^{11}Be $\beta^-\alpha$ decay 1971Al07,1981Al03,1982Mi08

History

Type	Author	Citation	Literature Cutoff Date
Full Evaluation	Hu, Tilley, Kelley, Godwin et al.	NP A708,3 (2002)	23-Aug-2001

Parent: ^{11}Be: E=0; $J^\pi=1/2^+$; $T_{1/2}$=13.76 s *7*; Q($\beta^-\alpha$)=2845.15 *61*; %$\beta^-\alpha$ decay=3.1 *4*

^{11}Be-$T_{1/2}$: from weighted average of 13.81 s *8* (1970Al21) and 13.57 s *15* (1959Wi49).

^{11}Be-Q($\beta^-\alpha$): from 2012Wa38.

1971Al07: ^{11}Be β-decay activity was produced in the ^{9}Be(t,p)^{11}Be reaction by bombarding 50 μg/cm^2 targets with 3.0-MeV tritons. Ge(Li) and NaI(Tl) detectors and Si detectors were used to measure γ-rays and α-particles. Eight γ-ray transitions and $T_{1/2}$=13.6 s *6* were measured. In general, the decay intensities to ^{11}B levels are deduced by balancing the observed γ-ray transitions and γ-decay branching ratios (BRs) with the observed rate of β-rays. The strongest ^{11}B transition is the 2125-keV γ ray from the first excited state to the ground state, which is directly fed and fed from higher-lying states.

The delayed α-particle spectrum was also measured. The interpretation of this spectrum was complicated because the produced ^{11}Be activity was implanted into the target, and the observed energy depended on implantation depth, ^{11}B parent level, emission angle etc.. Analysis of the spectrum appeared most consistent with emission from ^{11}B*(9870). Two other potential α-emitting states at ^{11}B*(10250,10380) were unfavored.

The delayed α Branching of 3.0% *7* from ^{11}B*(9870) to ^{7}Li$_{g.s.}$ was deduced, based on an analysis that found an intensity of 33% *3* for the 2125-keV γ ray. Observed delayed α-particles were not found in coincidence with 478-keV γ-rays from the first excited state of ^{7}Li, but α-particle emission to the ^{7}Li*(478) level could not be excluded because the relatively thick targets could absorb the alphas before they reached the detector. An upper limit of $\leq$ 5% feeding to the excited state was suggested.

1981Al03: ^{11}Be β-delayed particle decays were measured using the ^{9}Be(t,p)^{11}Be at E_t=3.4 MeV. The study was focused on measuring the β-delayed α-particle branch. Thin ^{9}Be foils contained in a Helium-jet system permitted the capture of produced activity in the He cell; the activity was then deposited on a counting tape. The activity was transported to a counting area where Si and NaI(Tl) detectors were used to measure delayed particles and γ-rays.

α particles and corresponding ^{7}Li recoils ions were observed both in singles and in coincidence with 478 keV γ-rays. The α-particle energy spectrum was unambiguously assigned to decay from ^{11}B*(9870). The charged-particle spectrum observed in coincidence with E_γ=485 keV *10* provided evidence that some small branching takes place from ^{11}B*(9875) to the first excited ^{7}Li*(478) state; the Branching for this decay is 12.6% *12*. It is then concluded that the Branching of ^{11}B*(9875) to ^{7}Li$_{g.s.}$ is 87.4% *12*. Compared with the well known E_γ=2125 keV intensity (I=0.33 *3*) and various cascades observed in the ^{11}Be(β^-) decay scheme, the Branching of 2.9% *4* to ^{11}B*(9875) was deduced.

1982Mi08: ^{11}Be β-decay γ-ray activities were studied in the ^{9}Be(t,p)^{11}Be reaction by bombarding a ^{9}Be foil with 3.0-MeV tritons. Ge(Li) and NaI(Tl) detectors and Pilot-B scintillation crystal were used to measure singles γ-ray, γ-γ coincidence and β spectra and β-γ coincidences, respectively.

The intensity of 2125-keV γ-decay of 0.370 *25* was deduced. Authors adopted the value of 0.355 *18*, which is the average of their value and the previous value of 0.33 *3* (1971Al07).

Comments: By normalizing the $I_\alpha/I_{2125\gamma}$ of (1981Al03) to the 2125-keV γ-decay intensity=0.355 *18* from (1982Mi08) a more precise value of the β-delayed α-decay intensity, I_α=0.031 *4*, was obtained. In (1981Al02) ^{11}B*(9875) was found to decay with Branching of 87.4% *12* and 12.6% *12* to ^{7}Li*(0,478), respectively.

^{7}Li Levels

E(level)†	J^π†
0.0	$3/2^-$
477.612 *3*	$1/2^-$

† From Adopted dataset for ^{7}Li in ENSDF database.

^{11}Be $\beta^-\alpha$ decay 1971Al07,1981Al03,1982Mi08 (continued)

$\gamma(^{7}Li)$

E_γ	I_γ[†]	E_i(level)	J_i^π	E_f	J_f^π
477.6	0.39	477.612	1/2$^-$	0.0	3/2$^-$

[†] Absolute intensity per 100 decays.

Delayed Alphas (^{7}Li)

$E(\alpha)$	$E(^{7}Li)$	$I(\alpha)$[†]	$E(^{11}B)$
465.4 *26*	477.612	0.39 *4*	9873
769.3 *26*	0.0	2.71 *39*	9873

[†] Absolute intensity per 100 decays.

^{11}Be $\beta^-\alpha$ decay 1971Al07,1981Al03,1982Mi08

Decay Scheme

γ Intensities: $I_{(\gamma+ce)}$ per 100 parent decays
$I(\alpha)$ Intensities: $I(\alpha)$ per 100 parent decays