

startled to learn that "the victim's weight and mass are essentially the same." Although the example then given nicely illustrates the relative effects of mass and speed on the calculated quantity of kinetic energy, the phrase following the example is likely to surprise, if not disturb, a physics teacher: "The method [kinetic energy] is used merely to illustrate the change in force." I for one remain baffled as to how to get a force from an energy. And if the authors want force, why oh why are they even discussing energy?

Later in the book, in a discussion about collisions, the authors reveal that the "differences in mass (weight) among occupants of the same vehicle have relatively little effect on their vulnerability to injury." And they cleverly proceed to discuss energy conservation without saying a word about momentum, which seems passing strange given that most collisions between a person's body and a moving automobile are inelastic, if not perfectly inelastic.

This textbook is rife with confusion, misstatement, error and omission in its presentation of physics concepts, even elementary ones, and it concerns me that such a volume is being used in the classroom. And I am perplexed as to how this particular one came to be written, published and made part of a course. Although I am likely to remain baffled on that score, I can report that I have expressed my views about the book's inadequacies to the publisher, and I have received word that my suggestions and comments will be taken under advisement.

I still think it is a wonderful idea to mention and use physics in such a setting and to give nonphysics students a grasp of some basic science concepts. I believe that authors, editors and publishers should be encouraged to support this effort by creating the appropriate teaching materials. I believe even more strongly, though, that they should be encouraged to do so *only* if they are willing to make sure they do it correctly.

If we in the physics community want the public to see our subject as accessible and useful, then we need to find ways to ensure that the subject is presented properly, if only by our exercising some effective oversight function. If we as professionals believe that this is an important issue, then we need to act collectively to make certain that publishers not only hear us but also listen to us.

**PETER K. SCHOCH**

(pschoch@www.sussex.cc.nj.us)  
Sussex County Community College  
Newton, New Jersey

## Scientists, not Spies, Called Key to Soviet Nuclear Arms Program

It has come to my attention that a particular sentence in my introduction to the special issue of *PHYSICS TODAY* on the early Soviet bomb secrets (November 1996, page 26) has been taken by some readers to mean that I have no respect for Soviet and Russian science. I would like to correct that impression.

A bitter dispute has taken place in recent years about the relative contributions of scientists and the intelligence services to the development of Soviet nuclear weapons. I wrote that this dispute raised a broader question: "Did Russian scientists make a real contribution, or is Russia condemned to a backwardness that it must constantly try to overcome by stealing or borrowing from the West?" What I had in mind—and thought was clear from the context—was that current and former intelligence operatives, by denigrating Soviet scientists and claiming to have obtained everything from the West, were indeed portraying Russia as backward. If some readers formed the impression that I share that view, I am happy to correct that misunderstanding here. I believe that the rest of the article, and my own study of the Soviet nuclear program,<sup>1</sup> point to the very high level of Soviet and Russian science.

### Reference

1. D. Holloway, *Stalin and the Bomb*, Yale U. P., New Haven, Conn. (1994).

**DAVID HOLLOWAY**

(rc.dsh@forsythe.stanford.edu)  
Stanford University  
Stanford, California

## Bright Future Seen as Possible for Digitized X-Ray Image Amplifiers

John Rowlands and Safa Kasap's article on digital x-ray imaging in your November 1997 issue (page 24) raises a question: What happened to image amplifiers? Developed by Varo Manufacturing Co (which made the light amplifiers for astronomy and the military) and by Westinghouse Electric Corp, they were neglected for a generation by the medical community. Then they suddenly became common at airports for x-ray checking of carry-on baggage when that lucrative market appeared. But they still seem to be neglected for medical use.



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And they can readily be digitized.

Fifty years ago, our family doctor dark-adapted his eyes and examined my chest with a low-intensity fluoroscope in his office. How strange that his successors do not have a replacement for that very useful albeit somewhat hazardous device, but there is one for examining baggage!

