

Adopted Levels

Type	Author	History Citation	Literature Cutoff Date
Full Evaluation	Jun Chen	NDS 202,59 (2025)	25-Feb-2025

$Q(\beta^-) = -16530$ *syst*; $S(n) = 14230$ *syst*; $S(p) = 780$ *syst*; $Q(\alpha) = -1660$ *syst* (2021Wa16)
 $\Delta Q(\beta^-) = 580$, $\Delta S(n) = 580$, $\Delta S(p) = 360$, $\Delta Q(\alpha) = 420$ (*syst*, 2021Wa16).
 $S(2n) = 32310$ 580, $S(2p) = 680$ 300, $Q(\epsilon) = 13920$ 310, $Q(\epsilon p) = 14010$ 300 (*syst*, 2021Wa16).
Mass excess = -33358 141, deduced by 2011Ro47 based on known mass excess of ⁶⁵As and an estimated Coulomb Displacement Energy between ⁶⁵As and ⁶⁵Se: 10941 111. Other: mass excess = -33410 260 (1993Ba12).
2017GoZT (thesis; also 2020Gi02): ⁶⁵Se was produced in the fragmentation of a 350 MeV/nucleon ⁷⁸Kr beam at RIKEN. Fragments were identified and selected by the BigRIPS and the ZDS separators, and implanted into the WAS3ABi device consisting of 3 DSSSDs, surrounded by the EURICA array of Ge detectors for γ -ray detection. Measured E(p), I(p), implant-decay time correlations, E γ . Deduced T_{1/2}, branching ratios. All details are from 2017GoZT. 2020Gi02 only report the same T_{1/2}.
2011Ro47 (also 2014Ro14, 2011RoZZ): ⁶⁵Se was produced in the fragmentation of ⁷⁸Kr on a Ni target with E(⁷⁸Kr) = 70 MeV/nucleon at GANIL. Fragments were selected with the α -LISE3 separator, identified by ToF and ΔE , and implanted into a detector system consisting of four silicon detectors: ΔE , degrader, DSSD, and Si(Li). γ rays were detected with four HPGe Clover detectors. Measured E(p), I(p), E β , E γ , implant- β time correlation. Deduced T_{1/2}, decay branching ratio.
1995Hu24: ⁶⁵Se was produced in the ⁴⁰Ca(²⁸Si,3n) reaction at IMP, Lanzhou. Charged particles were detected with a telescope of ΔE and E detectors. Measured E(p), I(p), decay curve. Deduced T_{1/2}, decay branching ratio, mass excess.
1993Ba12: ⁶⁵Se was produced via ⁴⁰Ca(²⁸Si,3n) reaction with 175 MeV ²⁸Si from the 88-inch cyclotron at LBNL. Charged particles were detected with a ΔE -E detector telescope. Measured E(p), I(p). Deduced decay branching ratio. Similar previous efforts by 1987Ho01 (also 1986HoZZ), 1978ViZT were unsuccessful.
Other measurement:
2005St34, 2005St29: ⁹Be(⁷⁸Kr,X) E = 140 MeV/nucleon at NSCL. Measured σ .
Theoretical calculations:
2022Ca20, 1997Or04: calculated binding energy, S(p), S(2p).
2022Zo01, 2021Ma33, 2019Zo02: calculated mass excess, S(n), S(p).
2021Co08: calculated J^π for the ground state.

⁶⁵Se Levels

E(level)	J $^\pi$	T _{1/2}	Comments
0.0	(3/2 ⁻)	34.2 ms 7	$\% \epsilon + \% \beta^+ = 100$; $\% \beta^+ p = 94 + 6 - 4$ (2017GoZT) T _z = -3/2. J $^\pi$: suggested by 2011Ro47, based on mirror symmetry arguments (⁶⁵ Ga J $^\pi$ = -3/2) and non observation of p decay to excited states in ⁶⁴ Ge which suggests low-spin. T _{1/2} : from implant-decay time correlation (2017GoZT, 2020Gi02). Others: 33 ms 4 (2011Ro47), 9.6 ms +53-41 (1995Hu24). $\% \beta^+ p$: from 2017GoZT. Other: 88 +12-13 (2011Ro47), from integrating the decay-time spectrum gated on proton spectra above 900 keV. Two proton groups are observed to depopulate the IAS in ⁶⁵ As from the decay of ⁶⁵ Se: E(p0)(c.m.) = 3523 16 to ⁶⁴ Ge g.s. with $\% I(p0) = 44$ 2 and E(p1)(c.m.) = 2638 15 to 901, 2 ⁺ level in ⁶⁴ Ge with $\% I(p1) = 18$ 2, seen by 2017GoZT in coincidence with a γ of E = 901.1 3 (not seen in 2011Ro47 due to low statistics). The energy of IAS in ⁶⁵ As is determined to be 3433 82 by the evaluator, weighted average of 3433 82 from E(p0)(c.m.) = 3523 16 and 3449 82 from E(p1)(c.m.) = 2638 15, both with S(p) = -90 80 from 2021Wa16. Others: 3453 82 (2017GoZT, using E(p0) only); 3420 87 (2011Ro47, using ⁶⁵ As mass in 2011Tu02); 3680 (1995Hu24, using a S(p) = -81 keV), 3250 (1993Ba12, using a prediced S(p) = -360 keV). E(p0)(c.m.) = 3523 16 is weighted average of 3532 16 (2017GoZT) and 3510 20 (2011Ro47), in the center of mass (c.m.) frame. Others: E(p0)(lab) = 3550 30 (1993Ba12), 3700 80 (1995Hu24), in the lab frame. 2011Ro47 also observed a weaker proton peak at 3700 30, but didn't associate it with any decay branch. E(p1)(c.m.) = 2638 15 is weighted average of 2642 15 (2017GoZT) and 2620 30 (2011Ro47).

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Adopted Levels (continued) ^{65}Se Levels (continued)

<u>E(level)</u>	<u>J^{π}</u>	<u>T_{1/2}</u>	<u>Comments</u>
			<p>%I(p0)=44 2 and %I(p1)=18 2 are from 2017GoZT. Others: 2011Ro47 report %I(p0+p1)=62 13, from which with correction for proton efficiency 2011Ro47 estimate a branching ratio of 52% 18 for β-decay feeding to the IAS (2011RoZZ report %I(p0)=48 15 and a β-decay branching ratio of 48% 15 based on that).</p> <p>From %I(p0)+%I(p1), the branching ratio of β-decay to the IAS is estimated to %Iβ(IAS)=62 3. Others: 52 18 (2011Ro47); \approx21 (1995Hu24, based on I(p) of E(p)(lab)=3700 80 proton group); \approx60 (1993Ba12, based on I(p) of E(p)(lab)=3550 30 proton group).</p> <p>Note that only 1993Ba12 explicitly state that E(p) is given in the laboratory frame. The evaluator has determined E(p) values in 1995Hu24 are in the laboratory frame and values in 2017GoZT and 2011Ro47 are in the center of mass frame, simply based on comparisons of their reported energies of the IAS in ^{65}As with their E(p) values used to calculate the IAS energies.</p>