

THIS WEEK

A magnetic monopole, maybe 323
Mentally ill: Competent to refuse drugs? 324
The plight of a Soviet chemist 325
Saving sight with lasers 325
Volcanic cloud may lead to blue moon 326
Spermicide-birth defect link questioned 326
Temperature controls sex in alligator 326
Laser uranium enrichment gets a go-ahead 327
EPA plans to relax CO rules 327

RESEARCH NOTES

Neurology 330
Earth Sciences 330
Technology 331
Biomedicine 331

ARTICLES

Slow virus: A nonconventional gameplan 332
When physics and biology unite 334

DEPARTMENTS

Books 322

COVER: Electron micrograph of an oligodendrocyte in the brain of a child with subacute sclerosing panencephalitis. SSPE is caused by the persistent infection of the central nervous system with measles virus and is a member of the family of slow virus diseases—so called because the infectious agents may lurk in the body for years before the disease manifests itself. See p. 332. (Courtesy of Dubois-Dalcq et al., Arch. Neurol., Intern. Rev. Exp. Path. © Academic Pr., 1974, 1979)

PUBLISHER: **E. G. Sherburne Jr.**

EDITOR: **Joel Greenberg**

SENIOR EDITOR/PHYSICAL SCIENCES:
Dietrick E. Thomsen

ASSISTANT EDITOR: **Judy Klein**

BEHAVIORAL SCIENCES: **Wray Herbert**

BIOMEDICINE: **Joan Arehart-Treichel**

CHEMISTRY: **Linda Garmon**

EARTH SCIENCES: **Cheryl Simon**

LIFE SCIENCES: **Julie Ann Miller**

POLICY/TECHNOLOGY:

Janet Raloff, Ivars Peterson

SPACE SCIENCES: **Jonathan Eberhart**

CONTRIBUTING EDITORS: **Lynn Arthur Steen (mathematics), Kendrick Frazier, John H. Douglas, Michael A. Guillen**

SCIENCE WRITER INTERN: **Laura Tanglely**

ART DIRECTOR: **Ileana Mendez**

ASSISTANT TO THE EDITOR: **Betsy Gordon**

BOOKS: **Jane M. Livermore**

BUSINESS MANAGER: **Donald R. Harless**

ADVERTISING: **Scherago Associates, 1515 Broadway, New York, N.Y. 10036, Fred Dieffenbach, Sales Director**

Copyright ©1982 by Science Service, Inc., 1719 N St., N.W., Washington, D.C. 20036. Reproduction of any portion of SCIENCE NEWS without written permission of the publisher is prohibited.

Editorial and Business Offices
1719 N Street, N.W.
Washington, D.C. 20036

Subscription Department
231 West Center Street
Marion, Ohio 43302

Subscription rate: 1 yr., \$27.50; 2 yrs., \$47.50; 3 yrs., \$67.00. (Foreign postage \$5.00 additional per year.) Change of address: Four to six weeks' notice is required. Please state exactly how magazine is to be addressed. Include zip code. For new subscriptions only Call (1) 800-247-2160. Printed in U.S.A. Second class postage paid at Washington, D.C. Title registered as trademark U.S. and Canadian Patent Offices. Published every Saturday by SCIENCE SERVICE, Inc. 1719 N St., N.W., Washington, D.C. 20036. (202-785-2255) ISSN 0036-8423

SCIENCE NEWS OF THE WEEK

Monopoles are a GUT Proposition

Symmetry is a basic principle of physics. There are deep philosophical, mathematical, physical and psychological reasons for this, and physicists will persist in looking for some phenomenon predicted by a theory based on symmetry principles even when it begins to seem a little absurd to continue. An example is half a century of looking (on and off, to be sure) for magnetic monopoles.

A magnetic monopole is a single north or south magnetic pole moving along as a free particle. All the magnets available to either common or uncommon observation up to now—from electrons to room-sized superconducting coils—are at least dipoles. More complicated configurations are possible, but every ordinary magnet has at least one south and one north pole. Electric charges commonly exist as monopoles. It's no trick to get a body with net positive or net negative charge. Theories based on exact symmetry between electricity and magnetism demand the existence of magnetic monopoles too.

After 50 years of null results, there is now a report that one monopole may have been seen by a Stanford University researcher, Blas Cabrera. It is causing something of a sensation in physics.

