility. Ions of singly-charged ^{31}Na with an energy of 28 keV were separated using a high resolution mass separator, and were polarized by simultaneous pumping of both sub-levels of the atomic ground-state by two laser frequencies. At the counting station, static magnetic field of 0.53 T was applied along the polarization direction. Measured Eγ, Iγ, $\gamma\gamma$-coin, $\beta\gamma$-coin, level half-life by $\beta\gamma$(t), and β polarization asymmetries gated by γ rays using eight detector telescopes. Deduced levels, J, π, β feedings, log *ft* values. Comparison with antisymmetrized molecular dynamics (AMD) plus generator coordinate method (GCM). Data in 2017Ni02 are superseded by those in 2019Ni04.

1993Kl02: Na isotopes were produced by bombarding an Uranium Carbide target with 600 MeV protons from the CERN synchrocyclotron and separated by the ISOLDE2 separator. β particles were detected with a thin plastic scintillator, neutrons were detected with a liquid scintillator, and γ rays were detected with two Ge detectors. Measured Eγ, Iγ, $\beta\gamma$-coin, $\beta\gamma\gamma$-coin, $\beta\gamma$-n-coin. Deduced levels, J, π, branching ratios, log *ft*.

1984Gu19: Na isotopes were produced by bombarding a 30 g/cm^2 Ir target with 10 GeV proton beam from the CERN synchrotron. Fragments were separated and collected into a thin stainless steel tube. γ rays were detected with two Ge(Li) detectors and β particles were detected with two plastic scintillators. Measured Eγ, Iγ, $\beta\gamma$(t), $\beta\gamma$-coin, $\beta\gamma\gamma$-coin. Deduced levels, $T_{1/2}$, γ-ray branching ratios, β-delayed neutron-emission probabilities. Other papers from the same group with the same experimental setup are 1984La03: measured %β^-n, half-life and βn-coin; 1983De04: measured Q value, $\beta\gamma$-coin.

1979De02: ^{31}Na from U(p,X) E(p)=24 GeV at CERN. Measured Eγ, Iγ, γ(t), $\beta\gamma$-coin, $\beta\gamma\gamma$-coin. Deduced levels, $T_{1/2}$. 1980De26 from the same group produced the source also using 600 MeV protons, measured Eγ, Iγ, βn(t).

Others:

2017Ha23: measured half-life of ^{31}Na from implant-β(t). ^{31}Na from ^{9}Be(^{40}Ar,X) reaction with E(^{40}Ar)=69.2 MeV/nucleon from the RIBLL facility at HIRFL, Lanzhou.

2005Ma96: measured level lifetimes by $\beta\gamma\gamma$(t), ultra-fast timing.

1999Dl01, 1997Ta22 (also 2001Pe14): ^{31}Na from fragmentation of ^{36}S beam with ^{181}Ta target. Measured isotopic half-life, LISE spectrometer at GANIL.

1999YoZW, 1998NoZW: ^{31}Na from fragmentation of 75 MeV/nucleon ^{40}Ar beam with ^{181}Ta target, RIKEN facility. Results are preliminary in these reports.

Additional information 1.

2000Ke09, 1996Ke08: measured β^-NMR, deduced quadrupole interactions.

1974Ro31: measured half-life, delayed neutrons, $\beta\gamma$ coin.

1972Kl04 (also 1972RiZJ, 1971ThZL theses): Measured isotopic half-life.

1969Kl08: first paper on the production and identification of ^{31}Na isotope from Ir,U(p,X) reaction Ep=24 GeV, measured half-life.

The decay scheme is from 2019Ni04, unless otherwise noted.

Based on $\gamma\gamma$-coin data in 2019Ni04, no evidence was found for previously proposed levels at 3760 and 3815 keV in 1993Kl02. The 3538 and 3710 γ rays from the 3760 level were not seen by 2019Ni04 in coincidence with the 50-keV γ, and the 1571γ from 3815 level is relocated from 2244 level based on $\gamma\gamma$-coincidence data.

