Comment on "Measurements of Interaction Cross Sections and Nuclear Radii in the Light *p*-Shell Region"

In a recent Letter,[1] Tanihata *et al.* reported the measured values of interaction cross sections for a number of light p-shell nuclei and extracted from their data the rms radii of matter, proton, and neutron distributions for several unstable neutron-rich isotopes. The purpose of this Comment is to point out that, in a Glauber-type analysis using Karol's prescription, the distributions involved are those for point protons and point neutrons. Tanihata *et al.*, however, have used the rms charge radii of several stable isotopes from electron-scattering experiments as input data in their analysis. Properly, one should first obtain rms matter radii by unfolding the charge distributions of the proton and neutron.[2] For example, in the ^{4}He and ^{12}C cases, the rms matter radii so obtained are 1.48 and 2.32 fm, which are substantially smaller than the rms charge radii of 1.67 and 2.45 fm listed in column 3 of their Table II.

By use of rms matter radii of stable nuclei as inputs, the effective *NN* cross sections required would be appreciably larger than those reported by Tanihata *et al.* and would approach the free-nucleon values. The radius values would be smaller than the values listed in columns 4–7 of their Table II, by an amount which is isotope dependent but in the neighborhood of 0.15 fm.

The major findings reported in Ref. 1 are that the matter radius of ^{6}He is appreciably larger than that of ^{6}Li and that the isotope ^{11}Li seems to have a remarkably large size. These findings can be explained as follows:

(i) The isotope ^{6}He is the isobaric analog of the 3.56-MeV, $T=1$ excited state of ^{6}Li. The binding energy of the dineutron cluster in ^{6}He is only 0.975 MeV which is much smaller than the binding energy of about 2.3 MeV, measured with respect to the top of the Coulomb barrier, for the deuteron cluster in ^{6}Li. In fact, a simple quantitative estimate[3] showed that such binding-energy difference can lead to a ^{6}He-^{6}Li matter-radius difference of about 0.3 fm.

(ii) If all eight neutrons in ^{11}Li were to populate just the lowest *s* and *p* shells, the dineutron pairing correlations would be substantially reduced.[4] Thus, in this neutron-rich isotope, one expects that it would be energetically favorable to excite a few neutrons out of the lowest shells, thus leading to a density distribution with a long tail.

In conclusion, we wish to mention that a reanalysis of the data of Tanihata *et al.* would be very useful in yielding reliable information concerning the sizes of unstable p-shell nuclei.

P. J. Ellis and Y. C. Tang
School of Physics
University of Minnesota
Minneapolis, Minnesota 55455

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[1] I. Tanihata *et al.*, Phys. Rev. Lett. **55**, 2676 (1985).

[2] See J. A. Koepke *et al.*, Phys. Rev. C **9**, 823 (1974), Appendix A.

[3] B. F. Bayman *et al.*, Phys. Rev. C **31**, 679 (1985).

[4] See K. Wildermuth and Y. C. Tang, *A Unified Theory of the Nucleus* (Vieweg, Braunschweig, Germany, 1977), Sect. 16.5a, for the discussion in a similar situation.