

Are the Data Neutral on Neutron Halos?

Richard N. Boyd and Isao Tanihata's article on radioactive nuclear beams (June 1992, page 44) implies that the nucleon density distribution of a neutron-rich nucleus such as ^{11}Be can be derived from a measurement of the interaction cross section of that nucleus with some target. An experimental "density distribution" obtained in this way is shown in figure 2b of the article.

The large interaction cross sections measured for ^{11}Li and ^{11}Be , among others, do indeed show that these nuclei are larger than more "normal" nuclei. But nothing can be inferred about the details of the nucleon density distribution without additional assumptions. For one thing, the measurement does not distinguish between protons and neutrons in the nucleus, nor does it shed any light on the central neutron and proton densities.

In fact one could obtain the measured large interaction cross section by assuming that the central density is unusually low and that the protons, neutrons or both extend out to a larger-than-normal radius. There could even be a sharp cutoff of the density at some radius. That is, there could be a neutron halo, a proton halo or no halo at all.

If the assumptions that are necessary to convert a measured interaction cross section into a density distribution presume the existence of a neutron halo, it will of course be found. But the cross section alone cannot demonstrate its existence.

BERNARD G. HARVEY
Lawrence Berkeley Laboratory
Berkeley, California

6/92

TANIHATA AND BOYD REPLY: Bernard G. Harvey is correct in saying that the measurements of interaction cross sections with symmetric nuclear targets do not distinguish between proton and neutron distributions. However, the existence of the neutron halo was not inferred from the interaction cross sections alone. As discussed in our article, it is obtained from three basic observations: the large interaction cross sections, the small separation energies of the last two neutrons, and the narrow momentum distribution. In particular, the narrow momentum distribution was observed only in the two-neutron removal channel in ^{11}Li -induced reactions (as we mention in the article and in *Physical Review Letters* **60**, 2599, 1988) and only in the one-neutron removal channel in ^{11}Be -induced re-

actions (see *Nuclear Physics A* **522**, 275c, 1991). Therefore one concludes that the main component of the tail is due to neutrons.

Harvey also addresses the question of whether or not a sharp cutoff of the density with some large radius could fit the data. That would be an issue if one measured the interaction cross section only at one beam energy and with one kind of target. As shown in reference 8 of our article, the cross sections have been measured at a variety of energies and with several targets. Since there are large differences between nucleon-nucleon cross sections at different energies, the measurements are therefore sensitive to the shape of the density distribution. As reference 8 also shows, neither a fat Gaussian distribution nor an empirically deformed distribution can reproduce the interaction cross sections consistently.

ISAO TANIHATA
RIKEN (Institute of Physical
and Chemical Research)
Wako City, Japan
RICHARD BOYD
Ohio State University
Columbus, Ohio

12/92

More on Merits of the Departmental Shop

I applaud John H. Reynolds of the University of California at Berkeley for his July 1992 letter (page 14). He asks if there are still open shops at other physics departments. I am happy to inform him that we at the University of Illinois at Chicago still enjoy that benefit. We think of it as routine for researchers, graduate students and those engaged in educational projects to bring their needs and ideas to both our mechanical and electronics shops. Labor costs and reasonable material costs are covered by the university and the department. The advantages are many.

It is highly satisfying to bring an incipient project to skilled instrument makers or electronic engineers, let them cogitate on various ways of implementing the idea, and even participate in the fabrication. Graduate students in particular develop invaluable skills in this process. The separation of graduate students and shop personnel into isolated castes is a particularly bad modern development.

We too have found such open shops to be a drawing card in the recruitment of new faculty. Younger faculty members just beginning their quest for funding need this type of support. And who is to say that those without

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LETTERS

external funding are necessarily undeserving of internal support?

LAMBERT H. SCHOONVELD

7/92 University of Illinois at Chicago

US and Foreign Grad Students Contrasted

I read M. Howard Lee's Opinion column "Foreign Graduate Students in a US University" (June 1992, page 75) with interest. As an American who was a graduate student in physics until I received my degree one and a half years ago, I would like to add my perspective on the diverse graduate student population. Having married one foreign graduate student and studied with many more, I have become aware of the differences in the styles, motivations and goals (among other things) of American and foreign students. While individuals differ significantly, each group follows general patterns. Here I will confine myself to differences in the realms of course work and thesis research so as to complement Lee's column.

Foreign students arrive at American graduate schools with more extensive formal educations in science and mathematics than American students have had. Many foreign students study the sciences almost exclusively as undergraduates, dedicating four years to physics and mathematics. Many Americans, including myself, had liberal arts educations. As a consequence, American students often must work harder to remain competitive with the foreign students. In contrast, my wife told me that her graduate course work here in America was much easier for her than her undergraduate education at Beijing University. (For various reasons I consider a broad education to be superior to early specialization, but that is the topic of a different discussion.)

But course work does not last forever, and I found that American students have an advantage in thesis research. One obvious difference is skill with equipment. Most foreign students did not grow up repairing cars or doing handyman chores for summer jobs. But the difference is much more deeply rooted than that. Lee points out that foreign students are quiet, courteous and respectful, not willing to break the educational ritual ingrained in them. They often lose direction when plunged into the vagaries of thesis research. A thesis project may have well-defined goals, but the daily work is not spelled out in detail. Most foreign students are more accustomed to solving specifically assigned homework problems.

American students, in contrast, are more accustomed to jumping head-first into a project and determining a course of action as the project progresses. American students are more comfortable with self-guidance, and this gives them an advantage in independent research.

American and foreign students benefit by studying together. The foreign students demonstrated to me that I needed a lot of work if I was to understand the fundamentals of physics. And through their generous help I finally understood what I was doing. I hoped to make a contribution to the foreign students by showing them how to operate more independently than they are accustomed to doing and how to use an unstructured environment to their advantage. This mixing of the best traits of each group was as valuable as the specific scientific training in graduate school.

MICHAEL JOSEPH SHEA

GTE Sylvania

7/92

Danvers, Massachusetts

The Great Priests of the Physics Roundtable?

I very much enjoyed the February 1992 issue of PHYSICS TODAY. However, one thing bothered me about the roundtable discussion of "science under stress" (page 38): So many of the participants seem to view themselves as the Great Priests and the public as the millions of penny groundlings who are too thick to listen to reason. Some other fathers and I started a program in a local public school called Family Math. We love giving it, the parents and children love to attend it, and nobody had to lobby Congress or the Administration in order to do it. People know I'm a physicist, and hence the idea of professional science has become associated, in some of the parents' minds, with direct public service that makes a difference. I wonder if part of the problem of science in this country doesn't stem from its leaders' being unable to roll up their sleeves and do some practical, effective work that helps the public schools. From what I've seen, and especially read in the February 1992 PHYSICS TODAY, our leadership seems to be more interested in Washington, DC, politics than in the welfare of the nation. A less condescending attitude and a greater demonstration of desire and ability to engage in effective public service might go a long way toward ameliorating the "stressed out" condition of science in America.

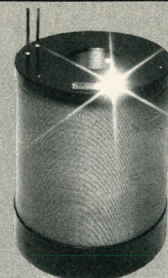
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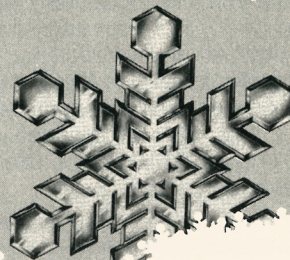
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