Physics Today

Saturday morning physics

Leon M. Lederman

Citation: Physics Today 35(9), 11 (1982); doi: 10.1063/1.2915243
View online: http://dx.doi.org/10.1063/1.2915243
View Table of Contents: http://scitation.aip.org/content/aip/magazine/physicstoday/35/9?ver=pdfcov
Published by the AIP Publishing

letters

Saturday morning physics

We who work in basic research are keenly sensitive to the problem of the care and love we must lavish on the pre-scientist. The graduate student is already committed, though his world is full of uncertainties. The undergraduate? Science lost many good students during the period after Vietnam when "relevance" was the password for social responsibility. As an assembly of universities we do a fair job with undergraduate scientists—we do an absolutely abysmal job in teaching science for the non-scientist. This brings us to high schools. Here the situation varies from subject to subject, but there is widespread concern about the crisis of science and math in the nation's secondary schools. What follows is a description of a program we initiated two years ago at Fermilab to rekindle the flame among bright high-school science students. In the course of this experience we came to appreciate some of the problems.

Two years ago we wrote to the principals of about 70 high schools within a 20-mile radius of Fermilab, outlining a Saturday morning program for four or five of their brightest science-oriented juniors and seniors. After some follow-up via the chairpersons of the science departments, we eventually got a very large (>95%) response. The year was divided into three ten-week sessions. Each session contained about 90 students and about 10 teachers. We wanted the teachers for their response and their opinions as to their level of education in modern physics.

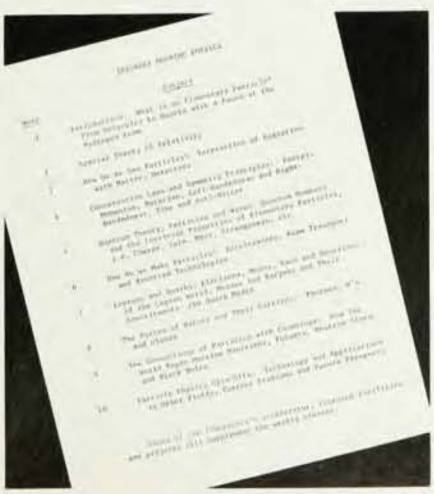
The ten-week period was devoted to the topics listed herein. The morning began with a 90-minute lecture including a 10-minute "ice-cream" break. The group was then divided into four sections for more detailed response to questions about the lecture and as a preparation for our tour. Each Saturday we selected a different activity of the laboratory for a one-hour visit. The class was released promptly at noon.

The last lecture included "graduation." We invited the parents of our students, gave them a mini-tour and a compressed lecture, and then listened to their comments. We ended with tea, cookies and a presentation of certificates of attendance.

