physics again. All these spin-ins are direct, palpable and *sine qua non* for the SSC. All claimed future spinoffs from it are ephemeral, vague and oh-so-indirect. Why?

My challenge to Kaplan is the same as that of years ago. Can he provide any plausible scenario by which specific new information on Higgs bosons or quarks, which presumably the SSC is really intended for, can be translated into a new product or service? Or indeed can he suggest, on the basis of past-citation studies, how particle physics data could be cited in any paper on condensed matter physics, solid-state chemistry or any other science? To call such esoterica as the W, Z and Higgs "basic" to science is surely the ultimate travesty. Basic human science is that which is closest to human experience and aspirations.

I remind Kaplan that from the public's point of view the payoff he brags about is hardly a great achievement of "large-scale applications" if in 70 years with very large public investments all we now have is a very modest mri industry partly dependent on superconductors.

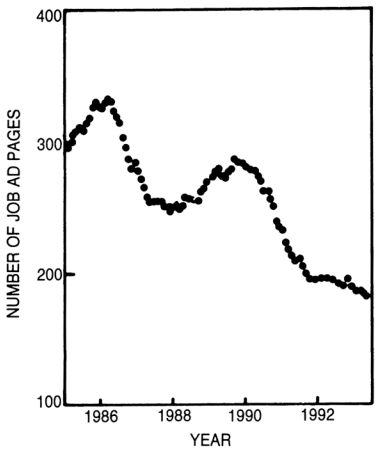
In case Kaplan hasn't heard, the nation is in deep financial trouble. After its incredible generosity to his tribe, all the nation is asking is, Please think like an American, first, not a particle physicist, for a decade or two if you would like more American money.

RUSTUM ROY
Pennsylvania State University
7/93 *University Park, Pennsylvania*

Rethink Physicists' Role in Light of Job Decline

Every month a number of pages with employment opportunities for physicists appear in PHYSICS TODAY. Although this number is not directly related to the actual number of open positions for physicists (some of which may not be advertised or filled), the preeminence of PHYSICS TODAY as the source for employment information for physicists validates this simple and timely measure as a gauge of the interest of prospective employers in hiring professionals from or in the field.

In the accompanying figure, I have plotted this number on a monthly basis for the last few years, adding to each point the numbers for the 11 preceding months so as to eliminate the seasonal variation. The recent steep decline in hiring interest evident from the figure is best summarized by averaging: The average number for the last 18 months stands at less than 68% of the average during the five-year period from 1985 to 1990. Standard deviations for both averages are less than 10%.



In view of what appears to be a worsening employment slump, I believe our community should seriously address the issue of recruiting and training its coming generation, especially at the graduate level, in such a way as to enable them to cope with a changing world. The role of physicists may have to be consciously redefined by the community, so that a physics education is not necessarily viewed as preparation for a traditional academic or industrial research career; rather, it may have to be perceived as acquisition and development of a unique approach to problem solving that gives physicists an edge in creatively thinking about and dealing with the complex challenges of the world at large, be they technical or economic, organizational or societal. Such a conscious diversification of the available career options and of the image of physicists might serve well in attracting the best and brightest minds to spend the peak years of their intellectual power in physics. Attracting such people is the best way to guarantee the long-term advancement and healthy funding of this endeavor. In this light, I hail the recent appearance of the column "Career Choices" (April, page 39) as an important first step.

ALEX KALAMARIDES
IBM Thomas J. Watson Research Center
4/93 *Yorktown Heights, New York*

YBCO Magnetic Texture Credit Smoothed Out

I read with great interest Bernard Raveau's review of high-T_c superconductivity in layered cuprates (October 1992, page 53). Toward the end of the article Raveau discusses texturing as a way to raise the critical-current density J_c. He talks about the success achieved using melt-textured growth and, more recently, using magnetic texturing. He mentions magnetic texturing as a well-established technique and refers in this context to work done by P. de Rango and colleagues, from Grenoble, France.[1] I agree that the work of the scientists from Grenoble deserves a lot of credit, especially the demonstration by M. R. Lees and colleagues[2] of high J_c, exceeding 1.5×10^4 A/cm^2 at 77 K, in magnetically textured YBCO material in the presence of magnetic fields as high as 6.9 tesla.

My only reservation is that the work of my colleagues and myself on magnetic texturing was not recognized in the article. In fact, we did the first research on magnetic texturing (where the treatment is done in a magnetic field at temperatures approaching melting point) at least two years ahead of anybody else. In March 1989 we reported texture produced in YBCO and HoBCO during sintering (below melting point) in a small magnetic field.[3] In November 1991 I reported a very high degree of texture produced during sintering in a strong field.[4] On 7 January 1992 our patent was published.[5] This patent explained, among other things, the procedure of partial melting and subsequent cooling in the presence of a field (a procedure used by the group from Grenoble). It should be noted, however, that in the work of Lees and colleagues the temperature schedule was such that the samples were treated for many hours in the magnetic field at the sintering temperatures. I think that it is during this sintering stage that the size of the grains increases further and, maybe even more importantly, the coupling between grains becomes stronger. Groups from the University of Liège in Belgium[6] and the University of California at San Diego[7] have recently confirmed magnetic texturing at the sintering temperatures.

Thus we did the earliest and the most comprehensive job on magnetic texturing. And I hope that Raveau's omission is unintentional.