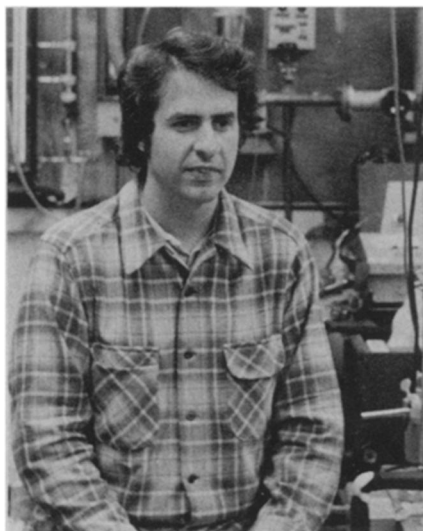
It is an excitement that goes with a certain suspension of judgment. Other experimentalists praise Cabrera's experiment for its simplicity and elegance. Theorists seem to be choosing up sides: Those who favor theories that require monopoles are cautiously accepting; those who like theories that don't have monopoles are more negative. Everybody is waiting for further results. One is not enough to be conclusive.

Cabrera's own assessment of the situation is: "There is no easy way," he told

SCIENCE NEWS, "to attribute it to other things." Other particles, that is, which are not expected to be magnetic in this way. "But," he continues, "we cannot rule out other causes." Other causes being things having to do with the apparatus or the environment that could give a spurious reading. Cabrera's paper on the subject is due to appear in the May 17 PHYSICAL REVIEW LETTERS.

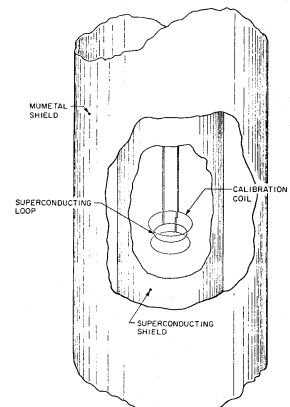
The apparatus is indeed very simple. It consists of a superconducting niobium loop connected to a device called a SQUID (Superconducting Quantum Interference Device), which is an application of the famous Josephson junction. Among other things a SQUID makes an ultrasensitive magnetometer. If a magnetically charged body, that is, a monopole, threads its way through the niobium loop, the current flowing in the SQUID circuit will show, in Cabrera's words, "a d.c. shift," that is, a sudden change up or down. That is what was seen—once in 200 days of operation.

Once seems to have been enough to start something of a run on the small company in La Jolla, Calif., that makes SQUIDS. According to Richard A. Carrigan of Fermi National Accelerator Laboratory, "Ours was the fourth order that they had in the last few weeks." Cabrera's experiment continues to look for more instances, and within the next month he hopes to have an apparatus in operation that will have detectors oriented along three different axes, thus covering a larger volume and a larger number of possible monopole trajectories. Besides SQUIDS there are a large variety of other schemes for seeking monopoles on the boards or on paper. Thus, in the person of monopoles at least, particle physics is returned to the domain of the single experimenter working in a



Cabrera: "... no easy way to attribute it to other things."

The detector used by Blas Cabrera in the possible discovery of the magnetic monopole. The superconducting loop is made of niobium that is bathed in liquid helium.



Illustrations: Stanford Univ.

small room. If current theory is correct, the kilometer-sized accelerators and colliding beam rings with their teams of dozens of physicists per experiment have no hope of finding monopoles.

Monopoles were originally brought into physics by the man responsible for thinking up a number of other exotica that have now become commonplace, P. A. M. Dirac of Florida State University in Tallahassee. Dirac was concerned with finding an explanation for the quantization of electric charge. All electric charges are observed to come in integral multiples of a fundamental unit, the amount of charge on an electron. In the theory of 50 years ago there was no explanation for that quantization. Dirac found that if magnetic monopoles could exist, the reciprocal relation between them and electric charges quantized both. Dirac was able to calculate the amount of the magnetic charge quantum. This value, one Dirac unit, is what appears in Cabrera's experiment.

According to theorist Qaisar Shafi of the University of Maryland, Dirac "put monopoles into the theory by hand," using them to explain something that was already there. In contrast, monopoles are a prediction of the modern grand unification theories (GUTS) that come out quite naturally, Shafi says, after a lot of already observed phenomena have been put in by hand. The GUTS are trying to unite three quarters of physics, the domains animated by three kinds of force, electromagnetism, the weak interaction and the strong interaction, into one framework that would exhibit them all as different aspects of a single underlying unified interaction of force. The previous partial unification, called Weinberg-Salam theory, which puts together electromagnetism and the weak interaction, does not have monopoles, even though, as Shafi says, you'd think it ought to, being a theory that contains electromagnetism.

Adding the strong interaction, the force that among other things holds atomic nuclei together, necessitates monopoles. They are represented by a particular solution of the mathematics (a soliton or solitary-wave solution) that gives them some odd properties. They would be very massive. One figure is 10^{16} billion electron-volts. This is somewhat more than 10^{16} the mass of a proton or about the mass of an amoeba or paramecium. GUT monopoles would also have internal structure. Dirac's monopoles are simply bundles of matter-energy concentrated in a geometrical point and emanating a magnetic field. GUT monopoles take up space, and they can contain in themselves all the other particles predicted by the theory: quarks, gluons, etc., etc. This means they relate to everything else in the theory or, in Shafi's words, "they know all the fields of the theory."

