we would have been if we had taken Bethe's advice of the 1950s: a slave state in the Soviet empire.

Another item of asymmetry is this: If we drive aggressively to solve the problem of SDI, we remain in the forefront of complex, demanding, sophisticated technology—the kind that has invariably produced all sorts of unpredicted side benefits in the past. If instead we stay on the sidelines, proclaiming that it can't be done, or that it is hopelessly difficult and expensive, we will have become effectively 20th-century Luddites. We are surrendering the "can do" psychology that has made the West the scientific–technological dynamo of history, and we are writing the penultimate chapter of the decline and fall of Western civilization.

So let us get going on SDI! Stop hobbling American creativity!

LAWRENCE CRANBERG
4/87 *Austin, Texas*

BETHE REPLIES: The remark about the hydrogen bomb that Lawrence Cranberg attributes to me must have been made in 1950. After the Teller–Ulam invention of the spring of 1951, it was clear to me that an H-bomb could be built both by us and by others, and therefore we had to do it. I frequently expressesd myself in this way, both at Los Alamos and at the meeting of the General Advisory Committee in Princeton in June 1951.

In its meeting in October 1949 the General Advisory Committee proposed negotiations between the Soviet Union and the US, with the idea that we both refrain from developing the H-bomb. If successful, such negotiations would have avoided this enormous escalation of the power of atomic weapons, which has greatly diminished the security of the United States.

Probably we won't ever know whether the Soviets would (or could) have developed the H-bomb if we had not done so; it is quite possible that fallout from our test gave them critical clues. In any event, Herbert York, in his book *The Advisors*, which is based on intensive study of all the facts and Russian publications, has shown in detail that even if the Soviets had developed an H-bomb first, they would have been unable to reach (let alone maintain) overall strategic superiority in nuclear weapons because we already had a much larger arsenal of powerful fission weapons.

Turning to SDI, the technical problems it faces are many. Nothing like the Teller–Ulam invention has occurred. Four years of intensive and ingenious research, supported by billions of dollars, have largely served to elucidate how difficult SDI's mission is.

I was not a member of the APS group investigating SDI, or even a consultant. The group formed technical judgments on the requirements for SDI development. It did not offer any opinion on the desirability of proceeding with SDI. And it did not try to make a comparison between our SDI and that of the Soviets. Concerning Cranberg's suggestion that the Soviets should have "disclos[ed] all their pertinent plans," I would hope that we in the US would not have opened our laboratories to a Soviet counterpart of the APS panel.

Let us use the can-do spirit in areas where we really can do, such as superconductivity and building automobiles as well as the Japanese do, or, in military technology, developing sophisticated, non-nuclear defensive weapons to counter the reputed Soviet superiority in tanks. And let us not forget that a great breakthrough in military technology, like the invention of the H-bomb, can quickly come back to haunt us.

