Adopted Levels

History

Type	Author	Citation	Literature Cutoff Date
Full Evaluation	Balraj Singh et al. ,	NDS 175, 1 (2021)	19-May-2021

Q(β^-)=3640 *SY*; S(n)=4970 *SY*; S(p)=6600 *SY*; Q(α)=3870 *SY* 2021Wa16
Estimated uncertainties (2021Wa16): 200 for Q(β^-) and S(n), 360 for S(p) and Q(α).
S(2n)=8550 *200*, S(2p)=16920 *450*, Q(β^-n)=−110 *200* (syst,2021Wa16).
Additional information 1.
2010Al24 (also 2009Al32): ^{219}Bi nuclide produced and identified in ^{9}Be(^{238}U,X),E=1 GeV/nucleon at the SIS synchrotron facility of GSI. The fragment residues were analyzed with a high resolving power magnetic spectrometer Fragment separator (FRS). The identification of nuclei was made on the basis of magnetic rigidity, velocity, time-of-flight, energy loss and atomic number of the fragments using two plastic scintillators and two multisampling ionization chambers. The FRS magnet was tuned to center on ^{210}Au, ^{216}Pb, ^{219}Pb, ^{227}At and ^{229}At nuclei along the central trajectory of FRS. Unambiguous identification of nuclides required the separation of different charge states of the nuclei passing through the FRS. At 1 GeV/nucleon incident energy of ^{238}U, fraction of fully stripped ^{226}Po nuclei was about 89%. Through the measurement of difference in magnetic rigidity in the two sections of the FRS and the difference in energy loss in the two ionization chambers, the charge state of the transmitted nuclei was determined, especially, that of the singly charged (hydrogen-like) nuclei which preserved their charge in the current experimental setup. Measured production cross sections with 10% statistical and 20% systematic uncertainties. Criterion established in 2010Al24 for acceptance of identification of a new nuclide: 1. number of events should be compatible with the corresponding mass and atomic number located in the expected range of positions at both image planes of the FRS spectrometer; 2. number of events should be compatible with >95% probability that at least one of the counts does not correspond to a charge-state contaminant. Comparisons of measured σ with model predictions using the computer codes COFRA and EPAX. See also previous report 2009Al32 by the same group as 2010Al24.
2012Be28: see 2010Al24 above for method of production at GSI facility. In this work half-life of the isotope is measured from implant of 2800 events using FRS-RISING setup at GSI.
2014Mo02, 2014Mo15: ^{219}Bi produced in ^{9}Be(^{238}U,X), E=1 GeV/nucleon and ^{9}Be(^{208}Pb,X),E=1 GeV/nucleon reactions at GSI using FRS separator; RISING array used for γ-ray measurements from decay of ^{219}Bi.
2016Ca25, 2017Ca12: ^{219}Bi produced by fragmentation of E=1 GeV/nucleon ^{238}U beam from SIS-18 synchrotron at GSI on a ^{9}Be target of thickness 1.6 g/cm^2. Reaction products were separated and identified by GSI Fragment Separator (FRS) using Bρ-ΔE-Bρ technique. The FRS tracking detectors were four time-projection chambers (TPCs), two ionization chambers, and thin plastic scintillators for tof measurement. Mass-over-charge (A/Q) ratios were measured for ions analyzed on an event-by-event basis. Finally selected ions of interest were implanted into a stack of double-sided silicon strip detectors SIMBA, which also detected β-decay events. Comparison with theoretical calculations using FRDM+QRPA, DF3+cQRPA KTUY and RHB+RQRPA models. (cQRPA=continuum quasi-random-phase approximation; FRDM=finite−range droplet model; DF3=density functional theory; RHB=relativistic Hartree-Bogoliubov; RQRPA=relativistic QRPA; KTUV=Koura−Tachibana−Uno−Yamada model). Relevance to r-process in nucleosynthesis.
Theoretical calculations: four primary references in the NSR database (www.nndc.bnl.gov/nsr) related to radioactivity.

^{219}Bi Levels

E(level)	J$^\pi$	T$_{1/2}$	Comments
0	(9/2$^-$)	22 s *7*	%β^-=100 The β^- decay is the only decay mode expected, thus 100% β^- decay mode is assigned by inference. The β^-n decay mode is less likely as Q(β^-n)=−110 keV *200* (2021Wa16). From A/Z plot (figure 1 in 2010Al24), a large number (certainly more than few hundreds) of events are assigned to ^{219}Bi. Production σ=118 nb (from e-mail reply of Oct 29, 2010 from H. Alvarez-Pol). Production cross section measured in 2010Al24, values are given in figure 2, plot of σ versus mass number for Bi isotopes. Statistical uncertainty=10%, systematic uncertainty=20%. E(level): the observed fragments are assumed to be in the ground state of ^{219}Bi nuclei. J$^\pi$: proposed by 2014Mo02, based on unpaired proton in 1h$_{9/2}$ orbital. T$_{1/2}$: from (implant)$\beta\gamma$ correlations (2012Be28) from 2800 implants, using a fitting method applicable for high background conditions. Other: 8.7 s *29* (2016Ca25,2017Ca12, from implant-β

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Adopted Levels (continued)

^{219}Bi Levels (continued)

E(level)	J^{π}	$T_{1/2}$	Comments
			correlation). Statistics of the decay curve shown in Fig. 18 of 2017Ca12 is poorer as compared to those in Fig. 3 of 2012Be28, thus half-life from 2012Be28 is recommended by the evaluators.