Adopted Levels

History

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

Q(β^-)=−22940 *SY*; S(n)=18820 *SY*; S(p)=640 *SY*; Q(α)=−8590 *SY* 2021Wa16
ΔQ(β^-)=360, ΔS(n)=270, ΔS(p)=200, ΔQ(α)=450 (syst,2021Wa16).
Q(ε)=18360 *200*, S(2n)=42790 *480*, S(2p)=160 *200*, Q(εp)=18100 *210* (syst,2021Wa16).
Evaluators deduce Q(ε2p)=13705 *200*, Q(ε3p)=10956 *200* from mass values in 2021Wa16.
Other measurements:
1986La17: First identification of ^{31}Ar isotope in reaction: Ni(^{40}Ca,X) E=77 MeV/nucleon, at LISE-GANIL facility.
1987Bo36, 1991Bo32: ^{31}Ar from fragmentation of ^{36}Ar E=85 MeV/nucleon at LISE-GANIL facility. Measured delayed protons and ^{31}Ar half-life. 1991Bo32 supersedes 1987Bo36.
1989Re02: ^{31}Ar from reaction: Mg(^{3}He,X) E=110, 135 MeV at LBNL. Measured delayed one-proton and two-proton spectra, mass excess.
1990Bo24: ^{31}Ar from Ca(p,xn3p) reaction E=600 MeV at CERN-ISOLDE facility. Measured delayed protons, pp-coin.
1992Ba01: ^{31}Ar from fragmentation of ^{36}Ar E=85 MeV/nucleon at LISE-GANIL facility. Measured delayed three-proton decay and half-life.
1999Th09, 1998Ax01, 1998Ax02, 1998Mu06: ^{31}Ar from Ca(p,X) E=1 GeV at CERN-ISOLDE facility. Measured delayed 2-proton spectra, angular correlations, recoil energy shift.
1999Fy01: ^{31}Ar produced at CERN-ISOLDE facility. Measured Eβ, E(p), delayed multi-proton branching ratios, upper limit for 3-proton branch,
2000Fy01 (also 2000Bo59): ^{31}Ar from Ca(p,X) E=1 GeV at CERN-ISOLDE facility. Measured delayed protons, 2-proton decay, p-p energy and angular correlations, ^{31}Ar half-life. Note that 1998Ax02 (from the same group as 2000Fy01) proposed many additional levels based on their observed proton branches, but 2000Fy01 state that a number of assignments in 1998Ax02 of proton groups to corresponding levels in ^{31}Cl were incorrect since the two-proton branches were not appropriately considered. The evaluators assume that data in 2000Fy01 supersede those in 1998Ax02.
2002Fy01, 2002Bo29: ^{31}Ar from Ca(p,X) E=1 GeV at CERN-ISOLDE facility. Measured Ep, pβ coin, recoil energy shift.
2014Ko17, 2013Ko13, 2014Ko34, 2016Ma17: ^{31}Ar from Ca(p,X) at CERN-ISOLDE facility. Measured Eγ, E(p), I(p), pγ-coin, pp-coin, pp(θ), half-life of ^{31}Ar decay with six DSSSDs and two Miniball cluster detectors.
2015Li20 (also 2016Ci05): ^{31}Ar from ^{9}Be(^{36}Ar,X) E=880 MeV/nucleon at GSI. Measured E(p), I(p), ^{31}Ar-p-coin using gaseous optical-readout time-projection chamber (OTPC). Deduced branching ratios for β^+p, β^+2p and β^+3p modes.
Theoretical calculations: ten primary references for structure and eight for decay characteristics retrieved from the NSR database (www.nndc.bnl.gov/nsr/) are listed under 'document records'.
Additional information 1.

^{31}Ar Levels

Cross Reference (XREF) Flags

A ^{9}Be(^{31}Ar,^{31}Ar′)
B ^{9}Be(^{32}Ar,^{31}Ar)

E(level)†	J$^\pi$	T$_{1/2}$	XREF	Comments
0	5/2$^+$	15.0 ms *3*	AB	%ε+%β^+=100; %β^+p=68.3 *3* (2015Li20); %β^+2p=8.9 *2* (2015Li20,2000Fy01) %β^+3p=0.07 *2* (2015Li20); %2p<0.0006 (1998Ax01) Other decay modes: %$\beta^+\alpha$p<0.38 and %$\beta^+\alpha$<0.03 (1998Ax02), %ε+%β^+ is primarily β^+ (ε decay mode being negligible). %β^+p: from 2015Li20. %β^+2p: weighted average of 9.0 *2* (2015Li20) and 8.5 *4* (2000Fy01). Others: 7.2 *11* (1998Ax02), ≈12 (2002Fy01). %β^+3p: from 2015Li20. Others: ≈0.08 (based on 0.039% *3*p decay in 2014Ko17 from IAS at 12313 keV in ^{31}Ar and statement by authors that this decay represents about

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Adopted Levels (continued)

^{31}Ar Levels (continued)

E(level)†	XREF	Comments
		half the total 3p events); <0.11 (1999Fy01, at 99% confidence limit); the claim of a strong β3p branch by 1992Ba01 with $\%\beta^+3p=2.1$ *10* is not supported by other measurements. 1998Ax02 pointed out that a proton peak assigned to β^+3p in 1992Ba01 was observed as a single-proton transition in their work. Note that the total $\%\beta^+p+\%\beta^+2p+\%\beta^+3p=77.27$ *36*, while summed proton branching ratio is 62% *6*, of all observed and resolved proton branches which are assigned to proton decay of excited states in ^{31}Cl from data in 2000Fy01. The missing delayed proton branch of 15% *9* is attributed by 2000Fy01 to unresolved one or two-proton decays. J^π: spin from β-recoil energy shift (2002Fy01,1999Th09,1998Ax01); parity from log *ft*=4.9 to $3/2^+$ g.s. of ^{31}Cl. $T_{1/2}$: weighted average of 15.1 ms *3* (2014Ko17), 14.1 ms *7* (2000Fy01), 15.1 ms *+13−11* (1992Ba01), and 15 ms *3* (1987Bo36). Others: 16.5 ms *40* (1969Kl08); 17.7 ms *10* (1972Kl04) is discrepant.
950 *50*	A	
1580? *60*	A	
2120 *70*	A	
2.62×10^3 *13*	A	
3.56×10^3 *15*	A	
4.2×10^3 *2*	A	
x	A	E(level): a continuum region of ^{31}Ar excitations above 5 MeV inferred based on observed 1p transitions in a broad range of energy probably feeding the 3.0 MeV *2* level in ^{30}Cl (2018Mu18).

† Excited levels from ^{9}Be(^{31}Ar,^{31}Ar′) (2018Mu18).