journals, and also that we have received a strongly favorable response from authors, referees and others.

The financial situation is difficult for libraries everywhere, and the subscription (starting 1977) to *Communications on Physics* is being held as low as possible by the publishers.

DAVID CAPLIN
DAVID SHERRINGTON
ROY JACOBS
Communications on Physics
Imperial College
London

A UFO by any other name

I read with interest—and some amusement—the letter by Bruce Maccabee (March, page 90), "More Lights In the Sky". With interest because Maccabee (and Rutledge, Epstein and Heaton) are calling attention to what may be a new phenomenon, and certainly a new empirical observation—with amusement because of the careful and obviously studied avoidance of the term UFO.

Yet what else is the letter about? After all, the U in UFO simply means unidentified, and the observations described certainly fit this definition of UFO.

The literature of UFO's is replete with similar descriptions—of lights not only unidentified to the original observer, but that remain unidentified even after competent scrutiny by persons like those associated with the Center for UFO Studies in Evanston, Illinois. The Center has associated with it scientists from various disciplines (anthropology, sociology, psychology—even psychiatry, as well as physics and astronomy—we don't know to whom these new empirical observations, akin perhaps to the first observations of the fall of meteorites, or of bacteria or of cosmic rays, belong—perhaps we should include a chaplain!)

At any rate, kooks and crackpots aside (and they do obscure the issue), considerably more attention is being accorded today to the UFO phenomenon by academically trained persons. And why? Because of the incontrovertible fact that UFO *reports* exist, they have persisted for at least a quarter of a century, they represent a world-wide phenomenon, and the majority of the reports that fit the above definition (that is, the content of the report must remain really puzzling after serious study) are made by as responsible persons as those described by Maccabee. Isn't it time for us to recognize that a new empirical phenomenon exists (is being reported) which, whether one calls it the UFO phenomenon or not, still deserves to be studied. The Center for UFO Studies will be happy to furnish readers of PHYSICS TODAY with information on the nature and quality of the surprisingly extensive literature on the UFO phenomenon today.

J. ALLEN HYNEK
Center for UFO Studies
924 Chicago Avenue
Evanston, IL 60202

Role of small physics

W. A. Sibley's defense of small physics departments (August 1975, page 9) is a solid one, but it emphasizes only the conventional role physics plays in academic and industrial research. Also I believe Sibley is wrong about what constitutes critical mass for "excellent physics": one professor and one graduate student or two cooperating professors can constitute a critical mass sometimes, at least if one will settle for sound continuing research and not insist on an explosion.

In addition several points are not discussed by Sibley. Physics departments exist for more reasons than to do "excellent physics" or even to "do" physics. I believe the ideas and methods of physics must be appreciated by those outside the field.

First, physics is not worthy of great support simply because it is physics. Sibley suggests physics should assist industry and this can be important. But the human and cultural drama inherent in physics are also important and should be as exciting to anyone interested in the achievements of man as any other subject. Unfortunately, physics is considered by the general public as either too difficult to understand or too dry to make the effort of understanding worthwhile. Another physical science, astronomy, with all its very real difficulty and inherent uncertainties, is considered fascinating by the layman because astronomers and observatories have made the effort to explain astronomy's excitement and speculations to the general public, whereas we physicists have been so wrapped up in "excellent physics" that we have made no real educational efforts at all on this level.

As long as we continue to isolate ourselves, the gap between physics and the layman will probably grow, and without the support—social and financial—of the layman, physics can in effect collapse. If we involve non-physicists in our excitement and listen to their responses, we may find how to join the intellectual society we depend on. I believe the struggles and human frailty of Oersted's and Faraday's discoveries are potentially as exciting as the struggle Shapley, Hubble, Wright and others had to understand the nature and scope of the galaxy and the extra galactic nebulae, a struggle still going on with quasars and black holes now on stage.

If we could explain these situations, our colleagues across the campus might alter their view of physics as a dusty monolithic nonhumanity of omniscience.

A second point is the importance of the methods and concepts of physics to subjects outside the physical sciences. Physics is not deterministic (and therefore dull) truth, even though it is treated as such in some cases. But a real difference between physics and the social sciences *is* one of scale and time.

A basic problem is verification. When a colleague and I recently found ourselves in disagreement over certain fundamental characteristics of the magnetic field, we were able to set up an experiment and test it for inherent symmetries within an hour or so. A similarly fundamental concept in psychology or medicine or biology might take a decade of major effort to test, and one in political science or economics a hundred years or more. It is no wonder that the rest of academia looks upon us as a field apart.

However, recent developments in modelling theory permit a variety of evaluation of various concepts and interrelationships in the "soft sciences" to be conducted in hours rather than years or hundreds of years. There now is opportunity to try alternate worlds, a quasi verification akin to that of theoretical physics. But it is dangerous, and we, as physicists, more than most recognize the dangers inherent in the theoretical process. We know we can't really *believe* the results that come from theoretical modelling, even as we respect and use them. The System Dynamics model of Forrester, Meadows, et al has enabled "verification" in economics and political science to move into the same time domain as that of physics, and ideas like thermodynamics and general system behavior appear in these other sciences. It is important that physicists work closely with these other disciplines so that these techniques and ideas lead to knowledge and to intuition and not to confusion or even disaster.