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^{31}Mg Levels

A and P under comments are β asymmetry parameter of each β transition and spin polarization P of the parent nucleus, respectively. Expected values of A are −1.0, −0.4 and +0.6 for daughter J^π values of $1/2^+$, $3/2^+$ and $5/2^+$, respectively, from $3/2^+$ parent state.

A=−1.0 for 2244, $1/2^+$ level and A=−0.4 for 673, $3/2^+$ level are assumed by the authors to deduce P=0.32 *1* from measured A×P=−0.33 *1* for 2244 level and −0.11 *1* for 673 level. Quoted values of asymmetry parameters of other levels given under comments are then deduced from measured A×P values using P=0.32 *1* (2019Ni04).

E(level)[†]	J^π[‡]	$T_{1/2}$[‡c]	Comments
0.0[d]	$1/2^+$	270 ms *2*	
49.93[d] *6*	$3/2^+$[b]	12.0 ns *4*	Asymmetry parameter A=−0.43 *9* (2019Ni04). $T_{1/2}$: adopted value is taken as weighted average of 12.0 ns *3* (2019Ni04) and 16 ns *3* (1993Kl02), from $\beta\gamma$(t).
220.80[e] *6*	$(3/2)^-$[&]	133 ps *8*	$T_{1/2}$: adopted value is from $\beta\gamma\gamma$(t) (2005Ma96).
460.72[#e] *10*	$(7/2^-)$[&]	10.5 ns *8*	
673.08 *7*	$3/2^+$[a]		Asymmetry parameter assumed to be A=−0.4, giving P=0.28 *3* from A×P=−0.11 *1* (2019Ni04).
941.92[#] *9*	$(1/2^-,3/2^-)$[@]		J^π: probable $3/2^-$ bandhead of theoretically predicted $K^\pi=3/2^-$, 3/2[321] band (2019Ni04).
944.00[d] *9*	$5/2^+$[b]		Asymmetry parameter A=+0.7 *2* (2019Ni04).
1028.61 *9*	$(1/2^-,3/2^-)$[@]		
1435.93[#] *8*	$(1/2^-,3/2^-)$[@]		
2015.08[#] *9*	$5/2^+$[b]		Asymmetry parameter A=+0.3 *2* (2019Ni04).
2243.64 *6*	$1/2^+$[a]		Asymmetry parameter assumed to be A=−1, giving P=0.33 *1* from A×P=−0.33 *1* (2019Ni04).
3759.6? *9*	$(1/2^+,3/2^+,5/2^+)$		E(level): proposed by 1993Kl02 based on observed 3537.7γ, 3710.0γ and 3761.1γ, which however are not observed in β-gated γ spectrum or 50γ-gated γ spectrum in 2019Ni04, making those transitions and this level questionable. This level is not adopted in Adopted Levels. J^π: based on possible β feeding from $3/2^+$ parent.
2312+x			E(level): x<13056 *14* from $Q(\beta^-)(^{31}Na)-S(n)(^{31}Mg)$, where $Q(\beta^-)$=15368 *14* and S(n)=2312 *3* from 2021Wa16. This represents a range of unobserved levels that subsequently decay to ^{30}Mg via one-neutron emission.
8652+y			E(level): y<6716 *14* from $Q(\beta^-)(^{31}Na)-S(2n)(^{31}Mg)$, where S(2n)=8652 *3* from 2021Wa16. This represents a range of unobserved levels that subsequently decay to ^{29}Mg via two-neutron emission.

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

[‡] From Adopted Levels. Supporting arguments from this dataset are given in comments and footnotes where available.

[#] Level reported in 2019Ni04,2017Ni02 only.

[@] Assignments proposed by 2019Ni04 based on high log *ft* values, and consistency of ratio of intensities of γ rays from each level with Weisskopf estimates for E1 and M1 transitions. However, evaluators notes that no lifetime data are available.

[&] Proposed by 2019Ni04 based on band assignment.

[a] Spin from measured A_{2244}*P/A_{673}*P=3.0 *3*, which is consistent only with J=1/2 for 2244 level and J=3/2 for 673 level; positive parity from allowed β feedings from $3/2^+$ parent state (2019Ni04).