HANS BETHE
Cornell University
8/87 *Ithaca, New York*

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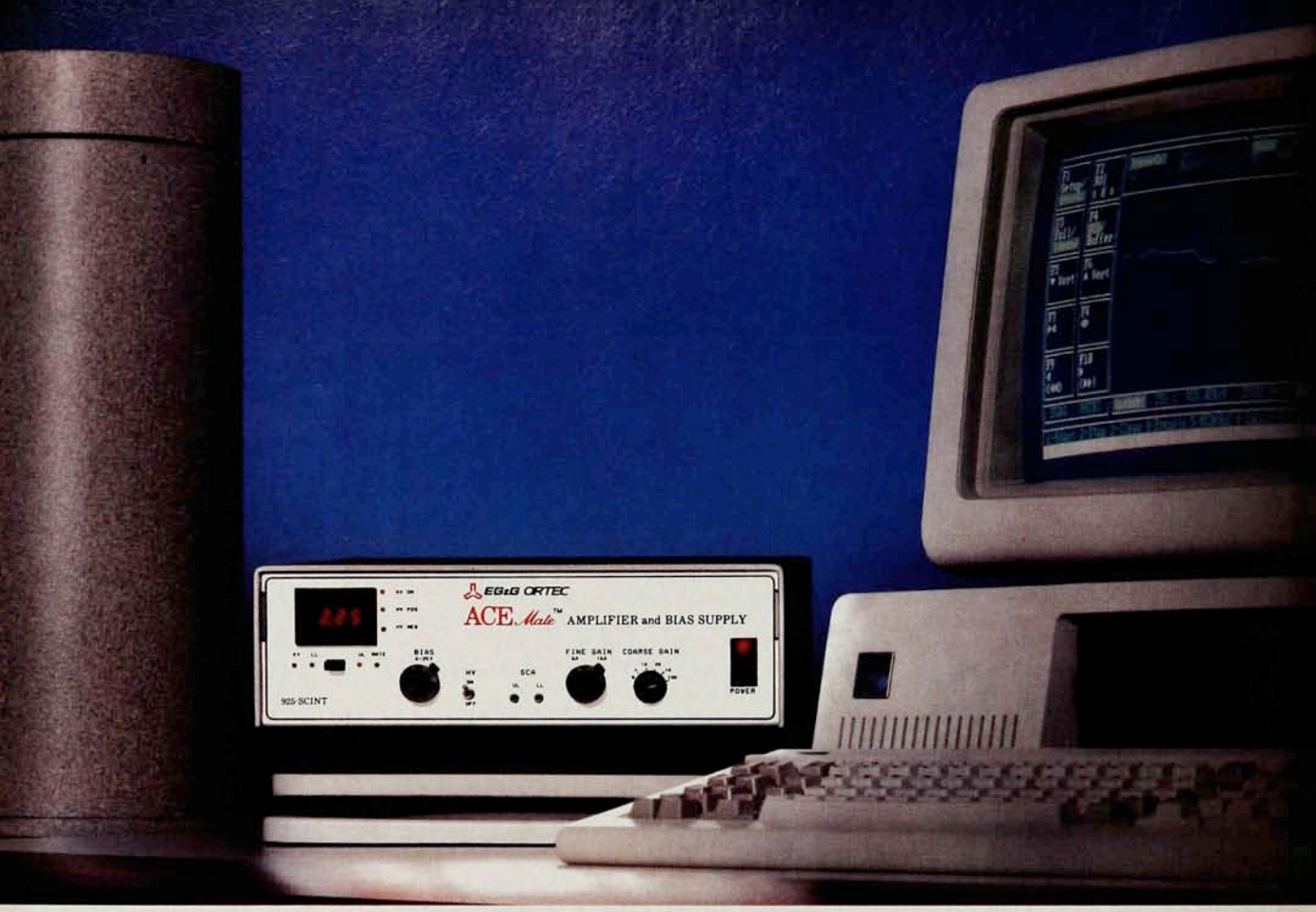
I am not a member of the APS; I belong to the Optical Society of America. Not being a member of the former organizatin, I can't speak with firsthand knowledge, but somehow I suspect that it is not a "mere mouthpiece for leftist political propaganda," as syndicated columnist William Rusher suggested in discussing the APS directed-energy weapons study in his column of 4 May 1987. [See PHYSICS TODAY, June, page 55.] As a loyal reader of PHYSICS TODAY I have seen many subjects debated in your pages, including Velikovsky, creationism and even SDI. I'm proud to be a member of an organization that is alive with debate and controversy. Perhaps we should work on promoting a public image more in line with the variety of opinion within our organizations. Maybe then we could convince Rusher that the APS is still "a worthy organization."

WILLIAM J. RICE
5/87 *Laporte City, Iowa*

Of SSCs, shuttles and taxes

On the surface, the United States space shuttle program and the plans for a Superconducting Super Collider would seem to have little in common. But as your news story "Reagan endorses the SSC (March 1987, page 47) indicates, the political process by which one was approved holds lessons for the future of



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the other.

Two things are disturbing. First, though some might wish it otherwise, it is clear that the SSC does not enjoy the sort of public support or Presidential leadership that the race to the Moon enjoyed. Instead, a President under heavy political and budget pressures has "discovered" the heretofore languishing project as he thrashes around in a lame duck continuum of troubles. That was the case with the Presidential go-ahead on the shuttle, as well.

Second, without broad public enthusiasm to work with, proponents of the SSC are already having to fudge their answers to very legitimate questions: Where is the money to do the job right going to come from? Will spending it distort or drain resources from other, related areas of R&D? How will the SSC be marketed in the political arena without large numbers of Americans declaring it a high-priority item?