These crucial points will not be addressed by having "real physics" done only by an autistic residue of forty institutions or even by having a few more institutions focus their energies in certain major research areas. The mission of physics also includes all the other aspects of a versatile program—aid to industry and government, responsibility to all students, responsibility to the other disciplines that rely or should rely on the methods and cautions developed by physics, and responsibility to carry the message of physics to society and society's concerns back to physics. Many an extinct species attests with its bones that excessive specialization of mission or capability or even of excessive size is not the way to ultimate success.

RICHARD C. SILL
University of Nevada

More on monopoles

I must take issue with Daniel Zwanziger's statement in the April issue (page 83). In

commenting on C. R. Hagen's letter he says "That the classical non-relativistic and relativistic theory of electric charges and magnetic monopoles is consistent does not appear to be in doubt."

In a paper many years ago, I gave a rigorous proof that no action principle exists for the classical relativistic electromagnetic field when its sources are both charged particles and magnetic monopoles, unless an extra condition, not derivable from the action principle, is assumed.[1]

The arguments for magnetic monopoles are essentially aesthetic. The fact that the electric-charge–magnetic-monopole system, if it existed, would be the only classical system whose dynamical equations could not be derived from an action principle destroys any aesthetic advantage for me, and thus any attractiveness to the concept. Even the asymmetry of Maxwell's equations without magnetic monopoles is artificial, since if they are written in spinor form the asymmetry disappears.

Lastly, P. A. M. Dirac's[2] first monopole paper, while original and beautiful, has so little mathematical rigor that it is more of a suggestion than a rigorous argument.

References

1. D. Rosenbaum, Phys. Rev. **147**, 891 (1966).
2. P. A. M. Dirac, Proc. Roy. Soc. (London) **A133**, 60 (1931).

DAVID ROSENBAUM
The Mitre Corporation
McLean, Virginia

I believe there is a consistent theory of the interactions of electric charges and magnetic monopoles (or "dyons"). The questions raised by C. R. Hagen, Daniel Zwanziger and others can be resolved if one goes back to the sources of theory and treats the singularity surface (string) of the potential as an additional dynamical field, as Dirac did (1948). Equations of motion of the string follow from the action principles. Strings or equivalent dynamical boundary conditions cannot be completely eliminated [see Nucl. Phys. **B81**, 477, (1974)]. The quantization of all fields guarantees not only covariance, but also the equivalence of charge, angular momentum and flux quantizations, and spin-statistics connections for half-integer n values.

A. O. BARUT
The University of Colorado
Boulder, Colorado

Pro metric

I take exception to the letter by David Bartlett and Chris Zafiratos (February, page 15) opposing a ten-year program to make SI units the general unit system of the United States. I wish to make the following points:

- The primary reason that the present (or any) adult population should be forced to adjust to new measures is because the main fault of the present system is its lack of universality—it is a non-system. How many average home owners can figure for their houses the amount of incident and exit energy, the electrical usage, the amount of specific fuels required to maintain certain temperature differentials, and the cost of various alternatives with the current mix of BS and practical electrical (SI) units? This is the sort of thing requiring simple arithmetic that almost every citizen should be able to do for himself, particularly in an era of scarcity of energy and materials. How can any system of units not based on at least a single common integer serve the needs of a modern people? Poorly.
- While the binary number system is popular with switches and logical subunits, the decimal system is the standard means of reckoning numbers among humans. I doubt that any physicists balance their checkbooks in binary.
- With regard to the ten-year timetable for metrication, it seems that a century or so is a long enough time to wait before starting such a system. A coordinated timetable is necessary to minimize the economic costs of conversion, to allow for long-range planning in all sectors. For example, it is probably more advantageous for manufacturers to retool gradually by equipment replacement.
- One of the most pressing reasons for the US to adopt the metric system widely is that our archaic unit system costs us money in the world market. If our manufactures were repairable using available metric parts, people abroad would be more likely to buy them. The BS also costs in unnecessary calculation and conversion effort, and effort is money. As a person on a relatively fixed income, I object to an inflation of expenses due in part to our trade situation not being as good as it might be.

A final point: failure to support a change in the current scheme of measures simply because some people are unfamiliar with it is to buckle under to stupidity, and that is something that I detest personally as a teacher of physics. Adoption of the metric system is an opportunity for growth, a chance for the US public to learn something (that a majority of it has already been taught).

DAVE GOSS
Nebraska Wesleyan University
Lincoln, Nebraska

Correction

October, page 30—In the first paragraph under the head "Switching," the switching process is described as being "very fast (about 4 sec)"; it should read, "very fast (about 1 nsec)."