

letters

the course serves an essential role. It is a fortunate high school that has a physics teacher who has had more than one year of general college physics! The students are thrilled by contact with the "advanced" topics and contact with working scientists and a working laboratory. If we can reach 250 students per year, there should be 50 universities that can do the same. We urge all physics departments to initiate such programs for their area. For an investment of about 300 man-hours per year, we can touch a significant fraction of the science-oriented, bright high-school students. We at Fermilab will be happy to learn of other plans and to provide more detailed information.

The Fermilab effort is not original and, even if multiplied by 50, will not solve the abysmal collapse of science education in our schools. However, the relatively small and very practical effort can have far-reaching effects on keeping alive that spark which leads students into science.

LEON M. LEDERMAN

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6/82

Backwards photo

The picture of Yukawa and Feynman that appeared in April (page 43) was printed *backwards*. I found this out by trying to read what was on the bulletin board (behind Kobayashi); it didn't make any sense to me until I noticed some other clues. Then I turned the page and, with backlighting, read the four characters; loosely translated, they mean "Urgent Notice."

There are altogether *five* clues, one of which I shall point out: The men's jacket and shirt pockets are on the wrong side. The rest of the four clues I leave as an exercise for the reader.

PETER H. Y. LEE

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5/82

Avoid land-based missiles

In response to the letter by James Locker (February, page 101), which attempts to justify a large number of US counterforce missiles targeted at Soviet missile silos by considering the available options open to us after an initial Soviet nuclear attack on US missiles, an attack which Locker suggests would destroy 80% of US land-based missiles.

Surely the obvious solution is to avoid having any US land-based missiles at all, thus saving ourselves tens of billions of tax dollars and, more important, avoiding the possibility of a Soviet

strike arising from, for example, a Soviet computer malfunction which mistakenly identified a US counterforce first strike from US land-based missiles, an error which could not be identified in the thirty minutes (or ten minutes for missiles based in West Europe) before Soviet land-based missiles would be destroyed.

Without land-based missiles we would still have security in the ocean depths, a multitude of nuclear armed submarines which would still have the capability of exacting a terrible revenge for any Soviet nuclear attack on the US but which do not (as, yet) threaten Soviet missile silos. Land-based missiles cannot *defend* anyone—they simply bring the threat of the extinction of mankind in a nuclear holocaust one step closer.

CHARLES SKINNER

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2/82

Learning how science is done

In your interesting editorial in February (page 128) you concluded by saying that "we can succeed in giving children their own hands-on experience of how science is done and what is meant by a scientific theory." I am dubious that in fact this will be done by means of the existing curriculum development projects, at least in their current form. In your editorial you referred to the ESS project at MIT. There were, of course, similar projects at Berkeley (SCIS and ESS) and within AAAS. But these materials are, unfortunately, receiving extremely little use in American schools. I happen to have heard recently of a survey of elementary schools done by the New Mexico State Department of Education. Of the 88 schools replying, only two were using the SCIS materials and none were using ESS materials.

The classroom problems rest in the difficulty of providing any individualized attention to students and in the difficulty of letting them work as scientists in a "discovery mode." Additional problems come from the fact that many teachers are ill-prepared to bring such an approach to children because they themselves do not understand it. A glance at the courses typically used to train teachers in science indicates that both in quantity and quality they are inadequate to the task.

However, I believe that there is a way that we can move toward a better understanding of science, not only with children but also with a much wider part of our society. This is by putting these and similar materials in a self-contained, highly interactive computer environment in which each student can be immersed in a series of different



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