High energy, low morale

Budget cuts in particle physics have exposed long-dormant issues of relevance and organization

by Dietrick E. Thomsen

Particle physics, otherwise known as high-energy physics, is the latest scientific specialty to grow out of efforts to discover and study the most fundamental constituents of matter. Less than 20 years old as recognized specialty, it follows atomic physics, which began about 80 years ago, and nuclear physics, which began about 40 years ago.

The term high energy refers to the necessity of using probes accelerated to energies in the billions of electron-volts (giga-electron-volts or GeV in the accepted international terminology) to study the subnuclear particles that are the specialty's object. Accelerators to produce such energies are large installations. The atomic-physics experiments of the turn of the century could be done with equipment the size of a fluorescent light fixture. The 500-GeV National Accelerator Laboratory, which expects to begin operations in July at Batavia, Ill., has a main accelerator ring four miles in circumference.

In terms of equipment and money, high-energy physics is thus big science. Its total budget in the United States runs around $200 million a year. There are about 2,000 practitioners of the specialty in the country. It is big science in organization too. To mount an experiment at one of the country's seven major high-energy laboratories requires a sizable number of physicists —10, 20, sometimes more—many technicians and other support personnel and hundreds of hours of time on an accelerator that costs millions of dollars a year to run.

These high expenses, in a time of fiscal restraint, are one reason the field is in trouble. For without a doubt, high-energy physics is in crisis. The crisis began with a cut in its budget, and some feel that is where it ends. Dr. Robert Hofstadter of Stanford University, chairman of a panel that discussed the situation at the recent meeting of the American Physical Society in Washington, says: "There is no problem we have that dollars wouldn't solve."

Others disagree. Many expected a lessening of money sooner or later, but the budget cut has come so quickly and drastically that there is a severe employment crisis. And this has exposed problems of the relevance of the science and of its internal organization that lay dormant as long as it was expanding.

One aspect of the relevance question lies on the right. High-energy physics is difficult to understand and seems remote from practical application. In a technologically oriented country with a Government intent on listening to the silent majority, it should expect short shrift. "Congressmen are not as stupid as we feel they are," says Dr. Oreste Piccioni of the University of California at San Diego. If physicists tell them that high-energy physics is an intellectual and spiritual activity "just like music" and fuss about taking money from the defense budget, he says, they are likely to fund it as they do music.

Particle physics also meets indifference on the left. "We have failed to capture the imagination of the so-called hippie generation," says Dr. Bogdan Maglić of Rutgers University. "This generation is searching for profound motivation. Particle physics offers just that, but we present it as a dull, boring industry."

Dr. Victor Weisskopf of Massachusetts Institute of Technology concedes the point. "We must try to formulate the role of high-energy physics in society," he says. "Men of my age are not to do it. We grew up in a different culture and time. Younger men should do it, but we are often left to do it."

That different culture and time is described by Dr. Maglić as the "glorious generation when there were only 12 particle physicists in the world and they were all geniuses." Probably there never was such a time, but there was a time when most of the prominent physicists were acquainted with each other and some of them were intermarried. Now the science is big and organized like a large corporation. One

Failure of s-Channel Helicity Conservation in A_1^- Production*

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Work in particle physics often involves the collaboration of many researchers.

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of the questions is how to get some of the old family-business feeling back.

