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## Particle Physics Spinoffs, Religion: Replies to Roy

Rustum Roy's comments (November 1992, page 13) to the contrary, had particle physics received an order of magnitude less funding in recent decades, hundreds of thousands of non-scientists would have noticed. Spinoffs of particle physics techniques into medicine are a case in point. Many thousands of cancer patients have received particle-beam therapy at the Harvard cyclotron, the Berkeley Bevatron, Fermilab and other institutions around the world.<sup>1</sup> Researchers trained in particle physics were instrumental in the commercialization of computerized axial tomography. Fermilab's Tevatron project stimulated a factor-of-20 increase in the industrial capacity for large-scale manufacture of superconducting cable, an essential step in the commercialization of magnetic resonance imaging.<sup>2</sup> Indeed, medical applications of particle physics techniques continue to proliferate: Witness the Loma Linda synchrotron, developed at Fermilab,<sup>3</sup> and the application of scintillating fibers to positron emission tomography.<sup>4</sup>

Particle physics has made important contributions in other areas as well. Electronic instrumentation developed for particle physics has found application in a wide variety of other fields, ranging from disk-drive testing to materials research and development. Synchrotron radiation has spawned an entire field of condensed matter physics with applications including semiconductor electronics, pharmaceuticals and biomaterials.

While spinoffs are not the ultimate reason for doing basic research, they are the first benefits to be derived. If history is any guide, improving our understanding of matter and energy on the most fundamental level will lead to further applications in coming decades. Superconductivity, discovered in 1911, is a striking example: It was some 70 years before the first large-scale applications were found. Some recent or soon-to-be-found result of particle physics could have considerable significance for civilization 70 years from now.

## References

1. J. Sisterson, *Particles* 10, 14 (July 1992). Fermilab Neutron Facility

Newsletter, 31 December 1992.

2. *Ferminews* 15(19), 2 (October 1992).

3. *Ferminews* 15(19), 3 (October 1992).

4. R. C. Chaney *et al.*, *IEEE Trans. Nucl. Sci.* 39, 1472 (1992), and refs. therein.

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1/93

I object strongly to the blatant anti-Catholic comments and innuendos that *PHYSICS TODAY* published in a letter by Rustum Roy (November 1992, page 13).

Roy is very insulting to the Blessed Mother of Jesus Christ by using the term "Immaculate Assumption" in connection with the deceptions presented to the public about the benefits of high-energy research. Comparing the Blessed Mother—the Immaculate Conception—with the physics elite's false rationalizations for increasing funding demeans and defames the Mother of God, Mary most holy.

Roy also insulted and defamed many holy and selfless churchmen in the Vatican by comparing them to the compassionless wonders who are running the lobbies for the high-energy physics programs.

Roy could have easily made his attacks and comments without impugning or even mentioning the Blessed Mother and the Catholic College of Cardinals. His comments were gratuitous insults to 900 million Catholics. During the modern era (from 1517 until today), heroic popes, cardinals, bishops and priests have had to contend with the debacles caused by the usurpation of ecclesiastical functions and properties by greedy laymen, the blatant robbery of church goods and the forced disestablishment of religious orders by brutal anticlerical regimes. Their staunch defense of the faith and of proper ecclesiastical independence from secular rulers has merited these churchmen a high crown that should not be dimmed by Roy's unsubstantiated sneers.

In the present situation, it is only we Catholics who are obliged to sit quietly as the brunt of everyone's stupid comments, while history shows that the whole enterprise of modern science arose from the Catholic milieu of the Middle Ages, and the Church has always contributed outstanding leaders to science. The famous pioneers Galileo, Copernicus, Mendel and Lemaître were all employees of the Church. Pasteur also was a devout Catholic.

To answer the attacks against the Church and Church leaders, I and others have formed the Catholic As-

sociation of Scientists and Engineers. Readers can obtain further information about the association by contacting me at the address below.

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12/92

ROY REPLIES: I am amazed that Francis Kelly could find in my letter anything that anyone could construe as anti-Catholic. I count several Catholic priests and nuns among my close friends; they too were amazed at Kelly's interpretation. As the first chair of the National Council of Churches' Committee on Science, Technology and the Church and a member of Pope John Paul II's very first Nova Spes meeting—his first attempt at a rapprochement with science—I am rather familiar with the issues of the relation between science and religion.

Perhaps it is Kelly who "demeans"—namely, demeans the English language, when he takes offense at the use of an ordinary play on words. Moreover he is clearly in a tiny minority of Catholics, since in Pittsburgh, a very Catholic city, an analogous pun has become a household word. Franco Harris's catch for the 1972 winning touchdown for the Steelers against Oakland has been known for a decade as the "Immaculate Reception." No offense intended or taken by millions of Catholic Steeler fans. Lighten up, Mr. Kelly, and thanks for your support against the high-energy physics lobbyists.

Daniel Kaplan's letter repeats the same old erroneous claims about the "spinoffs" from subnuclear particle physics. In most of his examples the net flux of spins is certainly *in* toward particle physics, not out from it. Think of building the SSC without the civil engineering advances in building tunnels. We poor benighted electrical and materials engineer types have built all the electronic devices without which no SSC detector or circuit would work—spin-in again. Nicolaas Bloembergen, recent APS president, has already dealt in a "fiery letter" (*Science* 253, 1204, 1991) with the nonsensical claims by SSC proponents with regard to magnetic resonance imaging and so forth. As to the SSC's helping magnet research, Japanese materials and electrical engineers, I am told, already have magnets more powerful than those planned for the SSC that would reduce its size by over one-half—materials science's spin-in to particle

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

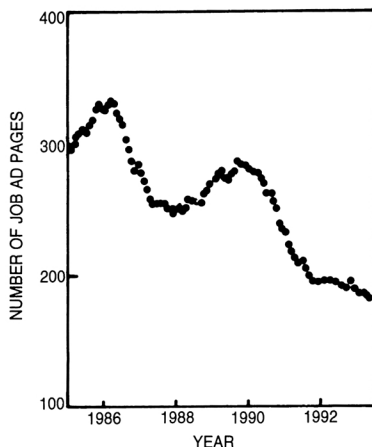
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7/93

## 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 summa-



rized 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.

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## YBCO Magnetic Texture Credit Smoothed Out

I read with great interest Bernard Raveau's review of high- $T_c$  supercon-

ductivity 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.<sup>1</sup> I agree that the work of the scientists from Grenoble deserves a lot of credit, especially the demonstration by M. R. Lees and colleagues<sup>2</sup> of high  $J_c$ , exceeding  $1.5 \times 10^4$  A/cm<sup>2</sup> 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.<sup>3</sup> In November 1991 I reported a very high degree of texture produced during sintering in a strong field.<sup>4</sup> On 7 January 1992 our patent was published.<sup>5</sup> 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<sup>6</sup> and the University of California at San Diego<sup>7</sup> 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).

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