Indeed, another theorist, Michael S. Turner of the University of Chicago, points out that if the monopole discovery holds

up, it will be the first direct evidence for any or all of the GUTS. A confirmation would also have great cosmological importance, Turner says. It would show that the universe had at one time in the past been at a temperature of 10^{27} kelvins. (The highest temperature for which there is now evidence is 10^{11} .) Only the big bang at 10^{27} kelvins could have produced this kind of monopole. That is also why they cannot be made in accelerators, colliding beams or cosmic rays; there is just not enough energy in those things.

All is not well theoretically, however. Turner also says: "I think it's a very beautiful experiment, but it's very difficult to reconcile with theory." The theory of the galactic magnetic field that is. Free magnetic monopoles should "short out" a magnetic field the way free electric charges short out an electric field. The magnetic field of our galaxy manifestly is not shorted out. Some years ago Eugene N. Parker, also of the University of Chicago, calculated a limit, usually called the Parker bound, that the flux of monopoles could not exceed as long as the galactic field exists. Lately he and Turner have been recalculating the limit based on new information about monopoles derived by theorists. The new information raises the bound a little, but the flux inferred from the Cabrera experiment is still a thousand times this limit.

Something has to give. One could suppose that monopoles don't fly around the galaxy, that they are trapped in the center of the sun, say, and that a few leak out locally to give the observed flux (an idea attributed to Savaf Dimopoulos of Harvard and Frank Wilczek of the University of California at Santa Barbara). But then, what force pulls monopoles out of the trap? "Something is wrong somewhere," Parker says. "There may be some massive misunderstanding that we have about the situation in space. That would be very exciting if it's true." But then he goes on, "I suspect [the Stanford people's] interpretation is wrong, and we'll wind up with nothing. It's something we're compelled to check out."

And that is starting to happen all over the place. It is very important, says Peter Trower of Virginia Polytechnic Institute, who describes himself as "the godfather" of Cabrera's experiment, to find out more about the other properties of the supposed monopoles. Trower would like to put an ionization detector around Cabrera's apparatus to look for electric charge. Most theories do not permit a particle to have both magnetic and electric charge, but at least one, Julian Schwinger's theory of "dyons," explicitly does. There are many other important questions. When waves are made on this scale in physics, they seem to penetrate everywhere. Physicists are pondering the many ramifications of a discovery of monopoles as they wait for the other shoe to drop.

—D.E. Thomsen

Few mentally ill understand drugs

As few as 8 percent of the patients in a typical state psychiatric hospital are well informed about the psychoactive medication they are receiving, and more than half show absolutely no understanding of the drugs or their intended effects, according to research reported in the *MAY AMERICAN JOURNAL OF PSYCHIATRY*. The findings emerge as the Supreme Court is considering the case of *Mills v. Rogers*, which questions the right of psychiatric inpatients to refuse drug treatment for their disorders.

According to Jeffrey L. Geller, a psychiatrist at Northampton State Hospital in Massachusetts, a survey of the hospital's 281 residents revealed that only 22 knew the drugs they were taking, how often they took them and why. Only 27 patients—or 10.3 percent—knew the therapeutic purpose of the antipsychotic and antidepressant medications. According to Geller, the inpatient population of Northampton is representative of psychiatric patients remaining in the nation's public hospitals following two decades of systematic "deinstitutionalization"; more than 60 percent are schizophrenic, another 17 percent are retarded or demented, and more than half have been hospitalized more than a year. Older patients and long-time inpatients were more likely to lack understanding of their medication, Geller says.

The case of *Mills v. Rogers* stems from a 1975 class action suit in which Rubie Rogers, a patient, sued the Massachusetts commissioner of mental health and Boston State Hospital to stop forced medication. Rogers was concerned about the physical side effects of Haldol, an antipsychotic drug, and the case was based on a patient's constitutional right to privacy (including the right to bodily integrity). Judge Joseph L. Tauro, ruling for Rogers in 1979, concluded that most patients are able to understand the risks and benefits of psychoactive drugs.

Mark Mills, now mental health commissioner in Massachusetts, appealed the case to the Supreme Court, which heard arguments in January. Although the right to privacy is technically at issue in the case, the justices were especially interested in the question of whether or not the typical psychiatric patient is competent to decide about medication. And the decision is apt to turn on that point, according to psychiatrist Paul S. Appelbaum, author of *Clinical Handbook of Psychiatry and the Law*. On that issue, Appelbaum says, Geller's data are unconvincing. The important legal question, he says, is *why* the patients lack understanding of their medication. While these patients, largely chronic schizophrenics, may well be incompetent, the data do not prove it, he says; it may be that they were never told about the drugs