

Program at Fermilab for minority students

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For the past six years, the Fermi National Accelerator Laboratory has sponsored a summer program for undergraduate minority students in physics. The primary objective of the program is to stimulate minority students' interest in pursuing a career in science by bringing them in contact with actual technical work and technical workers. The program has

GUEST COMMENT

by

J. C. Davenport E. Malamud
F. T. Cole R. A. Carrigan, Jr.

produced a number of students who have continued in science, and we therefore believe that the program can claim some success. Many people of the Fermilab Equal Employment Opportunities Office and of the Laboratory Summer Program Committee have contributed to this success, and we are writing on their behalf to encourage other institutions planning such programs.

The under-representation of minorities in science and engineering is well known and well documented.¹ Less than 2% of scientific and technical people come from minority groups that constitute 16% of our population. Our summer program is an attempt to reduce the disparity by encouraging undergraduates to continue on in science by bringing approximately twenty students to Fermilab each year to work in one of our technical groups. We have six years of experience with this program, and we believe that the choice of students, choice of assignments and supervision are vital factors for success.

We choose our students by visiting the campuses of minority institutions to interview them. Minority students from majority institutions have also participated in our program, but our primary sources are still the minority institutions, which produce 75% of the minority graduates in physics. They frequently cannot offer their students the contact with active research that a large majority institution can, and our program therefore has more to offer them. Technical staff members from the Summer Program



Committee and staff members from the EEO Office conduct these interviews together. Usually two students are chosen from each institution for definite offers, as well as several alternates.

The students are chosen on the basis of their course work and the interviews, with heavy reliance on the advice of faculty members of the institution. We prefer that a student have completed his junior year; younger students will be more difficult to find good assignments for, because they have not yet had many physics courses. Students who have completed only an introductory physics course have participated successfully; so the rule is not ironclad.

In principle, students who have graduated will have made their career decisions and are beyond our program, but in many cases we have taken graduates and helped them to prepare for graduate school. A few graduate students also participate. A summer spent working on an active high-energy physics experiment will help to motivate them toward a re-

search career. This has been particularly true for students who are returning to Fermilab for a second summer. We believe from our experience that participation for two years is advantageous for students, because they have learned how to utilize the summer. Beyond the second year, the returns for the student appear to diminish and we do not as a rule encourage further participation.

The choice of the right assignments for students is at least as important as the choice of good students. If a student does not need contact, discussion and guidance with a technical staff member, then he probably does not need our program. The supervisor must be ready to show the student how to do things in the laboratory and why he is carrying out particular tasks. Every job in a laboratory has tedious aspects; people are sustained through these tasks because they understand the part they play in the larger aspects of the work of the laboratory. This understanding is an important part of the education a student gets from his super-

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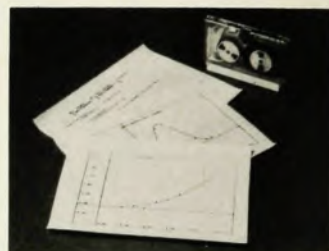
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letters

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We ask our technical colleagues to propose job assignments, giving us information about the nature of the job, the supervision they will provide, and the background the student will need. Our judgment of these proposals is tempered by our knowledge that some supervisors have records of providing excellent summers for our students. We choose the assignments and match students to them individually. Some assignments have been: working as an accelerator operator; taking data on an experiment; analyzing data; building and testing equipment used in accelerator or experimental improvements, and working on the design of test equipment for superconducting magnets.

The students are here for 11 weeks in June, July and August. The Laboratory brings them by air and arranges housing at a nearby college. After considerable trial and error, we believe that the best and most economical way for the students to get between the college and Fermilab is to provide a leased car for every four students. They manage the sharing very well by themselves. We try to treat our students as professionals working physicists' hours, and transportation is a crucial part of the flexibility needed.

The Laboratory provides a stipend for the students at a level of approximately \$700 per month, not very different from what similar programs at other institutions provide. The Laboratory also subsidizes the students' housing. The participants in our program depend on summer earnings to help with college expenses. In most cases, they could probably save more money by working and living at home, but we try to give them educational benefits they could not get elsewhere.

As an adjunct to their work in their groups, we give a series of lectures on physics topics. At the end of the summer, each student gives a seminar on his summer work. He also writes a report on his work and an evaluation of the program. The reports are valuable training, and the evaluations help us to guide the direction of the program.

The lectures, seminars and oversight of the students' progress are managed and supervised by a coordinator who comes for the summer and spends full time on the program. He is able to correct difficulties that students are having with assignments or living arrangements. This close coordination and supervision has been an important part of our success.

Of the students who have participated in our program, approximately 40% are in graduate school, 25% are still undergraduates, 25% are active in scientific, engineering or technical careers, and 10% have moved on to other careers. We believe

that we have influenced many young people toward careers in science, and we are proud of our record. We believe that our success comes from hard work in the ways outlined above. It is not a large program, but it is one of many small actions that will move us closer to the American goal of equal opportunity for all.

More information is available on our program and we plan to publish a more detailed account shortly.

Reference

1. A. Wilburn, *Science* 184, 1148 (1974).

J. C. DAVENPORT

*Fermi National Accelerator Laboratory
and Virginia State College
Petersburg, Va.*

R. A. CARRIGAN, JR

F. T. COLE

E. MALAMUD

*Fermi National Accelerator Laboratory
11/11/76 Batavia, Ill.*

Temperature scales

The beautiful work of Leslie Guildner at the NBS in gas thermometry (November, page 19), and the note that these better measurements of the thermodynamic temperatures of certain phase equilibria will be used in a new version of the International Practical Temperature Scale, raises questions on the making and changing of practical scales.

The Thermodynamic Kelvin Temperature Scale (TKTS) has a basis in nature. The International Practical Temperature Scales (IPTS) are artifacts and conveniences that exist by agreement rather than truth, and may be changed at will or whim.

But there is good reason not to change. A primary characteristic of a consensus measure must be stability, so that a measurement made at time t_2 can be compared with one made at time t_1 on the same scale, or so that an instrument calibrated at time t_2 will not have a different calibration than it had at time t_1 for reasons external to itself. History is less useful if it requires translation.

IPTS₄₈ (with the *de facto*, if not *de jure*, replacement of the 0°C icebath with the much more precise 0.01°C triple point) was an entirely workable scale down to 90 K, and had the advantage of interpolation equations which could be done on a desk calculator. It is still the scale used in the bulk of US industry, for the economic burden of recalibrating US industry and of translating years of US product history for no particularly good reason is unthinkable.

IPTS₁₉₆₈ was constructed to bring the defining fixed points into closer conformity with what were the then best values for the TKTS. The cost of the change was mathematically horrendous interpolation formulas. Even then it was

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