References

1. P. de Rango, M. Lees, P. Lejay, A. Sulpice, R. Tournier, M. Ingold, P. Germi, M. Pernet, Nature **349**, 770 (1991).

continued on page 66

continued from page 15

2. M. R. Lees, D. Bourgault, D. Braithwaite, P. de Rango, P. Lejay, A. Sulpice, R. Tournier, Physica C **191**, 414 (1992).
3. A. Lusnikov-Holloway, L. L. Miller, R. W. McCallum, S. Mitra, W. C. Lee, D. C. Johnston, J. Appl. Phys. **65**, 3136 (1989).
4. A. Holloway, J. Appl. Phys. **70**, 5716 (1991).
5. A. Holloway, R. W. McCallum, US patent 5 079 225.
6. See, for example, C. Hannay, R. Cloots, M. Ausloos, Solid State Commun. **83**, 349 (1992).
7. J. McKittrick, R. Contreras, in *Layered Superconductors: Fabrication, Properties and Applications*, Mater. Res. Soc. Symp. Proc. 275, D. T. Chaw, C. C. Tsuei, T. R. Scheider, Y. Shiohara, eds., MRS, Pittsburgh (1992), p. 425.

ALEX HOLLOWAY
University of Nebraska at Omaha

11/92

RAVEAU REPLIES: There is no doubt that Alex Holloway and his colleagues were the first to show that it is possible to align the grains of YBCO in a magnetic field. This is fully recognized by Robert Tournier from the Grenoble group without any ambiguity, and he references their work in his first paper. But according to Tournier the texturing of YBCO such that high J_c is obtained was first really achieved by him.

In any case, I agree that I made a mistake, since the work of Holloway and his colleagues is really at the origin of magnetic field texturing. I do apologize for that, and I assure Holloway that my omission was absolutely unintentional.

BERNARD RAVEAU
University of Caen Caen, France

5/93

Do Portland *Science Essays* Distort Science?

Hunter Adams's response to Kenneth Fox's letter (June 1992, page 106) may mislead readers about the fundamental problem associated with the use of the Portland *Baseline Science Essays* to teach *science* to children in grade school. The fundamental problem is not, as Adams implies, just a philosophical difference in epistemology or a question of historiography. It has to do with whether children in grade school are going to be taught that science deals with the natural world, testable, empirical, universal and rationally communicable to all groups of people, or that science is local and thus may legitimately include ESP, "psi," "psychoenergetics," parapsychology, remote viewing and so on.

What children need to learn about science is that it is fun, that it depends on experiments, that it involves critical thinking and verification. Beyond this, as the American Association for the Advancement of Science's Project 2061 argues, "less is more." Fewer topics should be covered, but in more depth, to achieve understanding. The topics to be covered should be "normal science" such as characteristics of matter, energy and its conversions. How will critical thinking be fostered and familiarity with matter and its processes be enhanced by extraordinary claims of exotic past "science" presented with little or no evidence? For example, the Portland essays contain, among other similar statements, claims that Egyptians flew in full-size gliders 2000 years ago, that they electroplated gold with batteries 4000 years ago and that some African people had knowledge of stellar objects invisible to the naked eye long before they had access to telescopes or similar instrumentation. It is also claimed that ancient Egyptian assertions of a celestial origin for the Nile River are preludes to modern scientific speculation about water-filled meteorites!

Many groups, academic and nonacademic, mainstream and offbeat, are currently criticizing science. Such critiques, which are often valid—as is, for example, the National Academy of Sciences statement quoted by Adams—focus on the influence that gender, ethnicity, religion, culture, politics and so on have on who does science, what research agendas dominate and what hypotheses are formulated. They will normally assert that there are fundamental differences between science and myth, contrary to the implications of the following quote from one of the Portland essays: "In this light, the common concepts of mathematics; of physical theories such as mass, momentum, and energy; electric charge and magnetic field; the quantum wavefunction; entropy; distance and time and even myth, are actually no more than useful organizing strategies our consciousness has developed for ordering the chaos of information it receives from its environment."

Feminist and other reasonable critiques of the objectivity of science do not go so far as to allow scientific paradigms to include the supernatural. This is fundamental. As Judge William R. Overton ruled in the scientific creationism case *McLean v. Arkansas*, the essence of science is that it is guided by natural law, it has to be explanatory by reference to natural law, it is testable against the empirical world, its conclusions are tentative, and it is falsifiable. This is in sharp contrast to arguments in the Portland *Basic Science Essays* that a religious philosophy called "Ma'at" was integral to the research paradigm that led to Egyptian scientific discoveries. One of the key tenets of "Ma'at" is the existence of both material and supernatural cause and effect. Hence the claims in the Portland essays that parapsychology, ESP and "psi" exist and are scientific—for example: "Psychoenergetics (also known in the scientific community as parapsychology and psychotronics) is the multidisciplinary study of the interface and interaction of human consciousness with energy and matter. . . . Psi, as a true scientific discipline, is being seriously investigated at prestigious universities all over the world (*e.g.*, Princeton and Duke)." Thus, the essays assert, "for the ancient Egyptians, as well as contemporary Africans worldwide, there is no distinction and thus no separation between science and religion." Is this what children should be taught in a *science* curriculum?

All societies have developed paradigms for describing and relating to their surroundings—their natural and human-influenced worlds. Not all of these mental frameworks are "scientific," nor are all easily conducive to becoming scientific. [See the interesting letter by Joseph D. Ciparick in the same issue of PHYSICS TODAY (page 108): "In every system I have taught in, there is a religious value system that the students (and their parents) see as inimical to science. . . . Add in all the other typically American 'fads,' from parapsychology to the popularity of the ridiculous tabloids, and you have an environment that is not exactly favorable to true science."] Even "scientific" societies have ample scope for nonscientific paradigms. Yet "science" is now a "power word," and many groups wish to appropriate it for their own purposes, often inimical to science, as in, for example, "creation science." They ask, with Adams, "whose interpretation of the history of science . . . would be the authoritative one?" If we, because of timidity or "racial guilt," cannot give as a firm answer, "Those educated in science are the authoritative ones," if we cannot formulate and communicate a clear distinction between sci-