[b] Spin from measured asymmetry parameters and positive parity from allowed β feedings from $3/2^+$ parent state (2019Ni04).

[c] From Adopted Levels. Adopted value which is taken from this dataset is indicated in comments and is from decay curve measured using implantation of the ^{31}Mg into a Si strip detector (2005Ma96), unless otherwise noted.

[d] Member of $K^\pi=1/2^+$,ν1/2[200] sequence (2019Ni04).

[e] Member of $K^\pi=1/2^-$,ν1/2[330] sequence (2019Ni04).

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β^- radiations

E(decay)	E(level)	Iβ^{-} †‡	Log *ft*	Comments
(3×10^3 @ *3*)	8652+y	0.7 *1*		Iβ^-: from adopted %β^-2n=0.7 *1* for the decay of ^{31}Na g.s.
(7×10^3 @ *7*)	2312+x	39 *5*		Iβ^-: from adopted %β^-n=39 *5* for the decay of ^{31}Na g.s.
(11608# *14*)	3759.6?	2.6 *7*	5.3 *1*	av Eβ=5544.1 *70*
(13124 *14*)	2243.64	21.8 *22*	4.7 *1*	av Eβ=6293.1 *70*
(13353 *14*)	2015.08	1.04 *11*	6.0 *1*	av Eβ=6406.0 *70*
(13932# *14*)	1435.93	<0.07	>7.3	av Eβ=6691.9 *70*
(14339# *14*)	1028.61	<0.2	>6.9	av Eβ=6893.0 *69* Additional information 2.
(14424 *14*)	944.00	0.68 *11*	6.4 *1*	av Eβ=6934.7 *69*
(14426 *14*)	941.92	0.20 *5*	6.9 *1*	av Eβ=6935.8 *70*
(14695 *14*)	673.08	5.4 *7*	5.5 *1*	av Eβ=7068.4 *69*
(14907 *14*)	460.72	0.10 *6*	10.0^{1u} *3*	av Eβ=7189.0 *70*
(15147# *14*)	220.80	<0.6	>6.5	av Eβ=7291.6 *69*
(15318 *14*)	49.93	8 *3*	5.4 *2*	av Eβ=7375.8 *69*
(15368 *14*)	0.0	22 *7*	5.0 *2*	av Eβ=7400.5 *69*

† From γ+ce intensity balance except for the ground state, where Iβ is deduced from 100−%β^-n-%β^-2n-Σ%I(γ+ce to g.s.), with adopted %β^-n=39 *5*, %β^-2n=0.7 *1*.

‡ Absolute intensity per 100 decays.

Existence of this branch is questionable.

@ Estimated for a range of levels.

$\gamma(^{31}$Mg)

Iγ normalization: Photon intensities given by 2019Ni04, 1993Kl02 and 1984Gu19 are per 100 decays of the parent. Normalization by 2019Ni04 is based on their estimated %β^-n and %β^-2n, and known absolute intensity of 666γ in ^{31}Al (2005Ma86) from the subsequent ^{31}Mg β^- decay. Normalization method by 1993Kl02 and 1984Gu19 is not obvious but it seems they have deduced absolute intensities of a few strong γ-rays using %β^-n=37.3% *54* and %β^-2n=0.87 *24* (1984Gu19,1984La03).

The following γ-rays with Eγ (relative Iγ) reported only by 1979De02 have been omitted here since these have not been confirmed in later studies (1993Kl02, 1984Gu19): 372.3 *10* (2.9 *14*), 473 *1* (8.2 *25*), 1222 *2* (13 *4*), 1259 *2* (4.5 *22*), 2030.5 *25* (12 *4*). Those intensities are relative to Iγ=100 for 1484γ in ^{30}Mg.

For relative intensities given under comments, values from 2019Ni04 are relative to I(50γ)=100 in ^{31}Mg while those from 1993Kl02, 1984Gu19, 1979De02 relative to I(1484γ)=100 in ^{30}Mg from ^{31}Na βn decay.

