results of physics, who do not belong to the "invisible colleges" and do not have informative colleagues and graduate students nor familiarity with the primary literature. If SPIN, and all other products can be useful in this way, they will in turn directly aid the financial health of the physics community.

S. SCHIMINOVICH
A. W. K. METZNER
Publications Division
American Institute of Physics

Ultrahigh fields

Your news story on ultrahigh field magnets, "Hybrid Magnets Promise High Field for Low Power" (October, page 20), does not, in our opinion, fully reflect today's state-of-the-art and, as such, is possibly misleading to your readers.

As a manufacturer of superconducting Nb_3Sn material as well as superconducting magnets and magnet systems, our corporation is very involved in the technology of ultrahigh magnetic fields. For several years, the limit to the magnetic field strength of superconducting magnets has been 150 kG. Finally, in the summer of this year, a significant breakthrough occurred whereby the 150-kG barrier was decisively penetrated, and a Nb_3Sn magnet of 165 kG was successfully demonstrated by Intermagnetics (see October, page 34). Although this magnet has a bore of only 25.7 mm, the nature of the advance is such that the new design and material that enabled this breakthrough can almost certainly be extended to much higher fields (using V_3Ga superconductor) and to magnets with a much larger bore.

With regard to your news report, we take no exception to your discussion that it is less expensive to produce steady fields of 200–300 kG by placing a small-bore, water-cooled magnet within a large-bore superconducting magnet rather than with a single water-cooled magnet only, since the field produced by the superconducting magnet consumes no input power and the field produced by the two magnets, is, of course, additive. Thus with the hybrid approach, fields in the range of 200–300 kG can be accomplished at a power level of only about 5–10 megawatts, rather than the 20–30 megawatts that would be required if a water-cooled magnet only were used. In economic terms the hybrid approach translates into a savings of at least \$1 000 000–\$3 000 000 in initial capital expenditure, and hundreds of dollars per hour in operating costs.

When you discuss the question of superconducting magnets themselves, however, your remarks seem to miss the point. In mentioning the achievement of a 165-kG field at IGC, you fail to take note that such a magnet facility has both an initial capital cost and an operating cost of less than 10% of a comparable water-cooled magnet; a complete 165-kG superconducting magnet facility costs about \$100 000 while a comparable conventional facility is priced in excess of \$1 500 000. Another important point is that this breakthrough, coupled with new superconductive materials now available, should shortly enable fields much higher than 165 kG to be achieved with superconductors only, and that such a superconducting magnet will reflect even larger dollar savings when compared either to a comparable hybrid magnet or a conventional water-cooled magnet.

Finally, you make a remark most confusing to your readers when you state that "a 165-kG superconducting magnet with a 40-cm bore would be very costly." This comment is not relevant to *any* of the issues presented, since a 165-kG magnet with a bore as large as 40 cm is not required even if a composite field as high as 300 kG is sought in a small bore, water-cooled insert magnet. Furthermore, while a 165-kG superconducting magnet with a 40-cm bore would indeed be very costly, your readers should know that such a magnet would still cost only a small fraction of a comparable water-cooled magnet facility and would operate at zero input power rather than at the several tens of megawatts required by such a water-cooled magnet.

Finally allow me to correct a small error made in your reference to the IGC magnet—its bore is 25.7 mm, not 20 mm as you state.

PAUL S. SWARTZ
Intermagnetics General Corporation
Guilderland, New York

Reply to Soviet requests

I recently received a request from E. M. Nadgornyi of the Institute for Solid State Physics of the Academy of Sciences of the USSR in Moscow for a reprint of one of my papers as well as for exact details of special search techniques for digital computer simulation.

I hesitated to send the information requested because of the recent increased repression of Soviet advocates of civil rights and of Soviet scientists who have applied for permission to emigrate to Israel and decided to adopt a different approach in sending the requested information in this instance.

