Adopted Levels, Gammas

History

Type	Author	Citation	Literature Cutoff Date
Full Evaluation	Balraj Singh and Jun Chen[#]	NDS 147, 1 (2018)	30-Nov-2017

Q(β^-)=5280 *SY*; S(n)=5450 *SY*; S(p)=12140 *SY*; Q(α)=−3390 *SY* 2017Wa10

Estimated uncertainties (2017Wa10): ΔQ(β^-)=320, ΔS(n)=420, ΔS(p)=500, ΔS(α)=420.

S(2n)=9720 *360*, S(2p)=23130 *500*, Q(β^-n)=310 *310* (syst,2017Wa10).

2012Ku26: ^{164}Sm produced and identified in ^{9}Be(^{238}U,F), E=1 GeV/nucleon reaction using SIS-18 synchrotron facility at GSI. Target=1.6 g/cm^2 ^{9}Be placed at the entrance of projectile Fragment Separator (FRS). Particle identification was achieved by event-by-event in-flight analysis of time-of-flight, energy loss measurement, and magnetic rigidity (tof-ΔE-Bρ). Time-of-flight measured using two plastic scintillation detectors, energy loss or deposit by ionization chambers (MUSIC), and magnetic rigidity by four time-projection chambers (TPC), which also provided energy deposit information. Isomer tagging method for known μs isomers was used to verify event-by-event identification and in-flight separation of new isotopes. Gamma rays from the known isomers were recorded in coincidence with the incoming ions using either the RISING array of Ge detectors at GSI or only two Ge detectors, a stopper foil and a scintillator for veto signal. Measured production cross section. Comparison of measured σ with predictions from ABRABLA model and EPAX-3 model.

2017Wu04: ^{164}Sm nuclide was produced at the RIBF-RIKEN facility using the ^{9}Be(^{238}U,F) reaction at E=345 MeV/nucleon. Two experiments, optimized for the transmission of ^{158}Nd and ^{170}Dy ions, were carried out with average beam intensities of 7 pnA and 12 pnA, respectively. The identification of the nuclide of interest was made in the BigRIPS separator by determining the atomic number and the mass-to-charge ratio of the ion using the tof-Bρ-ΔE method. The reaction products were transported through the ZeroDegree spectrometer and implanted into the beta-counting system WAS3ABi that was surrounded by the EURICA array comprising of 84 HPGe detectors. The typical implantation rate was ≈100 ions/s. Measured (implanted ions)β^--t, (implanted ions)(β^-)γ-t, (implanted ions)γ-t correlations, and half-life of ^{164}Sm decay.

For theoretical nuclear structure calculations, consult NSR database, for about 15 references. These are listed in the ENSDF dataset as document records.

Additional information 1.

^{164}Sm Levels

Cross Reference (XREF) Flags

A ^{164}Sm IT decay (0.60 μs)

E(level)[†]	J$^\pi$[‡]	$T_{1/2}$	XREF	Comments
0.0[#]	0$^+$	1.43 s *24*	A	%β^-=100; %β^-n=? Theoretical $T_{1/2}$=2.2 s, %β^-n=0 (2003Mo09). Theoretical $T_{1/2}$=1.15 s, %β^-n=0.3 (2016Ma12). $T_{1/2}$: from 2017Wu04, from a fit to the (implanted ions)β^--t decay curve using the least-squares and maximum-likelihood methods, including contributions from the parent, daughter and grand-daughter decays, and a constant background. Production σ(at 1 GeV/nucleon)=42 nb *4* (2012Ku26).
69[#] *1*	(2$^+$)		A	
224.9[#] *11*	(4$^+$)		A	
467.2[#] *11*	(6$^+$)		A	
1136.1 *11*	(5$^+$)		A	E(level): possible member of γ-vibrational band.
1485.5 *12*	(6$^-$)	0.60 μs *14*	A	%IT=100 Configuration: K^π=6$^-$, ν5/2[512]⊗ν7/2[633]. Calculations suggest β_2=0.295, β_4=0.029, β_6=−0.020 (2014Pa55). $T_{1/2}$: from decay curves obtained from (ion implantation)(γ)(t) correlations for 155-, 242-, 349-, 669-, and 911-keV γ rays.