With the space shuttle, it was decided to string out funding for an overpromised and underbuilt version of the "space truck" originally envisioned. Despite promises that other US space development goals would not be slighted, a higher and higher percentage of NASA spending went to maintain the shuttle program (in part because the money hadn't been there for better designs in the early years), and every other goal or mission had to ride the shuttle, one way or another. Those were mistakes.

I worry that those mistakes will be repeated with the SSC program when I read that its chief Administration proponent, Secretary of Energy John S. Herrington, answers questions about possible distortion of DOE's research budget by saying, in effect, "That's a problem for the next President." I am further disturbed by the proposed strategy of distributing chunks of the project as widely as possible throughout the States to insure pork-motivated votes in the SSC's favor both during the competition for its site and during construction. While practical, this plan purposefully avoids making a case on the merits—something I'm sure most PHYSICS TODAY readers have objected to when the project under discussion was the Strategic Defense Initiative, the B-1B bomber or any of various public works.

RICHARD S. PIEDMONTE
Falls Church, Virginia

3/87

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The debate over the Superconducting Super Collider, its pros, cons and funding implications, seems to have become such a standard item in the letters column of PHYSICS TODAY that I can't resist putting in my own five cents. Since my job does not depend on particle physics, nor is that my field of choice, nor is my work affected by the level or source of SSC funding, I have more of a taxpayer's view of this issue. That might not sound very scientifically informed, but we are the ones who will pay the final bill.

What bothers me most is that the arguments advanced in support of the SSC are "motherhood" statements that don't tell me in any way why particle physics specifically should be so much worthier of lots of money. Sure, as scientists we're always interested in new knowledge. Still, it is only natural that those who get the money to pursue their work in style are envied by those who have to fight much harder for much less.

But even if I were not a physicist I would still be against a thing like the SSC. Those whose knowledge will be enlarged there are too precious few! The percentage of taxpayers with a graduate education in physics is tiny enough, but even among those the people who are sufficiently knowledgeable about particle physics to understand eventual SSC results are so few that—and this is the key point—the number of dollars per person spent on their dreams is simply becoming too high! And that argument would hold just as well without a Federal deficit of the present size.

I can think of no field in the sciences where a few billion wouldn't establish international leadership, widen the frontiers of knowledge and virtually guarantee the discovery of the unexpected, produce a revolution, have spinoffs, discoveries and innovations. If the resulting science is "superb," however, I'd like to judge by the outcome, not by the enthusiasm of those being funded. What turns me downright off is that SSC fans seem so preoccupied with their own perceived excellence that they seem unable to understand that 99% of the voters probably don't know what an accelerator is or give a hoot about whether QCD is the correct description for anything. Simply too few people benefit to warrant this expenditure of everybody's tax money.

Put slightly differently, that the subject matter is so esoteric is the one reason *not* to spend that kind of money. If there is one thing I admire about the SSC it is the apparent success of those trying to fund it. The twist of turning a huge science project into political pork to bait the politicians is an interesting one and shows that the SSC's proponents indeed spend time in the halls of Congress and apparently know how to

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letters

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work the system. And soliciting an outgoing President's endorsement might be a good way to build momentum for the cause—but what all of that has to do with maximizing the scientific yield per tax dollar escapes me.

GEORG F. ALBRECHT
Livermore, California
4/87

Refusenik news

In May of this year we had the opportunity to visit the long-term scientific refuseniks in Moscow. These scientists, and their famililes, applied to emigrate to Israel during the 1970s but have still not been released. Although there are many promising developments in the Soviet Union, the tragic plight of these scientists has not improved, a fact that should be of special concern to their American colleagues.

The refuseniks are convinced that pressure from Western scientists has kept them out of labor camps, has allowed them to eke out meager existences despite the loss of their jobs and has permitted them to hold scientific meetings. It was therefore particularly distressing to learn that the refuseniks feel quite cut off from the US scientific community. Few American scientists are visiting them despite the enhanced level of contact resulting from *glasnost*. It is very important that physicists traveling to the Soviet Union visit the refuseniks; it is simple to arrange such visits, which are presumably monitored by the KGB—whence their importance! We can assure you that such a visit will add immeasurably to the significance of your trip.

