^{14}B β^- decay 1974Al11,1993ReZX,1996OgZZ

History

Type	Author	Citation	Literature Cutoff Date
Update	J. Kelley, C. G. Sheu		28-August-2013

Parent: ^{14}B: E=0; $J^\pi=2^-$; $T_{1/2}$=12.6 ms *6*; Q(β^-)=20644 *21*; %β^- decay=100.0

^{14}B-$T_{1/2}$: weighted mean of (16.1 ms *12*): 1974Al11, (12.8 ms *8*): 1986Cu01 and (12.4 ms *3*): see references in 1993ReZX; the uncertainty is enlarged.

^{14}B-Q(β^-): from 2012Wa38.

1974Al11: A target BeO (94% ^{10}Be) was bombarded with 31-MeV ^{6}Li ions; a fast beam chopper was used to establish beam activation and decay counting periods. A plastic scintillator detector measured the beta emissions while a NaI(TI) detector measured coincident decay gamma-rays.

Activities from numerous reaction products were detected in the target, however by applying a beta particle energy threshold cut to the beta-gamma coincidence data it was possible to select ^{14}C gamma-rays that followed the decay of ^{14}B.

The β-decay is primarily to ^{14}C*(6.09) [$J^\pi=1^-$] and (6.73) [$J^\pi=3^-$] states, though only an upper limit could be placed on a branch to the (7.34) [$J^\pi=2^-$] state. The half-life, $T_{1/2}$=16.1 ms *12*, was deduced by analyzing the decay curve of the ^{14}C*(6.09) state for events in coincidence with $E_\beta > 6.3$ MeV.

The experimental results are gamma-ray intensities. The measured γ-ray intensity ratios are $I_{6.09}/I_{6.73}/I_{7.34}$=100/(10.0±2.0)/< 2.2; using these observed intensities and the level decay branching ratios from 1970Aj01, the relative beta feedings to the ^{14}C*(6.09,6.73,7.34) states was deduced.

In order to place the relative intensities on an absolute scale the authors estimated the unobserved feeding to the ground state as (5 *3*)%, and they made a further assumption that the %beta-n=0. With these assumptions, which account for (5 *3*)% of the decay, the beta decay branching ratios were deduced by combining the measured γ-ray intensity ratios with the know level gamma-ray decay branching ratios. The absolute beta-branching ratios $I\beta_{6.09}/I\beta_{6.73}/I\beta_{7.34}$=(81 *9*)%/(8.6 *+17−40*)%/< 11% were deduced by normalizing to 100%. There are no new measurements on these relative values, however subsequent experiments have produced measured values for the beta feeding to the ground state and to neutron unbound states.

1993ReZX: Spallation products from 800 MeV proton bombardment of a ^{232}Th target were captured by a transport line with a mass-to-charge filter and transferred to the TOFI spectrometer at LAMPF. The beamline was separately tuned to transport a number of different nuclides. The neutrons were detected in a polyethylene moderated ^{3}He counter, and standard techniques were implemented. The β-delayed neutron probabilities were deduced from analysis of the number of implanted ions (per beam pulse) and the rate of β-delayed neutrons detected in the zero-threshold counter.

An associated conference report indicates the β-delayed neutron probability P_n=(6.1 *3*)% and $T_{1/2}$ = 12.4 ms *3* (the International conference on nuclear data for science and technology: nuclear data for the twenty-first century, Gatlinburg, TN (United States), 9-13 May 1994).

Results presented in (1993ReZX) analyzed the data measured in the polyethylene moderated ^{3}He counter and deduced a general value for the energy of neutrons emitted from the decay; E_n=1.38 MeV *+86−65*. The value E_n=1.3 MeV *3* is published in the 1994 conference report.

1996OgZZ: Fragmentation of a 110 MeV/A ^{22}Ne beam on a Be target produced a ^{14}B beam that was implanted in a 7 mm thick active plastic stopper. Beta-rays were detected in a ΔE-E scintallator telescope while gamma-rays were detected in a NaI detector. A high-energy component with $E_\beta > 14.6$ MeV was observed and found in anti-coincidence with gamma-rays. This branch is attributed to beta feeding directly to the ^{14}C ground state; $I\beta_{g.s.}$ = (1.4 *8*)%.

The conference proceeding (1996OgZZ) presents additional results indicating clear evidence for feeding of ^{14}C*(7.34) though no further details are given. No further analysis on the ^{14}C*(6.09,6.73) data are presented, and no subsequent publication of the work is found.

Comments: Absolute beta branching ratios have been measured for feeding to the ^{14}C ground state and for feeding to neutron unbound states. Therefore, the relative gamma-ray intensity values of (1974Al11) are reevaluated with the current level gamma decay branching ratios, and the deduced intensities are normalzed with the decay feeding the ^{14}C ground state and the %β-n.

In the analysis of the uncertainties of the Iβ branching ratios the $I\beta_{7.34}$ is treated as $I\beta_{max}/2 \pm I\beta_{max}/2$, and the uncertainty mainly impacts the $I\beta_{6.09}$ branch.

^{14}B β^- decay 1974Al11,1993ReZX,1996OgZZ (continued)

^{14}C Levels

E(level)†	J$^\pi$†	T$_{1/2}$†
0.0	0^+	5700 y *30*
6093.8 *2*	1^-	<7 fs
6728.2 *13*	3^-	66 ps *8*
7341 *3*	2^-	111 fs *42*

† From Adopted dataset for ^{14}C in ENSDF database.

β^- radiations

E(decay)	E(level)	Iβ^-†	Log *ft*	Comments
(13303 *21*)	7341	<10	>4.8	av Eβ=6405 *11* Iβ^-: upper limit is shown.
(13916 *21*)	6728.2	8.2 *17*	5.02 *10*	av Eβ=6709 *11* Iβ^-: 8.2 *+17−40*.
(14550 *21*)	6093.8	79 *6*	4.13 *4*	av Eβ=7024 *11*
(20644 *21*)	0.0	1.4 *8*	6.62 *25*	av Eβ=10048 *11*

† Absolute intensity per 100 decays.