Adopted Levels, Gammas

	History		
Type	Author	Citation	Literature Cutoff Date
Full Evaluation	Balraj Singh	ENSDF	28-May-2021

Q(β^-)=9380 *50*; S(n)=3190 *40*; S(p)=19540 *60*; Q(α)=−14750 *SY*   2021Wa16

Estimated uncertainty=400 keV in Q(α) (2021Wa16).

Q(β^-n)=3060 *40*, S(2n)=9200 *40*, S(2p)=37480 *400* (syst) (2021Wa16).

1983La23: ^{53}Ca identified from ^{53}K decay, the latter formed in Ir(p,X),E=10 GeV reaction; measured half-life of ^{53}Ca activity.

2008Ma01: ^{53}Ca produced in fragmentation of E=140 MeV/nucleon ^{76}Ge beam provided by the NSCL-MSU facility. Isotopes separated with A1900 fragment separator. Time-of-flight technique. Measured β particles using Beta Counting System of three Si PIN detectors, a double-sided silicon strip detector and six single sided silicon strip detectors. Detected γ rays using 16 Ge detectors of the Segmented Germanium array. Measured half-life of ^{53}Ca by fitting the decay curves to a function which included decay of the parent, growth and decay of daughter and a constant background. No gamma rays were seen in correlation with β rays.

2010Cr02 (also 2009Cr03): ^{53}Ca produced in fragmentation of E=130 MeV/nucleon ^{76}Ge beam provided by the NSCL cyclotrons K500 and K1200 at NSCL. Isotopes separated with A1900 fragment separator. Time-of-flight technique. Measured β particles using NSCL Beta Counting System of three Si PIN detectors, a double-sided silicon strip detector and six single sided silicon strip detectors. Detected prompt and delayed γ rays in coin with fragments using 16 Ge detectors of the Segmented Germanium array. Measured half-life of ^{53}Ca by fitting the decay curve of (^{53}Ca)β(2109γ) correlated events.

2013Wi06: measured precise mass excess=−29388 keV *43*.

2020Bh06: shell-model calculations of calculated level energies, J^π, B(E2), nuclear magnetic moments, and spectroscopic factors.

Theory references: consult the NSR database at www.nndc.bnl.gov/nsr/ for 32 references sealing with nuclear structure, β decay and other topics.

Additional information 1.

^{53}Ca Levels

Cross Reference (XREF) Flags

A	^{53}K β^- decay (30 ms)
B	^{1}H(^{54}Ca,pnγ)
C	^{9}Be(^{55}Sc,^{53}Caγ)

E(level)[†]	J^π[‡]	T$_{1/2}$	XREF	Comments
0	(1/2$^-$)	461 ms *90*	AB	%β^-=100; %β^-n=40 *10* (1983La23)
				1983La23 stated that %β^-n value for ^{53}Ca should be considered as a lower limit since %β^-2n decay of ^{53}K was neglected. But from 2006Pe16, measured %β^-2n≈10 *5* for ^{53}K decay. This value implies that %β^-n=40 *10* from 1983La23 is reasonable within the quoted uncertainty.
				T$_{1/2}$: from (fragment)β(2109γ) correlated decay curve (2010Cr02). Others: 230 ms *60* (2008Ma01, (fragment)β correlated decay curve), 90 ms *15* (1983La23 from ^{53}K -> ^{53}Ca β decay curve). Half-lives are very different in the three studies. Value from 2010Cr02 is adopted here due to (implants)$\beta\gamma$ correlated decay curves, with the caveat that the lower measured half-lives in 2008Ma01 and 1983La23 correspond to the ground state activity and not a low-lying isomer.
1746 *15*	(5/2$^-$)		BC	XREF: B(1738)C(1753).
2220 *1*	(3/2$^-$)		ABC	XREF: B(2220)C(2227).

[†] From Eγ values.

[‡] From L-transfers (L=1 for g.s. and 2220 level, and L=3 for 1746 level), and orbital assignments from parallel-momentum distributions in ^{1}H(^{54}Ca,pnγ), combined with shell-model calculations (2019Ch43).

Adopted Levels, Gammas (continued)

$\gamma(^{53}$Ca$)$

E$_i$(level)	J$^\pi_i$	E$_\gamma$	I$_\gamma$	E$_f$	J$^\pi_f$	Comments
1746	(5/2$^-$)	1746 *15*	100	0	(1/2$^-$)	E$_\gamma$: weighted average of 1738 *17* in ^{1}H(^{54}Ca,pnγ) and 1753 *15* in ^{9}Be(^{55}Sc,^{53}Caγ).
2220	(3/2$^-$)	2220 *1*	100	0	(1/2$^-$)	E$_\gamma$: from ^{53}K β^- decay.

Adopted Levels, Gammas

Level Scheme

Intensities: Relative photon branching from each level

$^{53}_{20}$Ca$_{33}$