Adopted Levels

History

Type	Author	Citation	Literature Cutoff Date
Full Evaluation	T. D. Johnson, Balraj Singh	NDS 142, 1 (2017)	15-Apr-2017

Q(β^-)=4670 *SY*; S(n)=4360 *SY*; S(p)=10660 *SY*; Q(α)=−1090 *SY* 2017Wa10

Estimated uncertainties (2017Wa10): 360 for Q(β^-), 420 for S(n), 590 for S(p) and Q(α).

S(2n)=10490 *420* (syst,2017Wa10). S(2p)=20220 (1997Mo25,theory).

2009Al30 (also 2012Al05): ^{189}Hf identified in ^{9}Be(^{208}Pb,X) at 1 GeV/nucleon at GSI facility. Secondary fragmentation residues were separated and identified event-by-event using GSI Fragment Separator with a setting centered on ^{190}Ta or ^{192}Ta. Secondary ions were implanted into the RISING stopper with a series of double-sided silicon strip detectors (DSSSDs) to determine the position of the implanted ions correlated with β^- decays. The RISING array of Ge detectors also provided β and γ correlated events following the decay of secondary fragments. Time-of-flight and energy loss techniques provided the identification of projectile fragments. In the two-dimensional particle identification plots, ^{189}Hf is clearly identified in Fig. 3 of 2009Al30 (also a similar plot in 2012Al05), as mentioned also in 2012Gr19, but is not discussed.

2014Ku02: ^{189}Hf formed in ^{9}Be(^{208}Pb,X), E=1 GeV/nucleon, measured production using FRS separator at GSI facility. Authors claim first experimental discovery of ^{189}Hf, but in evaluators′ opinion, 2009Al30 already had evidence for its production.

^{189}Hf Levels

E(level)	Comments
0	%β^-=100 While no decay mode has been experimentally observed, evaluators assign %β^-=100 by inference, as β^- is the only decay mode energetically possible. Production σ=3.8 nb *8* (2014Ku02) in ^{9}Be(^{208}Pb,X), E=1 GeV/nucleon reaction. E(level): the observed fragments are assumed to be in the ground state of ^{189}Hf nuclei. J$^\pi$: 3/2$^-$ from systematic trend (2017Au03); 9/2$^-$ in theoretical considerations (1997Mo25). $T_{1/2}$: no experimental value has been reported. A lower limit of 300 ns is implied from time of flight through the FRS separator (2008StZY). Assuming a systematic decreasing trend of half-lives in neutron-rich nuclei, as the neutron number increases, an upper limit of 3 min is suggested from the known half-lives of 4.1 h, 3.5 min and 2.6 min for ^{184}Hf, ^{185}Hf and ^{186}Hf, respectively. 2017Au03 in NUBASE list 2 s from a certain systematic trend. Theoretical values are 1.2 s (2003Mo09) and 11.7 s (2016Ma12).