ing in the loss of key staff, as well as overall cost escalations. The current schedule for SNS calls for the design phase to be completed during FY 2001; hard construction from FYs 2002–2004, including installation of the technical systems; testing in FY 2005; and operations starting in FY 2006.

At one point in the deliberations, House Science Committee Chair James Sensenbrenner (R-Wis.) pushed to prohibit SNS construction entirely. However, with further negotiations, committee members voted to provide $118-million-including $100-million for construction and $18-million for operations and research and development.

Although Sensenbrenner was persuaded by colleagues—in particular, committee members Jerry Costello (D-Ill.) and Bart Gordon (D-Tenn.)—to approve partial funding for the project, congressional staffers said the chair remains dissatisfied with the information DOE has provided about SNS so far. Sensenbrenner has promised no further opposition to the project once his requirements have been met, but as of early summer his dissatisfaction remains, and he has been pressing DOE for more precise estimates of the project's costs and construction schedule.

Sensenbrenner said, "I think it's just flat out irresponsible for us to authorize construction of this project without better projections from DOE."

His view has been echoed by Science Committee vice chair Vernon Ehlers (R-Mich.), "I support SNS. But it should not be started until we clear up the lingering questions."

On the Senate side, as of early summer, an energy and water development appropriations subcommittee has voted a total of $187-million for the SNS in FY 2000, including $169-million construction and $18-million operations and R&D—or $27-million less than requested. That figure is considered the minimum workable funding level for FY 2000, according to DOE officials. "We can get most of the work done at that level," one official said, adding, "Of course, anytime you receive an appropriation that's less than you requested, it's bound to have an effect."

A DOE internal review committee had been scheduled to meet at Oak Ridge last month in order to compile new detailed cost and schedule base lines for SNS. DOE officials said that the SNS review is a routine procedure: Semi-annual progress reports are compiled on every major project at the national research laboratories. The previous internal management evaluation, conducted by DOE last January and February, resulted in a major staff reorganization and the appointment of David Moncton as SNS Project Director at Oak Ridge. Moncton supervised the construction of the Advanced Photon Source at the Argonne National Laboratory.

Overall, SNS faces the same funding problem as do all federal scientific research programs: Congress is looking at spending about $1 billion less on such efforts next year than in FY 1999.

PHIL BERARDELLI

For commentary on the Spallation Neutron Source (SNS), see:
"Spallation Neutron Source to Provide Facilities to Conduct World-Class Science," by Thomas Weber (NSF) in the Public Affairs Forum in *MRS Bulletin*, February 1999, page 11 or on website www.mrs.org/pa/editorials/.

NRC Recommends Continuation of U.S./Russian Joint Program to Contain Russian Nuclear Material

In response to heightened concern that plutonium and uranium could be stolen or diverted from facilities in Russia to create nuclear weapons, a committee of the National Research Council (NRC) recommends that the U.S. government continue supporting a cooperative program dedicated to improving the security of Russian nuclear materials for at least a decade. The committee published a report saying that Russian nuclear materials that could be used in weapons are more extensively dispersed and inadequacies in security systems are more widespread than previously estimated.

Since a 1997 Research Council review of the joint program between the United States and Russia, the U.S. government has identified more facilities in Russia where nuclear materials are stored, and has determined that more extensive security upgrades are needed. Moreover, some Russian institutions do not have the funds to pay salaries or to ensure that security systems are installed and operated as intended. The recent decline in the Russian economy has resulted in financial hardship for many Russian government officials, nuclear specialists, and workers who have access to such material, the committee said, providing added incentive for materials to be stolen and sold illegally.

Building upon the 1997 Research Council report, the committee identified several priorities that the program should address, including the following: (1) consolidating material into a fewer number of buildings; (2) increasing Russia's capacity to manage and support nuclear security; (3) protecting large quantities of spent fuel once used for maritime purposes, research, and in breeder reactors; (4) negotiating to remove political, legal, and administrative barriers that impede progress in the program; and (5) improving the management of U.S. personnel and financial resources.

Copies of *Protecting Nuclear Weapons Material in Russia* can be obtained from the National Academy Press, 2101 Constitution Ave., NW, Washington, DC 20055; 202-334-3313 or 1-800-624-6242. □

CMMP Committee Supports Strategies to Advance Interdisciplinary Research

The following article is taken from a report published in the December 1998 issue of BPA News, *a publication of the National Research Council's Board on Physics and Astronomy.*

I chaired the Committee on Condensed-Matter and Materials Physics (CCMMP), which was commissioned by the National Research Council's Board on Physics and Astronomy to prepare a volume on this field as part of the decadal physics survey, *Physics in a New Era*. Our Committee* recently completed its report, and this article is based on its executive summary.

Condensed matter and materials physics (CMMP) plays a central role in many of the scientific and technological advances that have changed our lives so dramatically in the last 50 years. CMMP gave birth to the transistor, the integrated circuit, the laser, and low-loss optical fibers so important to the modern computer and communication

*The other members of the Committee included James B. Roberto (Oak Ridge National Laboratory), Gabriel Aeppli (NEC Research Institute), Arthur Bienenstock (who left the Committee to take up the position of Associate Director for Science at the Office of Science and industries. The years ahead promise equally dramatic advances, making this an era of great scientific excitement for research in the field. Communicating this excitement and ensuring further progress are the main goals of the CMMP report.