E$_\gamma$[‡]	I$_\gamma$[#a]	E$_i$(level)	J$^\pi_i$	E$_f$	J$^\pi_f$	Mult.	α[†]	Comments
49.9 *1*	21 *3*	49.93	3/2$^+$	0.0	1/2$^+$	[M1]	0.01325 *20*	α(K)=0.01241 *19*; α(L)=0.000812 *12*; α(M)=2.96×10^{-5} *4* E$_\gamma$: other: 50.5 *7* from 1993Kl02. I$_\gamma$: weighted average of 22 *3* (2019Ni04) and 20 *4* (1993Kl02). Iγ(relative)=125 *16* (1993Kl02). All relative Iγ values in 1993Kl02, 1984Gu19, 1979De02 are relative to I(1484γ)=100 in ^{30}Mg from ^{31}Na βn decay. Iγ(relative)=100 (2019Ni04). All other relative Iγ values in 2019Ni04 are relative to this value.
170.9 *1*	5.2 *9*	220.80	(3/2)$^-$	49.93	3/2$^+$	[E1]	1.04×10^{-3} *2*	α(K)=0.000977 *14*; α(L)=6.27×10^{-5} *9*; α(M)=2.312×10^{-6} *33* E$_\gamma$: others: 170.5 *5* (1993Kl02), 171.2 *8* (1984Gu19). I$_\gamma$: weighted average of 5.1 *9* (2019Ni04), 5.4 *9* (1993Kl02), and 4.9 *15* (1984Gu19). Iγ(relative)=35.0 *20* (1993Kl02), 34.0 *23* (1984Gu19). Iγ(relative)=24 *2* (2019Ni04).
220.8 *1*	2.0 *3*	220.80	(3/2)$^-$	0.0	1/2$^+$	[E1]	0.000466 *7*	α=0.000466 *7*; α(K)=0.000437 *6*; α(L)=2.81×10^{-5} *4*; α(M)=1.035×10^{-6} *15* E$_\gamma$: others: 221.0 *5* (1993Kl02), 221.7 *9* (1984Gu19). I$_\gamma$: weighted average of 1.9 *3* (2019Ni04), 2.2 *4* (1993Kl02), and 2.1 *7* (1984Gu19). Iγ(relative)=14.2 *11* (1993Kl02), 15.0 *15* (1984Gu19). Iγ(relative)=8.9 *6* (2019Ni04).
239.9[&] *1*	0.25[&] *5*	460.72	(7/2$^-$)	220.80	(3/2)$^-$			Iγ(relative)=1.2 *1* (2019Ni04).
452.4 *2*	0.38 *7*	673.08	3/2$^+$	220.80	(3/2)$^-$			E$_\gamma$: other: 451.1 *11* (1993Kl02). I$_\gamma$: weighted average of 0.4 *1* (1993Kl02) and 0.37 *7* (2019Ni04). Iγ(relative)=2.9 *8* (1993Kl02). Iγ(relative)=1.7 *2* (2019Ni04).
623.1 *1*	3.5 *6*	673.08	3/2$^+$	49.93	3/2$^+$			E$_\gamma$: others: 622.6 *14* (1993Kl02), 623.5 *8* (1984Gu19), 623.7 *10* (1979De02). I$_\gamma$: weighted average of 3.6 *6* (1993Kl02), 3.3 *10* (1984Gu19), and 3.4 *6* (2019Ni04). Iγ(relative)=23.0 *18* (1993Kl02), 23.0 *18* (1984Gu19). Other: 38 *4*

γ(^{31}Mg) (continued)

