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gold ring, while the other is a metal-oxide-semiconductor strip. While the Aharonov-Bohm effect manifests itself as a shift in an interference pattern, the Hall effect displays a quantized conductivity. Obviously these experiments describe two different effects. The question uppermost in my mind is, are these two effects the result of the same fundamental law of nature, the physical existence of the magnetic vector potential? From this point of view it appears reasonable that the same effect is found in two totally dissimilar objects. A universal law should be independent of material or configuration.

FRANCISCO IZAGUIRRE

3/86

Manhattan Beach, California

Physicists' terminology

The terminological error Veit Elser attributes to physicists (PHYSICS TODAY, May, page 120) is shared by lexicographers. Webster's Unabridged Dictionary (the revered 2nd edition) defines "finite" to mean "neither infinite nor infinitesimal." So does the Oxford English Dictionary.

This raises the interesting question of why, in spite of being "universally surprised," we "universally acknowledge the incorrectness of this choice of words" when Elser challenges us.

My guess is that we are seduced into acquiescence by a taste for simple logical paradoxes, a reluctance to consult authorities when we can figure something out for ourselves and an unwillingness to acknowledge that language (and life) are governed by laws somewhat murkier than nature's. Or is it just another tribute to Elser's charm and powers of persuasion?

DAVID MERMIN

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5/86

Polarized scattering

In your August 1985 Search and Discovery story on polarized scattering (page 17), Stanley Brodsky is quoted as saying, "We have absolutely no explanation for the Krisch data." While it is true that quantum chromodynamics offers no explanation, there are other theories that offer some explanation. In 1964, François Lurcat wrote¹ an article entitled "Quantum field theory and the dynamical role of spin." I quote from his abstract:

The point of view currently taken in elementary particle physics, that the spin plays no dynamical role, is criticized here. This assumption has no experimental ground; it is merely a consequence of the wave equation used, especially in field theory.

The Krisch data show that Lurcat was correct to question the assumption. The wave equation used depends on the group assumed to underlie the physics. The group used in QCD, namely SU(3), is far too small to give a wave equation with dynamical spin. The group Lurcat uses is too small to give the strong interactions. The first theoretical question to answer, then, is "What is the correct group?"²

Many very interesting theoretical papers have been written since 1964 on the subject, and the interested reader should refer to the Science Citation Index.

References

1. F. Lurcat, Physics (NY) 1, 95 (1964).
2. T. R. Love, Int. J. Theor. Phys. 23, 801 (1984).

THOMAS R. LOVE

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3/86

Capping research overhead

I was gratified to read, in a recent issue of *The New York Times*, that the Federal government is planning to put a cap on university overhead rates on research grants and contracts. I have advocated such a course of action for the last ten years. To reimburse universities for all overhead costs incurred merely penalizes efficient university administrations that have kept overhead costs down while rewarding the most inefficient universities and encouraging them to incur still more costs. If this step had been taken voluntarily by the research community, the savings might have been made available for the direct costs of research. Now they will merely go toward reducing the Federal deficit. More cost cutting will still be needed. Now that the bureaucratic budget-cutters in Washington have noticed "overhead," it is only a matter of time before they discover "summer salaries."

ROBERT J. YAES

University of Kentucky

Lexington, Kentucky

3/86

Physics classroom revisited

I wish to compliment George Pallrand and Peter Lindenfeld on their article

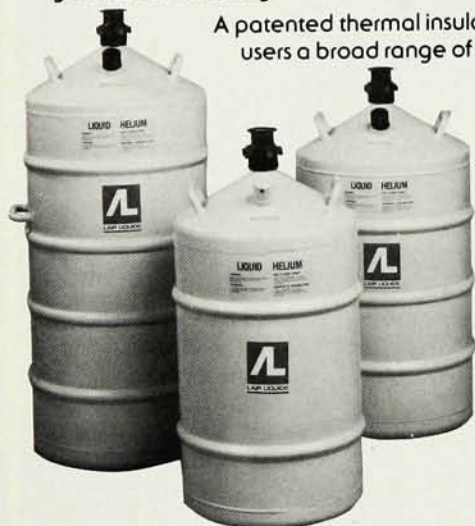
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"The physics classroom revisited" (November, page 46). Many of their insights are ones that I have experienced in my 27 years of teaching high-school physics. I do have trouble with one bit of statistics: The article states that 3% of students study physics and 20% of seniors study physics. Let us denote the number of students that study physics as x , the number of students that graduate as y and the total number of students as z ; then $x = 0.20y$ and $x = 0.03z$. This implies $0.2y = 0.03z$, or $y = 0.15z$. What an indictment! Thank goodness it is false.

