

NEW PRODUCTS

The descriptions of the new products listed in this section are based on information supplied to us by the manufacturers. PHYSICS TODAY can assume no responsibility for their accuracy. To facilitate inquiries about a particular product, a Reader Service Card is attached inside the back cover of the magazine.

LAWRENCE G. RUBIN

FOCUS ON MAGNETISM

Cryogen-Free Superconducting Magnet

Janis is introducing to the US market the Heless line of cryogen-free superconducting magnet systems, produced by Japan Magnet Technology. The 5 tesla system is available in 52, 100, and 300 mm room-temperature bores. Other standard systems include an 8 T, 50 mm room-temperature bore, a 10 T with a 100 mm bore, and a 12 T with a 100 mm bore. Typical cooldown times range from 24 hours for the 5 T, 52 mm bore system, up to 74 hours for the 12 T, 100 mm bore system. Ramp times to full field range from 5 minutes for the 5 T system, up to 100 minutes for the 12 T system. The standard systems offer a magnetic field homogeneity of 0.1% over a 10 mm diameter spherical volume; special systems are available with higher homogeneities, split coils, and persistent mode operation. The magnets are supplied with field-independent thermometry, standard and bipolar magnet power supplies, and vacuum pumping stations. *Janis Research Co, 2 Jewel Drive, P.O. Box 696, Wilmington, Massachusetts 01887*

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Active Shielding for MRI Systems

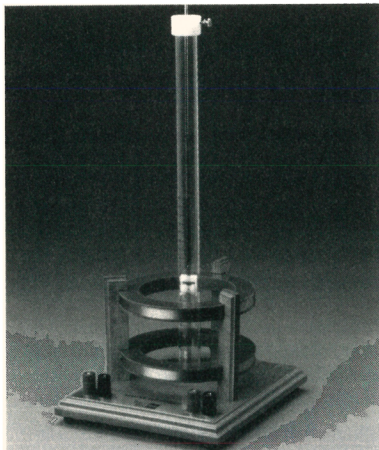
The Enviro-Shield active cancellation system (ACS) from Lindgren is a feedback system for the control of magnetic field fluctuations. We are told it allows magnetic resonance imaging (MRI) systems to be placed in the presence of fluctuating magnetic fields from moving vehicles, trains, elevators, and electrical transformers. Using a set of Helmholtz coils installed in the MRI room and a three-axis sensing magnetometer probe, the Enviro-Shield monitors the external magnetic field environment and drives current through the coils to create an equal but opposite magnetic field. Magnetic fluctuations

up to 120 milligauss can be reduced to less than ± 1 mG at the magnet isocenter. The feedback probe, mounted inside the volume created by the Helmholtz coils, can be positioned in magnetic fields up to 9 G in any axis. The system can be used with existing or new MRI installations. *Lindgren RF Enclosures Inc, 400 High Grove Boulevard, Glendale Heights, Illinois 60139*

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Magnetic Force Instrument for Teaching

The MF1-A from Teachspin is a hands-on classroom instrument designed to let students explore the forces on a permanent magnet dipole caused by an external magnetic field. The apparatus consists of a pair of Helmholtz coils—the source of the magnetic field—and a small magnetized disk mounted so that it can rotate in a gimbal that is suspended from a spring. The deflection of the spring, which



obeys Hooke's law, is used to measure the magnetic force on the disk, an easily calibrated quantity. The coils can be used individually or connected in series with their fields in the same direction to produce a uniform axial field at the midpoint between the coils. When the coils are connected in series opposition, a field gradient (a spatially

AMERICAN MATHEMATICAL SOCIETY

New Titles

Readers of *Physics Today* are entitled to the AMS member price for these titles through December 31, 1999.

Quantum Fields and Strings: A Course for Mathematicians

Pierre Deligne, Pavel Etingof, Daniel S. Freed, Lisa C. Jeffrey, David Kazhdan, John W. Morgan, David R. Morrison, and Edward Witten, Editors

In 1996–97 the Institute for Advanced Study (Princeton, NJ) organized a special year-long program designed to teach mathematicians the basic physical ideas which underlie the mathematical applications.

These volumes are a written record of the program. They contain notes from several long and many short courses covering various aspects of quantum field theory and perturbative string theory. The courses were given by leading physicists and the notes were written either by the speakers or by mathematicians who participated in the program. The book also includes problems and solutions worked out by the editors and other leading participants. Interspersed are mathematical texts with background material and commentary on some topics covered in the lectures.