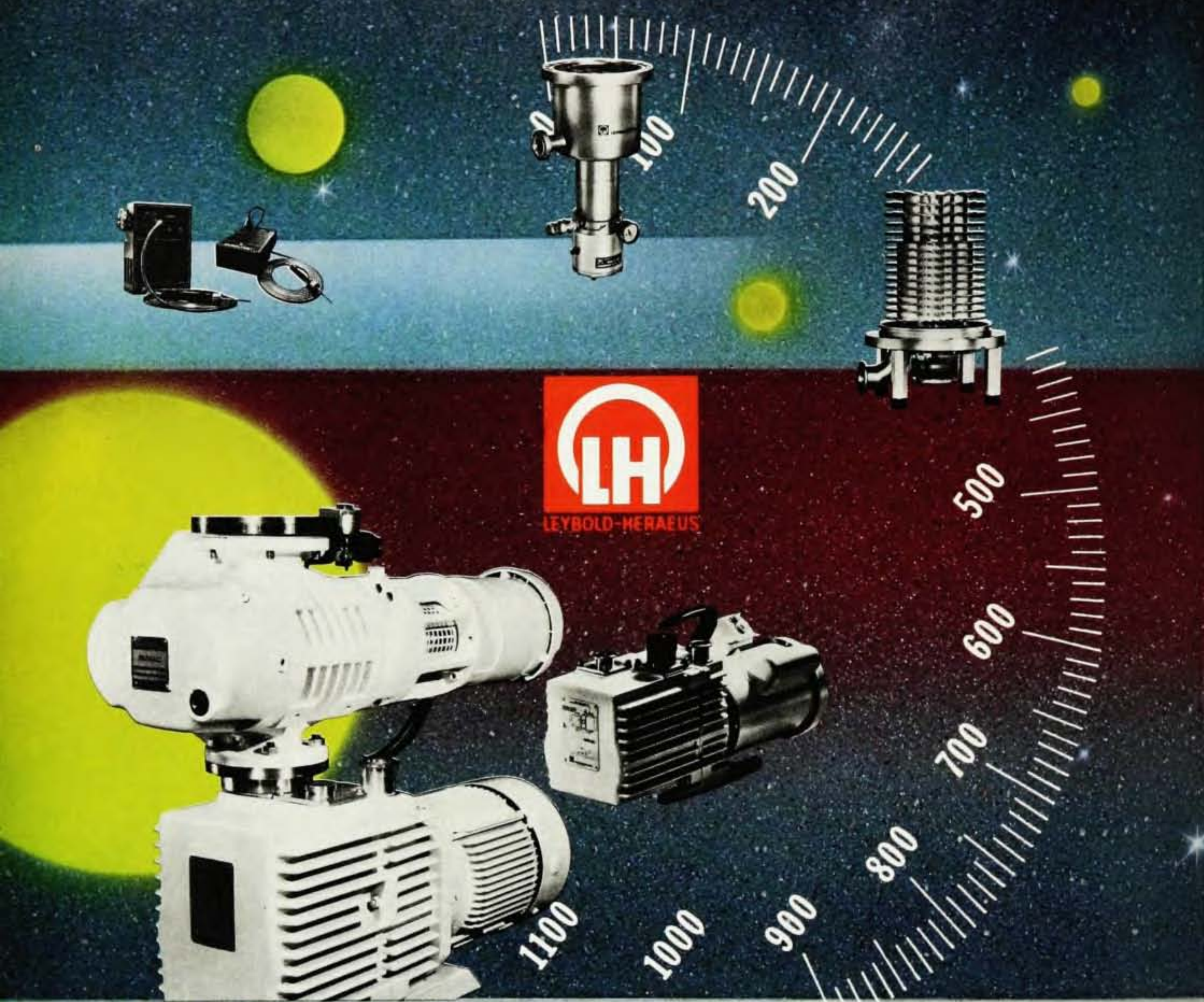
In the second year, we enlarged the group to about 110 acceptances, opening participation up to the City of Chicago, which we had avoided the first year. Thanks to a DOE grant, we were able to provide buses for these youngsters, and we were able to offer Scientific American off-prints, pay for some clerical help and xerox the notes. Each lecture was covered by a principal lecturer and three assistant lecturers, who also acted as tour guides—all were volunteers from the Fermilab scientific staff.

To give the lecturers feedback, the high-school teachers in attendance were asked to comment in detail on the subject, teaching technique, and so on, of each lecturer. We learned many tricks about an assembly of bright students. For example, a single bright student in a normal class will tend to dominate the question and discussion period. However, in a class with equally bright students, there is a sudden "shyness" about asking questions. We developed techniques for ensuring the asking of questions. Once the fears faded, most classes were characterized by lively discussion. We were amazed at how much these youngsters had read. Not surprisingly, their information far exceeded that of their teachers.

The comments that we received from students and their parents tell us that



The ultimate in vacuum technology.



A complete range of products to meet your vacuum requirements.

See Us at the Plasma/Fusion Show
BOOTH 17, 18

Our line of vacuum pumps, helium leak detectors, vacuum gauges and accessories are designed to meet just about any industrial and scientific application, including both standard and corrosive pumping requirements.

State-of-the-art development and precision engineering have made us the largest manufacturer of products that pump, maintain and measure vacuum.

As the oldest and most complete source of vacuum components and technology today, we have the expertise and capability to meet your industrial or scientific vacuum requirements.