In 1960 I participated in a PSSC summer orientation program. It was very useful. I returned to my classroom, changed our text and adopted the PSSC approach. After six years I modified the program to incorporate the best of *Modern Physics* and PSSC. Today I have drifted away from PSSC for several reasons:

- ▶ The program was meaningful only to about half of my students.
- ▶ My enrollment started to drop.
- ▶ My students scored lower on the Physics Achievement Tests.

Fearing the implication that I was not doing the job of teaching, I returned to *Modern Physics*. At present 45% of our graduates study at least one year of physics. (I do not know if this is good or bad because all of our students go on to college and university study.)

It might be good for NSF to repeat what they did in the 1960s to improve high-school teaching. Many of us would like to return to the classroom to:

- ▶ visit with other motivated teachers and share experiences, ideas and concerns
- ▶ learn more about some of the latest information in the physical world
- ▶ learn to do more with the computer in our classroom than just plugging into some software
- ▶ recharge some of our batteries.

Thank you for your concern with the high-school physics scene.

PETER FROEHLE
St. John's Prep School
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12/85

THE AUTHORS REPLY: We are very much aware of the pitfalls that await anyone who tries to gather reliable nationwide statistical data or to find them in the literature. Work on a recent survey in New Jersey (*Am. J. Phys.*, Nov. 1985) taught us that there is a wide range of courses called physics, physical science, technical physics, conceptual physics and so forth, whose content is difficult to gauge from their titles. Our numbers come, where possible, from