I informed Nadgornyi that while I personally favor cooperation, collaboration and dissemination of information between scientists of all countries, I cannot condone the official attitudes of

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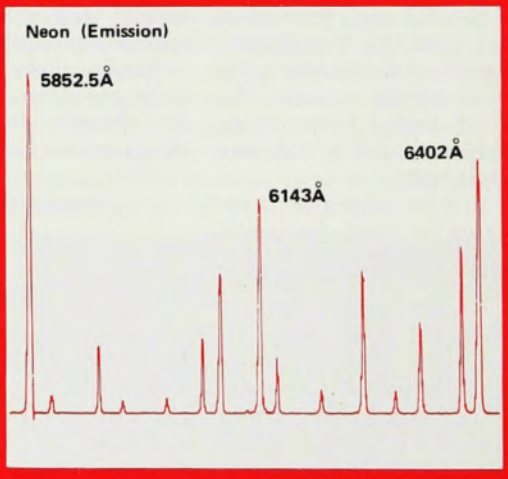

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the Soviet government in respect to such noted scientists as Aleksander Lerner, Benjamin Levich, and Andrei Sakharov. I am, therefore, sending all of the information requested by Nadgornyi regarding special computer-simulation techniques to Aleksander Lerner, a noted cyberneticist and computer scientist. I informed Nadgornyi that he could obtain these documents by contacting Lerner, a fellow Muscovite.

I feel that this may be an important method by which scientists and engineers in the western world can make it clear to their counterparts in the USSR that repression of Soviet Jewish scientists and, indeed, of many Soviet civil-rights activists such as Sakharov and Solzhenitsyn is counter to any East–West detente, be it political, cultural, or scientific. I urge others to follow my example in this matter of transmitting reprints and other information to the USSR.

MARC HERBERT RICHMAN
Brown University
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Solar sea power impact

I wish to comment on the Environmental Impact section in the article "Solar Sea Power" by Clarence Zener (January, page 48).

Zener mentions increased convection currents dissipating heat outside the tropics. Consideration must be given to changes in vertical water velocity in the site area due to the thickening of the 7 deg C layer of water and seasonal fluctuations of the temperature profile. The 5 deg C water, which usually has a higher dissolved oxygen content than 7 deg C water,[1] is raised approximately 400 meters before being released at the 7 deg C level (see figure 2 of Zener's article). James Rust (letter, September, page 9) quotes a flow rate of 5.6×10^{10} pounds per hour, which is roughly 2.4×10^5 cubic feet per second for sea water. Assuming a 100-square-mile area of impact and total vertical compensation, the resultant downward velocity is 0.86×10^{-4} feet per second (2.62×10^{-3} centimeters per second). H. Stommel and A. B. Arons[2] quote 4×10^{-5} centimeters per second as the maximum upward velocity at 1000 meters. To just balance this velocity would require an impact area of 6550 square miles; thus the area of influence of the sea power plant will not be small. Location of many of the sea-power sites will be near the continental shelves as a matter of economics, and the impact area may extend into the biologically productive shelf waters.

My assumptions are conservative, but they suggest that the environment impact of the redistribution of dissolved oxygen, nutrients, isotherms and corrosion products needs thorough investigation because oceanic fauna are much more sensitive than are estuarine fauna. The total number of environmentally suitable sites may not allow sea power to generate the total energy needed in the year 2000 as discussed by Zener, but sea power certainly can contribute a significant portion.

References

1. L. R. A. Cappurro, J. L. Reid. "Contributions on the Physical Oceanography of the Gulf of Mexico," chapter 1 in *Winter Circulation Patterns and Property Distributions*, Worth D. Nowlin, Jr, Gulf Publishing Co, Houston (1972).
2. H. Stommel, A. B. Arons, "On the abyssal circulation of the world ocean, II. An idealized model of the circulation pattern and amplitude in oceanic basins," Deep-Sea Research, 8, 2 (1960).

DAVID F. PASKAUSKY
University of Connecticut
Groton, Conn.

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I found Clarence Zener's article "Solar Sea Power" and the letters it generated very interesting. But, I question Zener's comment (June, page 13) that "Because of ecological reasons, the cold efflux of the condenser should not mix with the warm layers above the thermocline."

Most tropical oceans are relatively barren because phytoplankton, the base of the food pyramid, needs both nutrients and sunlight. The warm surface waters have light but few nutrients. The cold deep waters have the nutrients but not the light. In those few places where nature has arranged an "upwelling" and mixing of the layers, fish thrive. Off the west coast of Peru, we have an example of this. There, a tiny fraction of the sea provides over 20% of all the fish caught on earth.

Would it be feasible to build Zener-type power plants that would deliberately create upwellings in tropical seas, then make use of both the electric power (as hydrogen) and the increased fish (as a food source)?

Reference

1. C. P. Idyll, "The Anchovy Crisis," Scientific American, June 1973.

JAMES E. BLAIR
Milton College
Milton, Wisconsin

THE AUTHOR RESPONDS: David Paskausky has raised the very important consideration of the redistribution of oxygen content of the oceans by a widespread use of solar sea power. If solar sea power does indeed become economically competitive with nuclear and

continued on page 115