Over the decade since the last major assessment of the field, important results and discoveries have come rapidly and often in unexpected ways. These advances range from development of new experimental tools for atomic-scale manipulation and visualization, to creation of new synthetic materials (such as buckyballs and high-temperature superconductors), to discovery of new physical phenomena such as giant magnetoresistance and the fractional quantum Hall effect.

An enormous increase in computing power has yielded qualitative changes in visualization and simulation of complex phenomena in large-scale many-atom systems. Progress in synthesis, visualization, manipulation, and computation will continue to impact many areas of research spanning different length scales from atomic to macroscopic. Strong impact may also be expected in "soft" condensed-matter physics, particularly at the interfaces with biology and chemistry.

The priorities of society are shifting from military security to economic well-being and health. Changing societal priorities, in turn, create shifting demands on CMMP. Among these growing demands are improving public understanding of science, better education of scientists and engineers for today's employment marketplace, and making new contributions to the nation's industrial competitiveness.

The key challenges facing condensed-matter and materials physics are

- nurturing the intellectual vitality of the field—particularly the facilitation of the research of individual investigators and small teams in areas that cross disciplinary boundaries;
- providing the facilities infrastructure for research—for example, creation of laboratory-scale microcharacterization facilities at universities and large-scale facilities at national laboratories;
- enhancing efforts in research universities to improve integration of CMMP education and research, particularly at the boundaries of disciplines, and to prepare flexible and adaptable physicists for the future and;
- developing new modes of cooperation among universities, colleges, government laboratories and industry to ensure the connectivity of the field with needs of society and to preserve the fertile innovative climate of major industrial laboratories which have played a dominant role in CMMP research.

The different modes of research—benchtop experiments, larger collaborations, and so on—are evolving steadily. The work that is carried on in these varied venues is complex and diverse, and the Committee paid special attention to describing the forefronts of research in terms of a small number of research themes. These themes, listed in the box, are discussed in some detail in the Overview and reappear in each of the chapters of the report.

A number of actions are required to maintain and enhance the productivity of the field of condensed-matter and materials physics. These actions involve each level of the hierarchy of research modalities and the interactions among the various levels and the various performers. The principal recommendations of the Committee are summarized as follows:

- The National Science Foundation (NSF), the Department of Energy (DOE), and other agencies that support research should continue to nurture the core research that is at the heart of condensed-matter and materials physics. The research themes described in the overview provide a guide to the forefronts of this work.
- The agencies that support and direct research in CMMP should plan for increased investment in modernization of the CMMP research infrastructure at universities and government laboratories.
- The NSF should increase its investment in state-of-the-art instrumentation and fabrication capabilities, including centers for instrumentation research and development, nanofabrication, and materials synthesis and processing at universities. The DOE should strengthen its support for such programs at national laboratories and universities.
- The gap in neutron sources in the United States should be addressed in the short term by upgrading existing neutron scattering facilities and in the longer term by moving forward with the construction of the Spallation Neutron Source.
- Support for operations and upgrades at synchrotron facilities, including research and development on fourth-generation light sources, should be strengthened.
- The broad utilization of synchrotron and neutron facilities across scientific disciplines and sectors should be considered when establishing agency budgets.
- Federal agencies should provide incentives for formation of partnerships among universities and government and industry research laboratories that carry out research in condensed-matter and materials physics.
- Universities should endeavor to enhance their students' understanding of the role of knowledge integration and transfer as well as knowledge creation. In this area, experience is the best teacher.

Action on these issues will allow us to capture the opportunities for intellectual progress and technological impact that continue to emerge in condensed-matter and materials physics.

VENKY NARAYANAMURTI

Venky Narayanamurti is the Gordon McKay Professor and Dean of the Division of Engineering and Applied Sciences at Harvard University. He served as chair of the Committee on Condensed-Matter and Materials Physics (CCMMP), which was commissioned in the Spring of 1996 by the National Research Council's Board on Physics and Astronomy.

Research Themes in Condensed-Matter and Materials Physics

- The quantum mechanics of large, interacting systems.
- The structure and properties of materials at reduced dimensionality.
- Materials with increasing levels of compositional, structural, and functional complexity.
- Nonequilibrium processes and the relationship between molecular and mesoscopic properties.
- Soft condensed matter and the physics of large molecules, including biological structures.
- Controlling electrons and photons in solids on the atomic scale.
- Understanding magnetism and superconductivity.
- Properties of materials under extreme conditions.
- Materials synthesis, processing, and nanofabrication.
- Moving from empiricism toward predictability in the simulation of material properties and processes.

Technology Policy), J. Murray Gibson (University of Illinois—Urbana-Champaign), Steven Girvin (Indiana University), Mark Ketchen (IBM T.J. Watson Research Center), Edward Kramer (University of California—Santa Barbara), James S. Langer (University of California—Santa Barbara), Cherry A. Murray (Lucent Technologies), V. Adrian Parsegian (National Institutes of Health), Paul S. Peercy (SEMI/SEMATECH), Julia M. Phillips (Sandia National Laboratories), Robert C. Richardson (Cornell University), Frans Spaepen (Harvard University), and Katepalli R. Sreenivasan (Yale University).

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