Because of a new law, which came into force last January, emigration applications may be accepted only if the person has close relatives in Israel. (Thus the concepts of "open borders" and unfettered emigration have been rejected from the start.) Once an application has been accepted, however, "secrecy" is the *only* legal reason for rejection. It is here that the scientific community, as contrasted with the general public, has a special role to play.

The Soviets have stated that "secrecy" lasts only a few years, but in the application of the law they have denied permits to people who had their last contacts with secrets 10 or 15 years ago, and they have extended the limit of secrecy to the family members of the person in question. Minimal contact with the military establishment constitutes justification for "secrecy" in most cases: Anyone who was in the army (remember that there is a draft in the USSR), anyone who worked on a computer that someone else was using for classified studies, and so on may be refused permission to leave.

Scientists can make it clear, and we urge our colleagues to speak out on this point, that essentially no one still has secret information after 10 years.

The long-term scientific refuseniks need our help. Let us not refuse it.

KURT GOTTFRIED
Cornell University
Ithaca, New York
ANDREW SESSLER
Lawrence Berkeley Laboratory
Berkeley, California
8/87

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This letter is written to bring to the attention of the scientific community, once again, the case of Vladimir Kislik—formerly a resident of Kiev and now residing in Moscow—who has been a refusenik for 13 years. I was first made aware of Kislik's situation some ten years ago by a scientific colleague. At that time Kislik was interested in having some of his research on helium in metals published in a Western scientific journal. Since that time many unpleasant events have occurred in Kislik's life as a result of his simple desire to emigrate to Israel. Recently I received a copy of an open letter from Kislik to the secretary general of the Communist Party of the USSR, Mikhail Gorbachev. The letter, which speaks for itself, follows:

"Thirteen years ago I applied for the first time for permission to emigrate to Israel and I received a temporary refusal. The reason for the refusal was my employment by an organization that handled some classified projects on atomic energy. This position was terminated in 1966, that is, more than 20 years ago. Now these so-called secrets are well known to every college student and even to many high school students. However, the authorities still give my familiarity with this information as the reason why I am not allowed to emigrate.

"For 13 years I have been actively struggling to receive an exit visa and for 13 years the authorities have been actively persecuting me. They had me placed in a mental institution, and then sent me to prison for 'hooliganism' on charges that they fabricated. As a result I lost my qualifications as a scholar and engineer. My son, who emigrated to Israel as a small child, is now an adult.

"It goes without saying that your 'authorized organizations' can continue their repressive actions, they can put me in prison again, or they can arrange for me to be in an 'accident.' However, believe me, there is nothing that will change my determination to emigrate to Israel.

"For 12 years I have been a citizen of the state of Israel and for all these years I have been struggling to be freed from Soviet citizenship. What do you need me for? As an example to intimidate the others? As a hostage? Believe me, it no longer works. On the contrary, an example of determination and stamina results in sympathy and respect from the population. That is not what you want, is it? You claim that you are a proponent of a new way of thinking and a new approach to solving problems. Hence, I suggest that the wisest way to solve my problem is to give me permission to emigrate to Israel.

"Vladimir Kislik, Moscow 123458, Tallinskaja Street, 24, Apt. 176."

DAVID N. SEIDMAN
Northwestern University
Evanston, Illinois
1/87

Physics pro bono

In the November 1986 Reference Frame (page 7), Leo Kadanoff suggests that doing physics is analogous to building cathedrals: "One argument often used to justify society's support of pure science is that contemporary science is producing great and enduring structures that will be passed on to future generations as a major portion of the legacy of our age." Ah, yes, such structures as nuclear waste repositories, missile silos and the tens of thousands of nuclear weapons that are hidden about the landscape. Physicists do not make cathedrals, but many in our community contribute to the development of weapons, whether intentionally or not. If we are honest with ourselves, we must admit that it is the connection between physics and warfare that provides the strongest motivation for society to spend money on physics.

When testifying before Congress to gain financial support, some leaders of the physics community have tried to titillate the government with hints of quark bombs and other esoteric weapons. They needn't bother. Congress and the Department of Defense know full well who makes the best weapons and where the best weapon-makers get trained—in laboratories that do pure science.

At some stage in our careers, most physicists, I suspect, have made a Faustian bargain with the defense establishment, either directly or indirectly. But even those who have not done so still face a dilemma common to all