THE $\alpha$-DECAY PROPERTIES OF $^{181}$Pb

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Following the production of $^{181}$Pb in $^{92}$Mo irradiations of $^{90}$Zr the isotope's $\alpha$-decay energy was measured to be 7065 (20) keV. This $E_\alpha$ agrees with one previously published value for $^{181}$Pb but not with another.

The $\alpha$-decay energy of $^{181}$Pb has been measured as 7211(10) keV \(^1\) and 7044(15) \(^2\). In the first study \(^1\) the isotope was produced in $^{90}$Zr bombardments of $^{94}$Mo and, after traversing a velocity filter, implanted in a position-sensitive Si detector; no half-life for $^{181}$Pb was reported. In the second study \(^2\) the isotope was produced in $^{40}$Ca bombardments of $^{144}$Sm and transported to a position in front of a Si(Au) surface barrier detector with a fast He-gas-jet capillary system; an estimate of 50 ms was determined for the $^{181}$Pb half-life.

Recently we investigated $^{181}$Pb $\alpha$ decay at the Argonne National Laboratory ATLAS accelerator facility as part of a survey experiment in which a 1-pnA beam of 400-MeV $^{92}$Mo was used to irradiate targets of $^{89}$Y, $^{90,92,94}$Zr, and $^{92}$Mo to examine yields for one- and two-nucleon evaporation products from symmetric cold-fusion reactions. Recoiling nuclei of interest were passed through the Fragment Mass Analyzer \(^3\) and implanted in a double-sided silicon strip detector for $\alpha$-particle assay.

The accompanying figure shows spectra accumulated with the $^{90}$Zr target during two separate runs. In both spectra we observed an $\alpha$ group at 7065 (20) keV which was...
correlated with $A = 181$ recoils and had a half-life of 45 (20) ms. Our new results for $^{181}$Pb therefore agree with those of Ref. 2). There was no indication in our $^{90}$Zr + $^{92}$Mo data of the 7211 (10)-keV $\alpha$ particles seen by Keller et al. 1). The interested reader is referred to the 1993 atomic mass evaluation wherein the input $\alpha$-decay energies and resultant masses of the light Pb isotopes (including $^{181}$Pb) are discussed 4). In the evaluation the 7211-keV $E_\alpha$ rather than the 7044-keV value 2), is used as the $^{181}$Pb ground state decay energy. This leads to an apparent pairing energy in $^{181}$Pb which is significantly larger than values calculated with two separate formulae. Given the fact that our new measurements agree with the data in Ref. 2) the $^{181}$Pb pairing energy deduced in Ref. 4) needs to be reexamined.

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