^{16}N $\beta^-\alpha$ decay 2016Re01

History

Type	Author	Citation	Literature Cutoff Date
Full Evaluation	J. H. Kelley, J. E. Purcell and C. G. Sheu	NP A968,71 (2017)	1-Jan-2017

Parent: ^{16}N: E=0; $J^\pi=2^-$; $T_{1/2}$=7.13 s *2*; Q($\beta^-\alpha$)=3259.0 *23*; %$\beta^-\alpha$ decay=1.49×10^{-3} *5*

^{16}N-$T_{1/2}$: from Adopted Levels of ^{16}N in ENSDF database.

^{16}N-Q($\beta^-\alpha$): from (2017Wa10).

2016Re01: XUNDL dataset compiled by TUNL, 2016.

The β-delayed α decay feeds $^{12}C_{g.s.}$ from ^{16}O*(8871,9585,9845). While the total intensity to ^{16}O*(8871) was found with a total β branch of 1.0% in (1959Al06,1984Wa07), these three states contribute only a tiny fraction of intensity in α decay to ^{12}C.

The decay to ^{16}O*(9585) proceeds entirely via α decay and dominates the delayed α spectrum. Three results are reported for this branch′s intensity, Iα=(1.20 *5*)×10^{-5} (1961Ka06), (1.49 *5*)×10^{-5} (2016Re01), and (1.3 *3*)×10^{-5} (1993Zh13). The result of (1961Ka06) was obtained by α and β counting the ^{16}N activity produced in the (p,n) activation of a flowing stream of CO_2; the results depended on the flow-rate, ^{16}N lifetime, relative detection efficiencies, etc.. In (2016Re01), the ^{16}N ions were implanted and identified in a segmented ΔE-E telescope at KVI. After implantation, the ^{16}N decayed and the decay α particles were counted. The branching ratio was determined by comparing the number of ^{16}N nuclei implanted into the detector with the number of α particles measured. The selection of a thin, high-granularity detector decreased the sensitivity of the measurement to ambiguous β-particle pileup events; an important consideration since there are roughly 10^4 β particles for each α particle. *We accept the* result of (2016Re01).

Since the β-delayed α branching via ^{16}O*(9598) is the strongest, the branching ratios of ^{16}O*(8871,9845) reported in (1974Ne10,1969Ha42) were reported relative to the ^{16}O*(9585) β-α intensity given in (1961Ka06). In the original works Iα=(4.6 *9*)×10^{-8}% and (6.5 *14*)×10^{-7}% were deduced for the branching ratios for delayed α emission from ^{16}O*(8871,9845), respectively (1974Ne10,1969Ha42) using Iα(9585)=(1.20 *5*)×10^{-5} (1961Ka06). The revised values using the new Iα(9598)=1.49×10^{-5} (2016Re01) are given below.

The α decay of ^{16}O*(8871) is parity forbidden, and detailed measurements of this decay branch have set limits on irregular parity amplitudes in the wavefunction (1961Ka06,1969Ha42,1970Jo25,1974Ne10). In (1974Ne10) Γ_α=(1.03 *28*)×10^{-10} eV is determined for ^{16}O*(8871).

In (2016Re01), significant discussion on the astrophysical impact is included.

^{12}C Levels

E(level)†	J^π†
0.0	0^+

† From Adopted Levels.

Delayed Alphas (^{12}C)

E(α)	E(^{12}C)	I(α)†	E(^{16}O)	Comments
1282.5 *4*	0.0	5.71×10^{-8} *11*	8871	Inferred from present branching(9598)=1.49×10^{-5} *5* and (1974Ne10).
1827.1 *8*	0.0	1.49×10^{-3} *5*	9598	
2011.9 *4*	0.0	8.1×10^{-7} *15*	9845	Inferred from present branching(9598)=1.49×10^{-5} *5* and (1969Ha42).

† Absolute intensity per 100 decays.

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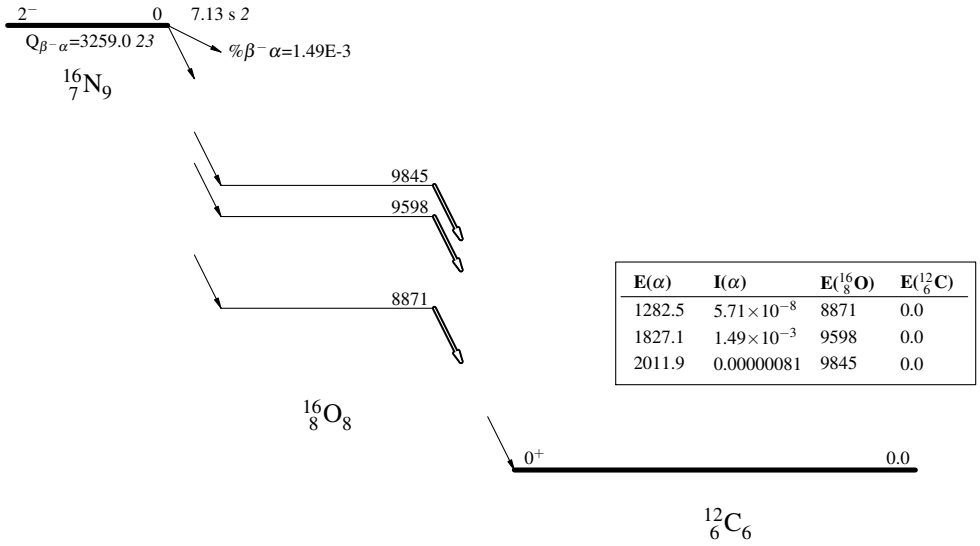
Decay Scheme

I(α) Intensities: I(α) per 100 parent decays



E(α)	I(α)	E($^{16}_{8}$O)	E($^{12}_{6}$C)
1282.5	5.71×10^{-8}	8871	0.0
1827.1	1.49×10^{-3}	9598	0.0
2011.9	0.00000081	9845	0.0