Further Results on ^{7}He

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(Received 9 October 1968)

Improved measurements of ^{3}He spectra from the ^{7}Li(t, ^{3}He)^{7}He reaction have given final results for the ^{7}He ground state. The ^{7}He mass excess (^{12}C=0) and width were determined, respectively, to be 26.11±0.03 and 0.16±0.03 MeV. Measurements of differential cross section for the ground-state group are reported for center-of-mass angles of 11° to 63°, and for a triton bombarding energy of 22.0 MeV.

Subsequent to the initial observation[1] of ^{7}He, additional data have been taken with the ^{7}Li(t, ^{3}He)^{7}He reaction. A thinner target (100 μg/cm^2 of ^{7}Li on 50 μg/cm^2 carbon) and improved energy calibration permitted better energy resolution and mass determinations. Data from all measured angles combine to give a value of 0.44±0.03 MeV for the energy of the ^{7}He→^{6}He+n decay. This value corresponds to a ^{7}He mass excess of 26.11±0.03 MeV on the ^{12}C scale. The width of the ^{7}He ground-state group was determined to be 0.16±0.03 MeV (full width at half-maximum). For a radius of 3.5 F and $l_n=1$, this width is 0.16 of the Wigner limit. The differential cross section of the ground-state group was measured for laboratory angles of 6° to 35°. Figure 1 shows these data with statistical errors indicated. The absolute accuracy of the cross section is estimated to be ±15%. No other state of ^{7}He were observed to an excitation energy of 2.4 MeV above the ground state.

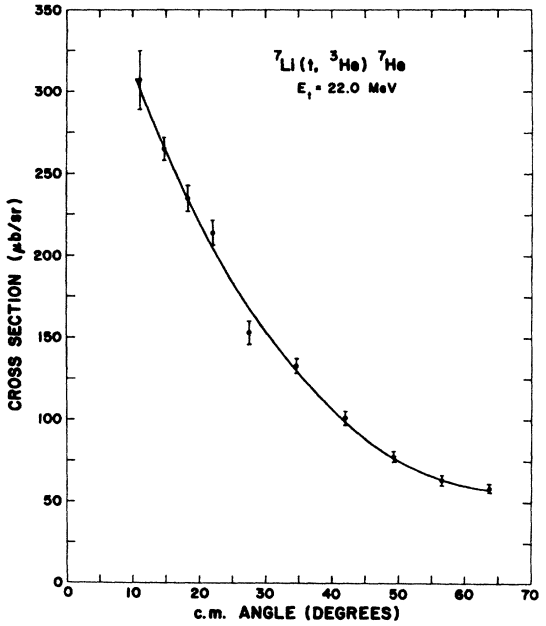

FIG. 1. Differential cross section of the ground-state group from the ^{7}Li(t, ^{3}He)^{7}He reaction. The energy of the bombarding tritons was 22.0 MeV.

The mass of ^{7}He and the revised masses[2] of the first $T=\frac{3}{2}$ levels in ^{7}Li and ^{7}Be can be used together with the isobaric multiplet mass equation[3] to predict the mass excess of ^{7}B as 27.76±0.17 MeV. *Note added in proof.* A second revision of the energy of the lowest $T=\frac{3}{2}$ state of ^{7}Be yields a value of 27.87±0.15 MeV for the predicted mass excess of ^{7}B [J. Cerny, Ann. Rev. Nucl. Sci. **18,** 27 (1968)]. This is consistent with the value of 27.94±0.10 MeV measured by McGrath, Cerny, and Norbeck.[2] Also, if the ^{7}B→^{6}Be+p two-particle decay mode is assumed to dominate the decay of ^{7}B, the width of ^{7}B can be calculated from the ^{7}He width and the ratio of $l=1$ penetrabilities ($r=3.5$ F). The resulting value of 0.60 MeV is a lower limit, and is consistent with the experimentally determined value[2] of 1.4±0.2 MeV.

* Work performed under the auspices of the U S. Atomic Energy Commission.

[1] Richard H. Stokes and P. G. Young, Phys. Rev. Letters **18,** 611 (1967).

[2] Robert L. McGrath, Joseph Cerny, and Edwin Norbeck, Phys. Rev. Letters **19,** 1442 (1967).

[3] For example, D. H. Wilkinson, Phys. Letters **12,** 348 (1964).