E_γ[‡]	I_γ[#a]	E_i(level)	J_i^π	E_f	J_f^π	Comments
						(1979De02) is discrepant. Iγ(relative)=16 2 (2019Ni04).
673.1 1	1.8 3	673.08	3/2+	0.0	1/2+	E_γ: others: 673.1 12 (1993Kl02), 673.8 12 (1984Gu19), 673.8 15 (1979De02). I_γ: weighted average of 1.8 3 (1993Kl02), 1.4 4 (1984Gu19), and 2.2 4 (2019Ni04). Iγ(relative)=11.6 9 (1993Kl02), 10.0 8 (1984Gu19). Other: 24 3 (1979De02) is discrepant. Iγ(relative)=10.2 7 (2019Ni04).
723.1[&] 1	0.11[&] 2	944.00	5/2+	220.80	(3/2)−	Iγ(relative)=0.51 7 (2019Ni04).
807.6[&] 1	0.4[&] 2	2243.64	1/2+	1435.93	(1/2−,3/2−)	Iγ(relative)=1.6 7 (2019Ni04).
807.8 1	1.3 2	1028.61	(1/2−,3/2−)	220.80	(3/2)−	E_γ: others: 807.6 6 (1993Kl02), 808.8 9 (1984Gu19), 809.8 15 (1979De02). I_γ: weighted average of 1.5 3 (1993Kl02), 1.6 5 (1984Gu19), 1.2 2 (2019Ni04). Iγ(relative)=9.4 14 (1993Kl02), 11.0 18 (1984Gu19). Other: 26 4 (1979De02) is discrepant. Iγ(relative)=5.7 6 (2019Ni04).
892.0[&] 1	0.15[&] 3	941.92	(1/2−,3/2−)	49.93	3/2+	Iγ(relative)=0.68 9 (2019Ni04).
894.1 1	0.7 1	944.00	5/2+	49.93	3/2+	E_γ: others: 894.6 7 (1993Kl02), 894.7 12 (1984Gu19). I_γ: weighted average of 0.9 2 (1993Kl02), 0.8 3 (1984Gu19), and 0.7 1 (2019Ni04). Iγ(relative)=5.8 12 (1993Kl02), 5.6 16 (1984Gu19). Iγ(relative)=3.0 2 (2019Ni04).
941.8[&] 2	0.13[&] 4	941.92	(1/2−,3/2−)	0.0	1/2+	Iγ(relative)=0.6 2 (2019Ni04).
1070.9[&] 2	0.13[&] 3	2015.08	5/2+	944.00	5/2+	Iγ(relative)=0.6 1 (2019Ni04).
1215.0 1	1.5 3	2243.64	1/2+	1028.61	(1/2−,3/2−)	E_γ: others: 214.7 9 (1993Kl02), 1214.4 9 (1984Gu19), 1222 2 (1979De02). I_γ: weighted average of 1.6 3 (1993Kl02), 1.2 4 (1984Gu19), and 1.5 3 (2019Ni04). Iγ(relative)=10.0 10 (1993Kl02), 8.6 8 (1984Gu19), 13 4 (1979De02). Iγ(relative)=6.8 5 (2019Ni04).
1301.7[&] 2	0.08[&] 2	2243.64	1/2+	941.92	(1/2−,3/2−)	Iγ(relative)=0.37 8 (2019Ni04).
1385.9[&] 1	0.19[&] 4	1435.93	(1/2−,3/2−)	49.93	3/2+	Iγ(relative)=0.9 1 (2019Ni04).
1435.8[&] 2	0.07[&] 2	1435.93	(1/2−,3/2−)	0.0	1/2+	Iγ(relative)=0.31 7 (2019Ni04).
1554.3[&] 1	0.15[&] 3	2015.08	5/2+	460.72	(7/2−)	Iγ(relative)=0.7 1 (2019Ni04).
1570.6 2	0.23 5	2243.64	1/2+	673.08	3/2+	E_γ: from 2019Ni04. Other: 1570.1 12 (1993Kl02). The placement is made by 2019Ni04 based on γγ-coin. 1993Kl02 place this γ from a level at 3815, with no coincidence data reported to support this placement. This γ is observed by 2019Ni04 to be in coincidence with 673γ but not with 2244γ from the 2244 level which is proposed by 1993Kl02 to be fed by this γ. Besides, the energy of this γ is consistent with the level energy difference between the 2244 and 673 levels. I_γ: from 2019Ni04. Other: 2.6 5 (1993Kl02) is discrepant. Iγ(relative)=16.8 19 (1993Kl02). Iγ(relative)=1.1 2 (2019Ni04).
1794.3[&] 1	0.7[&] 1	2015.08	5/2+	220.80	(3/2)−	Iγ(relative)=3.4 4 (2019Ni04).
1965.0[&] 2	0.06[&] 2	2015.08	5/2+	49.93	3/2+	Iγ(relative)=0.29 6 (2019Ni04).
2022.8 1	4.1 7	2243.64	1/2+	220.80	(3/2)−	E_γ: others: 2022.0 7 (1993Kl02), 2022.5 9 (1984Gu19), 2030.5 25 (1979De02). I_γ: weighted average of 4.5 9 (1993Kl02), 3.9 13 (1984Gu19), and 3.9 7 (2019Ni04). Iγ(relative)=29 3 (1993Kl02), 27 3 (1984Gu19). Other: 12 4 (1979De02) is discrepant. Iγ(relative)=18 1 (2019Ni04).