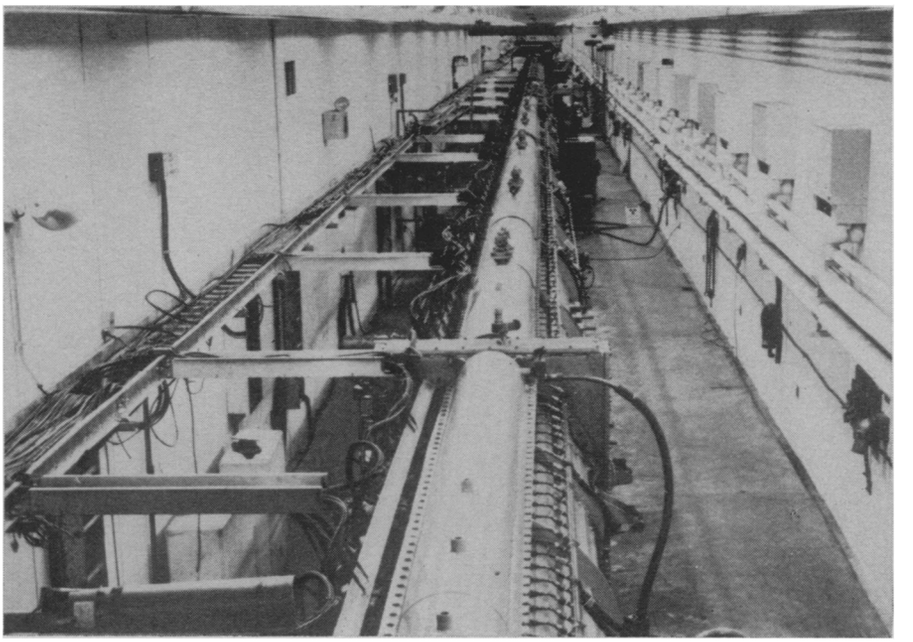
The younger men, who claim that they feel the effects of the crisis more strongly than the elders, want steps taken to alleviate the suffering and to shake up the organization of the science. For the short run, they suggest that the physics community take emergency responsibility for those already in it. From Dr. H. D. I. Abarbanel of Princeton University comes a suggestion that employed physicists contribute between five and seven percent of their income to a central fund. Matching grants would be sought from public or private donors and the money be used to support the unemployed for two or three years "to do physics or to see that they shouldn't do physics and to help them out of physics," he says.

For the long term, many of the younger people feel a ceiling should be set on the number of Ph.D.'s granted per year. Some of them also feel that since according to folklore a physicist's most creative years are his earliest, physicists should retire at 35. To that Dr. Piccioni snorts: "You are equating physicists with girls in certain kinds of houses."

Dr. Melvin Schwartz of Stanford University, who at 38 stands in the middle of the generation gap, proposes a five-point program to shake up the organization of high-energy physics and make life pleasanter for the younger people. His first point is that directors of national laboratories and the chairman of the High Energy Physics Advisory Panel, which advises the Atomic Energy Commission on how to spend its high-energy money, should be rotated after five years, ten in exceptional cases.

Dr. Weisskopf, current chairman of HEPAP, endorses the idea. He has been chairman for nearly five years and would like to get out. Dr. Edwin M. McMillan, who has been director of the Lawrence Radiation Laboratory since 1958, disagrees.

Dr. Schwartz's second point is that experimental groups should never be permanent. "This formal group structure, which lasts for 30 years at some places, should be changed," he says. The structure, in which seniors lead and juniors follow, rests on old academic tradition. As long as the science was expanding, younger men could hope to move out and become leaders of their own groups someday. Now that expectation is dim.



NAL

The linear accelerator at NAL is a small part of the protons' 500-GeV trip.

Dr. R. Donald Rau of Brookhaven National Laboratory says that something is already being done on this point. Junior men are being encouraged to form groups, from which seniors are encouraged to stay out. But it is a gradual change. "Gears can't be shifted instantaneously," he says.

Third, Dr. Schwartz proposes that HEPAP, which, he says, "makes decisions as to what labs get funded," should not be appointed by the AEC as it is at present. Its membership, he says, should be more representative of the high-energy community and somehow subject to its approval, perhaps by some form of ratification of AEC nominees by the community generally.

Others suggest that instead of altering HEPAP a representative body be set up to advise the whole Government, through the White House Office of Science and Technology.

In his fourth point, Dr. Schwartz suggests shaking up the program advisory committees of the various laboratories. These committees review proposals to do experiments. Because of the expense in money, labor and time involved in an experiment, they tend to be cautious. There are many complaints that they favor safe bread-and-butter experiments and make difficulties for daring ones. Dr. Schwartz wants them to encourage more "crazy experiments."

Finally Dr. Schwartz proposes a new system of fellowships. Instead of the present practice of giving postdoctoral fellowships through institutions and tying the recipient to a particular institution for the duration of his tenure, Dr. Schwartz suggests giving the money to the individual directly and letting him use it to visit several institutions during the term. Young physicists would gain broader experience that way, he believes.

Though there are many who believe with Dr. Hofstadter that there is nothing wrong that money won't cure, others feel money is not the heart of the problem. Dr. Alexander Abashian of the University of Illinois, who is on leave to work at the AEC, says: "$200 million a year is not negligible. We need imaginative ideas about what to do with the money we have." Dr. Maglić and others call on that same imagination for a radicalization of high-energy physics. Dr. Weisskopf sees in it a hope for the future: "In spite of the difficulties, this is a wonderful crowd of intelligent people. It must be possible to get over the problems." □

SLAC

It takes two miles of accelerator at Stanford to produce 20-GeV electrons.