Volume 1: 1999; 752 pages. *Hardcover:* ISBN 0-8218-1987-9; List \$40; All AMS members \$32; Order code QFT/1PT99; *Softcover:* ISBN 0-8218-2012-5; List \$25; All AMS members \$20; Order code QFT/1.SPT99

Volume 2: 1999; 800 pages. *Hardcover:* ISBN 0-8218-1988-7; List \$40; All AMS members \$32; Order code QFT/2PT99; *Softcover:* ISBN 0-8218-2013-3; List \$25; All AMS members \$20; Order code QFT/2.SPT99

Set: 1999; 1552 pages. *Hardcover:* ISBN 0-8218-1198-3; List \$75; All AMS members \$60; Order code QFT/1/2PT99; *Softcover:* ISBN 0-8218-2014-1; List \$40; All AMS members \$32; Order code QFT/1/2.SPT99

Five Lectures on Supersymmetry

Daniel S. Freed

Since physicists introduced supersymmetry in the mid 1970s, there have been great advances in the understanding of supersymmetric quantum field theories and string theories. These advances have had important mathematical consequences as well. The lectures featured in this book treat fundamental concepts necessary for understanding the physics behind these mathematical applications.

1999; 119 pages; *Softcover:* ISBN 0-8218-1953-4; List \$24; All AMS members \$19; Order code FLSP299



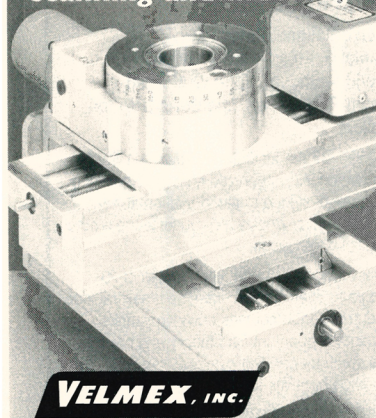
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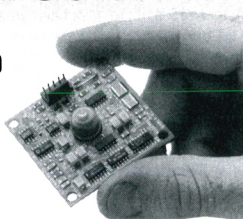
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varying field) is produced in the same region. The MF1-A is said to be appropriate for both high school and college students and may help to clear up some of their most pervasive misconceptions regarding electricity and magnetism. Teachspin Inc, 45 Penhurst Park, Buffalo, New York 14222-1013

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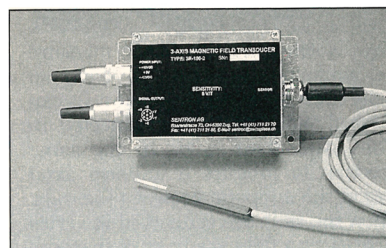
Shielding for NMR Magnets

Amuneal has announced standard and custom magnetic shields for nuclear magnetic resonance (NMR) and magnetic resonance imaging (MRI) installations. The use of low-cost material and efficient installation techniques permits shielding of vertical and horizontal stray fields in adjacent spaces. Based on the magnet's location, the company can design and install a shield configuration to meet both symmetry and total ferromagnetic mass proximity limitations, while reducing the stray fields. Amuneal's specially processed steel with ultralow carbon content has been used in hospitals, universities, and industrial research sites to lower stray fields adjacent to or above the magnet's isocenter. The shielding permits compliance with DC static field exposure standards for cardiac pacemakers and other biostimulation devices (5 gauss), as well as threshold sensitivity levels (1 G) for cathode ray-based computer monitors. Amuneal Manufacturing Corp, 4737 Darrah Street, Philadelphia, Pennsylvania 19124

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Three-Axis Magnetic Field Transducer

A three-axis series of low-power, high linearity, high stability, magnetic field-to-analog voltage transducers has been released by Sentron AG of Switzerland and is being distributed in the US by GMW Associates. The transducers are based on a unique Hall effect sensor that measures all three components of a magnetic field at a single point. The sensors have better than 0.1° alignment accuracy and a very small active volume (less than $0.25 \times 0.25 \times 0.2$ mm). Some



versions are capable of magnetic field-to-voltage conversion of better than 0.1% accuracy and less than 0.03% per °C temperature coefficient. All of the transducers have a DC-to-10 kHz (–3 db) frequency response with a full-scale differential output of ± 10 V for each field component. Applications include mapping of magnetic fields for magnet quality control or field shimming, remote position location and orientation in an external field, and mapping of magnetic fields to calculate current distributions in complex systems. GMW Associates, P.O. Box 2578, Redwood City, California 94064

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750 MHz Wide-Bore NMR Superconducting Magnet

Bruker's UltraStabilized magnet technology for very-high-field nuclear magnetic resonance (NMR) systems allows operation at reduced temperature and ambient pressure. The superconducting coils are subcooled in liquid helium at ~ 2 K by a Joule-Thomson (J-T) cooling unit, without pumping on the helium bath. Only the J-T unit operates at reduced pressure while the entire helium bath remains at ambient pressure. The new technology was initially developed for 750 MHz standard bore magnets and later applied to 800 MHz magnets. It has now been expanded to a 750 MHz, 89 mm bore magnet that operates at 17.6 tesla with a field stability of less than 10 Hz/hr. The system can be used with solids, for microimaging, and for high resolution spectroscopy. Bruker Instruments Inc, 19 Fortune Drive, Manning Park, Billerica, Massachusetts 01821