**GEORGE D. CURTIS**

([gcurtis@hawaii.edu](mailto:gcurtis@hawaii.edu))

University of Hawaii at Hilo

**R**OWLANDS AND KASAP REPLY: X-ray image intensifiers, or image amplifiers, an important part of radiology since the 1960s, are used primarily in fluoroscopic procedures that necessitate the interactive viewing of the inside of the body. They were invented by John Coltman at Westinghouse Research Laboratories in 1948. His key concepts were to incorporate the input phosphor screen within the vacuum tube that provides electron-optical amplification and to use a small (hence bright) output phosphor.

The earlier fluoroscopic systems mentioned by George Curtis used a nonintensified screen that had a very dim image and required one to dark-adapt one's eyes by wearing red goggles. However, because fluoroscopy requires continuous x-ray irradiation, it is no longer used for procedures such as routine chest examinations, in which visualization of motion is unnecessary.

As Curtis states, the output of x-ray intensifiers can be readily digitized. That approach, using a video camera, led to the first practical application of digital x rays, in the late 1980s. Based on sound physical principles, such intensifier systems are now well developed. However, improvement will be made possible by adoption of flat panel technology.

**JOHN ROWLANDS**

([rowlands@fisher.sunnybrook.utoronto.ca](mailto:rowlands@fisher.sunnybrook.utoronto.ca))

Sunnybrook Health Sciences Centre and

University of Toronto

Toronto, Ontario, Canada

**SAFA KASAP**

([safa\\_kasap@engr.usask.ca](mailto:safa_kasap@engr.usask.ca))

University of Saskatchewan

Saskatoon, Saskatchewan, Canada

## Top-Ranked Physics PhD Programs in 1982, 1995 Were Mostly Same Ones

**I**would like to update the core findings included in a letter of mine that you published in January 1989 (page 15) under the headline "Academic Elite Meet to Inbreed."

Back then, I examined the coun-

try's 12 top-ranked doctoral programs in physics as of 1982, as determined by *Changing Times*<sup>1</sup> on the basis of a 1982 National Academy of Sciences study, and I found that the programs themselves accounted for 68.1% of the doctoral degrees of their faculty members. I concluded that the programs did indeed constitute an elite, and I suggested that they had maintained and enhanced their reputations by employing their own and each other's graduates.

US doctoral programs in physics were ranked again in 1995, this time by the National Research Council.<sup>2</sup> It is instructive to examine the extent to which the 12 physics programs that ranked highest in 1982 retained their high rankings in 1995 and also the extent to which they persisted in employing their own and each other's graduates.

The universities with the 12 programs and the 1982 and 1995 program rankings are as follows (note that some institutions share the same ranking—hence, for 1982, the rankings end with number 10): Harvard University, 1 and 1; Caltech, 2 and 5; Cornell University, 2 and 6; Princeton University, 2 and 2; MIT, 3 and 3.5; University of California, Berkeley, 4 and 3.5; Stanford University (physics only), 5 and 9; University of Chicago, 6 and 7; Stanford (applied physics only), 7 and not ranked in 1995; University of Illinois at Urbana-Champaign, 8 and 8; Columbia University, 9 and 12; and State University of New York at Stony Brook, 10 and 22.5.

Of the 12 top-ranked programs in 1982, 10 were still top ranked in 1995. The only dropouts were Stanford (applied physics) and SUNY, Stony Brook. Furthermore, the 6 programs with the very highest rankings in 1982 continued to rank among the top 6 in 1995.

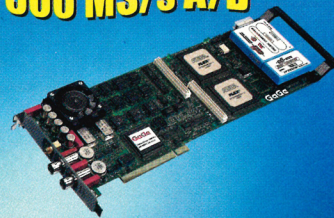
To examine the issue of who is employed by the 12 top-ranked programs, I obtained the names of the programs' full-time faculty members and their alma maters.<sup>3</sup> I found that the 1995 median proportion of faculty members who had obtained their doctoral degrees from either their own school or one of the 11 others (as ranked in 1995) was 70.2% (the range was 41.8% to 84.2%); this is nearly identical to the 1982 median proportion, which was 69.4% (range: 49.2% to 83.0%). It is interesting to note that, given its change in ranking, SUNY at Stony Brook had the lowest percentage in both 1982 and 1995.

In sum, the most highly rated doctoral programs in physics in 1982 maintained their highly rated posi-

*continued on page 117*

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