borrowing to stimulate the economy, but one must do so in a manner that will generate future revenue that will at least pay the interest on the debt that is created in the initial act of borrowing. The principal problem with today's debt is that it has been incurred in ways that are not generating and will not generate the required revenue.

One might then ask, Is the construction of the SSC an activity that will, in the long run, generate revenue that will more than balance the interest on the debt created to fund the construction of the laboratory? No one's crystal ball is clear enough to give a definite answer to that question, but we can use history as a guide.

Quite some time ago, when Michael Faraday's laboratory was visited by Robert Peele, Prime Minister of England, Peele asked Faraday what possible use electromagnetic induction might have. Faraday responded, "I know not, but I wager one day your government will tax it." And so it did! More recently we have seen the enormous importance to today's industry and economy of the research in atomic physics that was done at the beginning of the century. At that time, atomic physics was just as unreal and esoteric an area of research as is elementary-particle physics today. Yet it has been estimated that as much as one-third of our present GNP is generated by activities that have stemmed from our understanding of atomic physics and quantum mechanics. Next came an understanding of the nucleus, and that has been followed by applications that have brought us nuclear energy, isotopes, particle accelerators, magnetic resonance imaging and lots more.

The problem is that voices of doom, like that of Moellering, dwell only upon the problems that would accompany a burgeoning debt unaccompanied by an equally burgeoning Federal revenue. But in today's world, where perhaps the outstanding characteristic is the rate at which change is occurring, it is absolutely essential for a nation to continue to have confidence in itself and to invest heavily in its future. Without such an investment in research and education, that nation will soon awaken to find itself in the backwash of a rapidly progressing world.

Over 60 years ago Franklin Roosevelt said, "The only thing we have to fear is fear itself." It seems to me that the fear expressed by Moellering will only serve to stanch the very wellsprings of creativity that are our main hope for a strong survival in the future. Furthermore, although investments in technology are essential for our well-being in the immediate future, investments in science are equally important, not only for their long-range contributions to new technology but also for the intellectual and cultural vigor of our society. Let not the affluent US society of the 1980s turn its back on one of the great adventures of the human spirit. Not only can we afford it, but we cannot afford to let it pass us by.

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KANE AND EINHORN REPLY: Our remarks about the value of the SSC for resolving the issue of the Higgs particle were concise and could well be misinterpreted. The essential point is that of all the machines under consideration at present, *only* the SSC has the capability to provide the data relevant to understanding the origins of the breaking of the SU(2) symmetry of the Standard Model. The LEP collider at CERN, or SLC at SLAC, could discover a scalar boson and demonstrate that Nature had indeed chosen a world with Higgs bosons, but it could not tell us whether that world had a set of elementary scalar bosons (as required in supersymmetry and superstring approaches) or had scalars that are bound states of more fundamental entities, or whether W bosons had new interactions in the TeV energy regime.

To study WW scattering in the TeV region would require an e^+e^- collider with a total energy above 3.5 TeV and extraordinary luminosity, beyond the wildest dreams of even the e^+e^- optimists. The lower-energy hadron colliders lack both the luminosity and the energy to address the Higgs boson problem. Detecting some of the hypothetical scalar bosons at high-energy hadron colliders will be difficult, but we think that eventually ways will be found if the states are produced and the physics motivation is high. These goals will not be achieved instantly at the SSC, but rather will require a long program of experimentation. Nevertheless the SSC can provide the data needed to further the understanding of the extraordinarily fundamental problem of the origin of mass, while other machines cannot.

Concerning how these matters might affect our lives or those of our great-grandchildren: What is the value of knowing that elements are composed of atoms; atoms, of electrons and nuclei; nuclei, of protons and neutrons; subnuclear particles, of quarks and gluons? How much is it worth to know that electromagnetism and radioactivity are not distinct phenomena but inextricably intertwined? How much will it be worth if humans can confidently speak scientifically about the origin of our universe? While physical knowledge is often justified in terms of its technological or economic components, the value of such knowledge includes many other dimensions as well. This knowledge and its worth are not the private province of the few particle physicists who earn their livelihoods from the search for answers. Its effects on our lives include everything from the products that we produce to how we think about our place in nature.

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Dense Matter In formation

I applaud Bertram Schwarzschild for his exceedingly well-written Search and Discovery story "Nuclear Matter *In Extremis* Sought with Ultrarelativistic Heavy-Ion Beams" (March 1988, page 17). He touches on a point that I would like to elaborate upon. As he says, if dense hadronic or quark–gluon matter is formed in bulk, then this matter should undergo some collective expansion before the observed particles begin free streaming. Several years ago, in an analysis of cosmic-ray collisions in emulsions, my colleagues and I found evidence for such an expansion in the transverse momentum spectrum of charged particles in the range $p_T < 1$ GeV/c. The spectrum exhibited an upward curvature, unlike that obtained in proton–proton collisions.[1] We subsequently interpreted this curvature as being due to the collective expansion and cooling of matter that was produced at high energy density.[2] The data and its interpretation were presented at the Quark Matter '87 conference.

Since the cosmic-ray data consisted of only 19 high-multiplicity nucleus–nucleus collisions with energies ranging between those of the Alternating Gradient Synchrotron and the CERN Super Proton Synchrotron, it clearly was necessary to verify this result using the accelerator beams. This has now been done. In recent papers the WA80 collaboration reports evidence of a curvature in the π^0 spectrum,[3]

and the NA35 collaboration reports evidence of a curvature in the negative-particle (mostly π^-) spectrum.[4] Although one cannot conclude absolutely that dense matter was formed in these collisions, the shape of the transverse momentum spectrum is evidence in its favor.

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Einstein auf Englisch: Warum Nicht?

Einstein has been dead now for over 30 years. While he was still alive, most of his publications were available in Japanese translation. Shortly after his death, his published papers were translated into Russian. Yet to this day almost none of his papers are available in English (apart from a few very famous ones). Partly, this is due to the shameful, well-known fiasco created by his heirs and Princeton University Press. But even now, when a careful, scholarly edition of his works is being prepared, the works themselves will be available only in German. The English translations will be available only to those who buy the German edition, at extra cost.

While this scholarly edition will be of value to historians of science and similar researchers, an English translation of his papers, even if not scholarly, would be of incredible value to working and teaching physicists. For example, on his way to general relativity he explored numerous clever ideas that he ultimately put aside but which are still of research value. Also, his ideas on statistical mechanics were not merely a rehash of Gibbs; his emphasis on nonequilibrium processes led directly to his insights into quantum theory. These papers are a gold mine to physicists, and yet not only are they still unavailable in English, but Princeton Press seems determined to keep them largely unavailable.

It is astonishing that there has been no cheap, paperback edition of Einstein's papers in English translation after all this time. This constitutes, in my opinion, one of the more pronounced intellectual disgraces of the 20th century. That Princeton Press