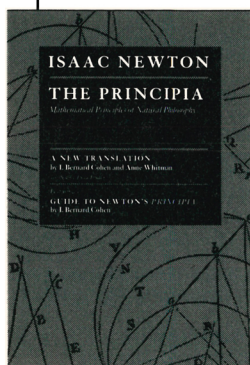
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GMR Magnetic Sensors

Nonvolatile Electronics (NVE) has incorporated its giant magnetoresistance (GMR) technology into magnetic field sensors, magnetic field gradient sensors, and digital field sensors. A miniature digital sensor consists of an eight-pin, surface-mounted package measuring $3.0 \times 4.9 \times 1.0$ mm. It allows magnetic sensing in situations not previously possible, we are told. The part is available with the sensing axis parallel to either the 3 or 4.9 mm dimension with switching points of 20, 40, and 80 oersteds.

The NVE sensors can be used to sense ferrous metals, gear wheel speed and position, electrical current, fluid flow,

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Earth's magnetic field, and American and foreign currency. *Nonvolatile Electronics Inc., 11409 Valley View Road, Eden Prairie, Minnesota 55344-3617*

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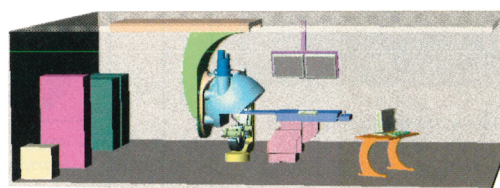
**Shielded
Superconducting
Magnets**

Cryomagnetics has introduced a new line of actively shielded superconducting magnets for ion cyclotron resonance (ICR) and nuclear magnetic resonance applications. The systems, currently available in 4.7 and 7.0 tesla versions, are said to require far less laboratory space than unshielded units. A typical shielded 4.7 T system requires less than 2 m² of dedicated floor space, almost ten times less than for an unshielded system. A very low loss "desktop" shielded 4.7 tesla ICR system, said to be exceptionally quiet and virtually free of vibration, is equipped with a small cryogen buffer volume for backup in case of a power failure; it is based upon a 4 K pulse-tube refrigerator. *Cryomagnetics Inc., 1006 Alvin Weinberg Drive, Oak Ridge, Tennessee 37830*

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**Magnetic Surgery
System**

A new system from Stereotaxis allows surgeons to guide instruments magnetically through the brain, and potentially through other sensitive parts of the body, without resort to conventional surgery and stereotactic frames. The system is currently being investigated



as a less invasive way to biopsy brain tumors and carry out interventional neuroradiology and cardiovascular procedures.

A magnetic tip attached to a fine flexible wire or catheter is guided by rapid adjustments to the magnetic fields of three superconducting magnets placed around the patient's head. A real-time x-ray image, showing two planes of the head, provides the surgeon with direct visual control of the tip. Position is determined to within 1 mm, and the wire can be guided in

a curved path to avoid vulnerable areas. Once in position, the magnetic tip is withdrawn, and a flexible biopsy tool can be inserted. A specially engineered three-coil 5 tesla, 40 cm bore magnet system is being supplied by Oxford Instruments. *Stereotaxis Inc., 4041 Forest Park Avenue, St. Louis, Missouri 63108*

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**Triaxial Fluxgate
Magnetometers**

Walker Scientific has revised its line of FGM single axis fluxgate magnetometers and added a triaxial model capable of measuring the three vectors of a magnetic field simultaneously. The instrument can display on a 3 1/2, 4 1/2, or 5 1/2 digit readout the individual vectors or the resultant vector and its direction within field ranges of ± 20 , ± 200 , and ± 2000 milligauss. All models feature an accuracy of $\pm 0.5\%$ ± 1 count, traceable to NIST, ± 0.01 mG resolution, and a linearity of $\pm 0.02\%$.

The FGM series is battery-powered, has a DC-to-100 or -400 Hz frequency response, a noise level of $<5 \mu\text{G}$, and a buffered ± 2 V analog output. *Walker Scientific Inc., Rockdale Street, Worcester, Massachusetts 01606*

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**Flat Brushless Linear
Motors**

Aerotech has announced the BLMFI and BLMFS series of flat linear motors, featuring a low profile of 35 mm and lengths from 81 to 386 mm. Continuous stall force ratings from 25.6 to 190 newtons (5.7 to 43 pounds) are available. The flat motors are said to be less expensive than U-channel linear motors. The BLMFI series has no magnetic attraction, making it suitable for scanning and other smooth velocity applications. The BLMFS series has steel laminations for additional

force within the same physical envelope. Compared to motors from other manufacturers, the Aerotech motors are said to offer up to 30% more continuous force for the same length. Travel lengths are unlimited due to the company's stackable magnet track system, which features a symmetrical mounting hole pattern. A complementary line of amplifiers and motion controllers is available. *Aerotech Inc., 101 Zeta Drive, Pittsburgh, Pennsylvania 15238-2897*

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