γ(^{31}Mg) (continued)

E_γ[‡]	I_γ[#a]	E_i(level)	J_i^π	E_f	J_f^π	Comments
2193.6 *1*	3.3 *5*	2243.64	1/2+	49.93	3/2+	E_γ: others: 2192.8 *6* (1993Kl02), 2193.1 *8* (1984Gu19), 2192.8 *25* (1979De02). I_γ: weighted average of 4.0 *8* (1993Kl02), 3.1 *10* (1984Gu19), and 3.0 *5* (2019Ni04). Iγ(relative)=26 *3* (1993Kl02), 22 *3* (1984Gu19), 17 *5* (1979De02). Iγ(relative)=14 *1* (2019Ni04).
2243.6 *1*	12.2 *20*	2243.64	1/2+	0.0	1/2+	E_γ: others: 2243.5 *6* (1993Kl02), 2243.8 *6* (1984Gu19), 2247.6 *25* (1979De02). I_γ: weighted average of 13.3 *23* (1993Kl02), 10.6 *33* (1984Gu19), and 12 *2* (2019Ni04). Iγ(relative)=86 *5* (1993Kl02), 74 *5* (1984Gu19), 58 *6* (1979De02). Iγ(relative)=54 *4* (2019Ni04).
3537.7[b] *12*	1.1 *3*	3759.6?	(1/2+,3/2+,5/2+)	220.80	(3/2)−	E_γ: weighted average of 3537.7 12 (1993Kl02), 3537.6 12 (1984Gu19). I_γ: weighted average of 1.2 3 (1993Kl02) and 0.8 4 (1984Gu19). Iγ(relative)=7.8 16 (1993Kl02), 5.5 18 (1984Gu19).
3710.0[@b] *20*	0.6[@] *4*	3759.6?	(1/2+,3/2+,5/2+)	49.93	3/2+	Iγ(relative)=4.0 *23* (1993Kl02).
3761.1[@b] *20*	0.9[@] *4*	3759.6?	(1/2+,3/2+,5/2+)	0.0	1/2+	Iγ(relative)=5.7 *21* (1993Kl02).

† Additional information 3.

‡ From 2019Ni04, unless otherwise noted. Values from 1993Kl02 and 1984Gu19 are less precise and given under comments.

\# Weighted averages of values from 2019Ni04, 1993Kl02 and 1984Gu19. The intensities are given by these authors as per 100 decays of the parent. Relative intensities are also available in those references and given under comments, with values from 2019Ni04 relative to I(50γ)=100 and those from 1993Kl02, 1984Gu19, 1979De02 relative to I(1484γ)=100 in ^{30}Mg. For deducing branching ratios to be used in Adopted Gammas, those relative intensities are used to avoid redundant uncertainties from normalization for the absolute intensities.

@ γ from 1993Kl02 only.

& γ from 2019Ni04,2017Ni02 only.

a Absolute intensity per 100 decays.

b Placement of transition in the level scheme is uncertain.

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Decay Scheme

Intensities: $I_{(\gamma+ce)}$ per 100 parent decays