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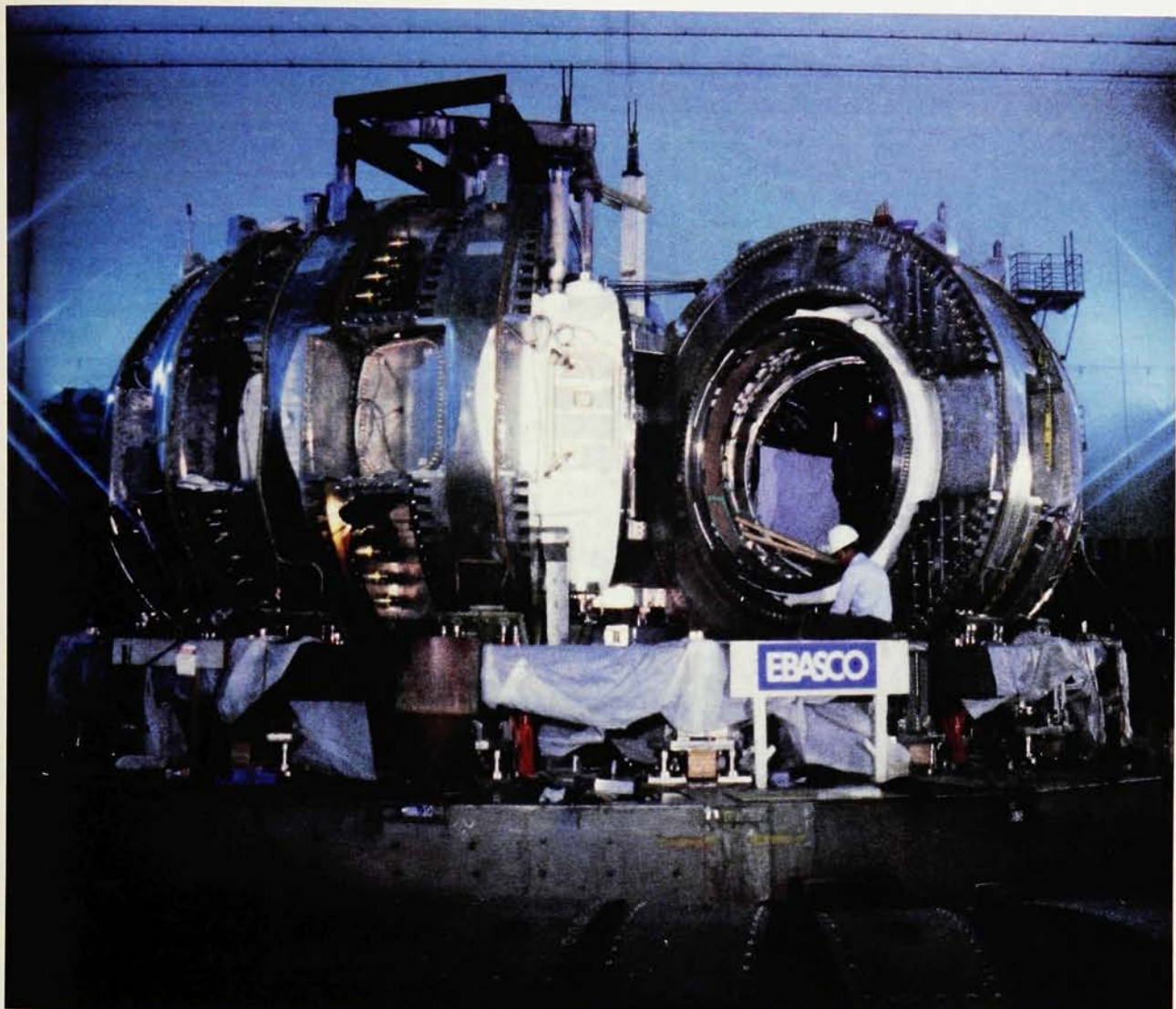
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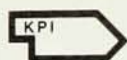
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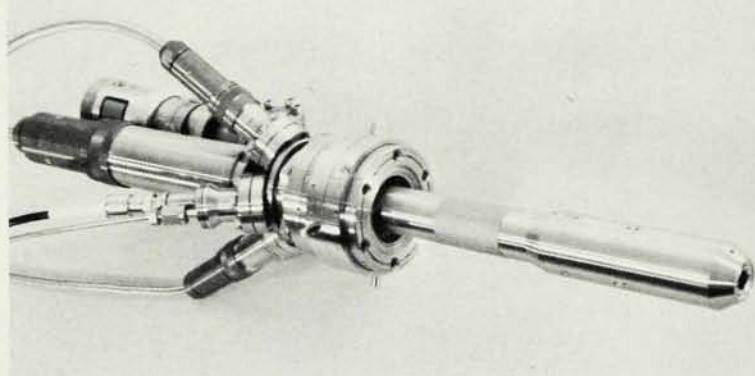
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the *Digest of Educational Statistics* of the Office of Education. Here, for example, are the numbers for 1960-61 from the 1964 edition: 0.385 million enrolled in physics, or 22% of the enrollment of 1.75 million in grade 12, or 4.7% of the 8.22 million in grades 9-12. Our data are consistent with those shown by John Layman in the September 1983 issue of *PHYSICS TODAY* (pages 28 and 29). It is difficult to guess their precision, but because they were presumably gathered consistently from year to year the trends are likely to be reliable.

Peter Froehle's letter points up a fact that we also tried to emphasize: The most important ingredient influencing the quality of the teaching, and hence ultimately the enrollment, is the teacher. Our congratulations to him and to the other dedicated and enthusiastic men and women who bring the excitement of physics to the classroom!

PETER LINDENFELD

GEORGE PALLRAND

Rutgers University

Piscataway, New Jersey

6/86

Einstein and the Vatican

I read with great interest Irving Klotz's letter (July 1985, page 13) and I certainly agree with most of what he states. But on the other hand I disagree with the omission of certain important aspects about Cardinal Pacelli (secretary of state to Pius XI and afterwards Pius XII) and about Galileo and his predecessors.

I do not think it is fair to imply that Pius XII disliked or resented Jewish people. If he did I deplore the attitude, but I have no reason to believe it.

Regarding Klotz's statement about "the policy of not irritating the Nazis," I think it is very easy to say that now. I believe the words of the great Spanish philosopher José Ortega y Gasset: "The man is he and his circumstance" (*El hombre es él y su circunstancia*). Several articles have been written in the last decade—some of them by Jewish authors—showing Pius XII's deep concern about the persecution of Jews. Many, many Jewish families were helped by the Vatican in that period. I have found that it is fashionable to attack Pius XII. However, I feel that sooner or later many historians and political scientists will agree that Pius XII acted in a wise, political manner on the one hand and showed profound human sympathy and charity in a rather secret fashion, pressured by circumstances, on the other.

Regarding Galileo's trial, there is no question about the deplorable treat-