- TRIVAC® and VAROVAC™ Rotary Vane Pumps
- Rotary Piston Pumps
- RUVAC® Roots Pumps
- Integrated Pumping Systems
- TURBOVAC® Turbomolecular Pumps
- Cryopumps
- Ultratest® Leak Detectors with QUICK-TEST™ Sniffing Probe
- Vacuum Accessories: including KF® Fitting, Gauges and Valves

LEYBOLD-HERAEUS VACUUM PRODUCTS, INC. 5700 Mellon Road, Export, PA 15632
Sales Offices and Service Centers throughout the United States and Canada
United States: (412) 327-5700 Canada: (416) 746-0050

LEYBOLD-HERAEUS

Circle number 12 on Reader Service Card

the course serves an essential role. It is a fortunate high school that has a physics teacher who has had more than one year of general college physics! The students are thrilled by contact with the "advanced" topics and contact with working scientists and a working laboratory. If we can reach 250 students per year, there should be 50 universities that can do the same. We urge all physics departments to initiate such programs for their area. For an investment of about 300 man-hours per year, we can touch a significant fraction of the science-oriented, bright high-school students. We at Fermilab will be happy to learn of other plans and to provide more detailed information.

The Fermilab effort is not original and, even if multiplied by 50, will not solve the abysmal collapse of science education in our schools. However, the relatively small and very practical effort can have far-reaching effects on keeping alive that spark which leads students into science.

LEON M. LEDERMAN
Fermi National Accelerator Laboratory
6/82 *Batavia, Illinois*

Backwards photo

The picture of Yukawa and Feynman that appeared in April (page 43) was printed *backwards*. I found this out by trying to read what was on the bulletin board (behind Kobayashi); it didn't make any sense to me until I noticed some other clues. Then I turned the page and, with backlighting, read the four characters; loosely translated, they mean "Urgent Notice."

There are altogether *five* clues, one of which I shall point out: The men's jacket and shirt pockets are on the wrong side. The rest of the four clues I leave as an exercise for the reader.

PETER H. Y. LEE
Lawrence Livermore National Laboratory
5/82 *Livermore, California*

Avoid land-based missiles

In response to the letter by James Locker (February, page 101), which attempts to justify a large number of US counterforce missiles targeted at Soviet missile silos by considering the available options open to us after an initial Soviet nuclear attack on US missiles, an attack which Locker suggests would destroy 80% of US land-based missiles.

Surely the obvious solution is to avoid having any US land-based missiles at all, thus saving ourselves tens of billions of tax dollars and, more important, avoiding the possibility of a Soviet strike arising from, for example, a Soviet computer malfunction which mistakenly identified a US counterforce first strike from US land-based missiles, an error which could not be identified inthe thirty minutes (or ten minutes for missiles based in West Europe) before Soviet land-based missiles would be destroyed.

Without land-based missiles we would still have security in the ocean depths, a multitude of nuclear armed submarines which would still have the capability of exacting a terrible revenge for any Soviet nuclear attack on the US but which do not (as, yet) threaten Soviet missile silos. Land-based missiles cannot *defend* anyone—they simply bring the threat of the extinction of mankind in a nuclear holocaust one step closer.

CHARLES SKINNER
Princeton University
2/82 *Princeton, New Jersey*

Learning how science is done

In your interesting editorial in February (page 128) you concluded by saying that "we can succeed in giving children their own hands-on experience of how science is done and what is meant by a scientific theory." I am dubious that in fact this will be done by means of the existing curriculum development projects, at least in their current form. In your editorial you referred to the ESS project at MIT. There were, of course, similar projects at Berkeley (SCIS and ESS) and within AAAS. But these materials are, unfortunately, receiving extremely little use in American schools. I happen to have heard recently of a survey of elementary schools done by the New Mexico State Department of Education. Of the 88 schools replying, only two were using the SCIS materials and none were using ESS materials.

The classroom problems rest in the difficulty of providing any individualized attention to students and in the difficulty of letting them work as scientists in a "discovery mode." Additional problems come from the fact that many teachers are ill-prepared to bring such an approach to children because they themselves do not understand it. A glance at the courses typically used to train teachers in science indicates that both in quantity and quality they are inadequate to the task.

However, I believe that there is a way that we can move toward a better understanding of science, not only with children but also with a much wider part of our society. This is by putting these and similar materials in a self-contained, highly interactive computer environment in which each student can be immersed in a series of different