Continued on next page (footnotes at end of table)

Adopted Levels, Gammas (continued)

^{164}Sm Levels (continued)

† From least-squares fit to Eγ data.
‡ As proposed by 2014Pa55 based on systematics of even-even nuclides for low-lying levels and potential-energy surface calculations for higher levels above 1 MeV, supported by multipolarities obtained from intensity balances.
# Band(A): $K^\pi=0^+$, g.s. band. Calculations suggest β_2=0.301, β_4=0.030, β_6=−0.023 (2014Pa55).

γ(^{164}Sm)

E_i(level)	J_i^π	E_γ	I_γ	E_f	J_f^π	Mult.	α†	Comments
69	(2$^+$)	(69 *1*)	100	0.0	0$^+$	[E2]	9.4 *6*	
224.9	(4$^+$)	155.9 *4*	100	69	(2$^+$)	(E2)	0.332 *6*	α(K)=0.264 *5*; α(L)=0.0551 *10*; α(M)=0.01108 *20*; α(N)=0.00199 *4*
467.2	(6$^+$)	242.2 *3*	100	224.9	(4$^+$)	(E2)	0.0723	α(K)=0.0600 *9*; α(L)=0.00995 *15*; α(M)=0.00198 *3*; α(N)=0.000362 *6*
1136.1	(5$^+$)	668.8 *4*	49 *18*	467.2	(6$^+$)			
		911.3 *3*	100 *28*	224.9	(4$^+$)			
1485.5	(6$^-$)	349.4 *2*	100	1136.1	(5$^+$)	(E1)	0.00576	B(E1)(W.u.)=8.8×10^{-9} *21* α(K)=0.0051 *7*; α(L)=0.000606 *9*; α(M)=0.0001179 *17*; α(N)=2.21×10^{-5} *4* Reduced hindrance f_ν=487 *38* (2014Pa55), assuming the the 349-keV transition feeds the $K^\pi=2^+$, γ-vibrational band (ν=3). Reduced hindrance $f_\nu=[T^\gamma_{1/2}(\text{exp})/T^\gamma_{1/2}(\text{Weisskopf})]^{1/\nu}$, where ν=ΔK−λ, λ=multipole order.

† Total theoretical internal conversion coefficients, calculated using the BrIcc code (2008Ki07) with Frozen orbital approximation based on γ-ray energies, assigned multipolarities, and mixing ratios, unless otherwise specified.

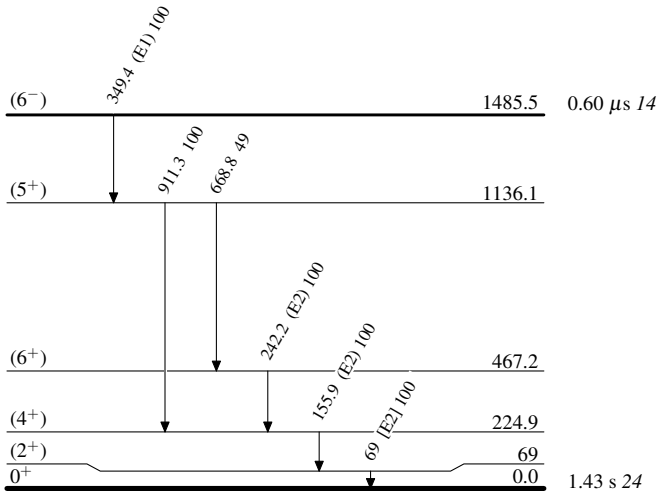
Adopted Levels, Gammas

Legend

Level Scheme

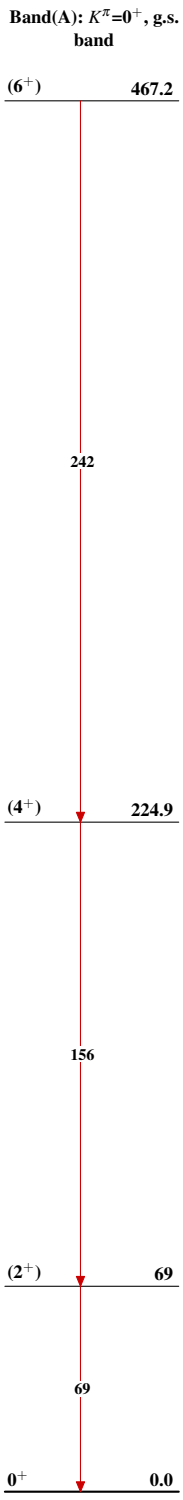
Intensities: Relative photon branching from each level

– – – – – – ► γ Decay (Uncertain)



$^{164}_{62}Sm_{102}$

Adopted Levels, Gammas



$^{164}_{62}Sm_{102}$