APS COUNCIL ENDORSES STRATEGIC PLANNING COMMITTEE FOR PHYSICS

At a meeting on 30 October, The American Physical Society's council decided in principle to establish a new committee to do strategic planning on an ongoing basis for the physics community. The council acted on a recommendation from a study group on strategic planning that was set up at the behest of the APS Panel on Public Affairs following a council meeting last April. The study group was headed by William F. Brinkman of AT&T Bell Labs (Murray Hill, New Jersey) and Andrew Sessler of Lawrence Berkeley Laboratory, and it included 12 other distinguished physicists (see page 89).

The idea of involving APS in strategic planning for physics has gathered momentum during the last year because of lower-than-expected government outlays for science and because projected outlays at current levels would not cover more than half the combined cost of projects desired for the next 5–10 years for all physics subfields. The situation has prompted some physicists to speak out in public against certain large projects such as the SSC in a manner other physicists have considered damaging to the field as a whole. A planning committee, it is felt, could serve as a lightning rod for complaints and help physicists come to stronger understandings with one another before going public with their wishes.

But even as the idea of doing strategic planning has gained ground, the concept of having APS do it has been extremely controversial. Skeptics express reservations about the very possibility of getting physicists from all the various subfields to agree on a common agenda, and they fear that establishment of a planning committee will exacerbate conflicts rather than ameliorate them.

Under the circumstances it may seem surprising that the APS council endorsed the idea of forming a planning committee almost without dissent. "The council applauded the whole scheme and, to a first approximation, was very much in favor of it," says Val Fitch, president of APS in 1987–88. According to James Krumhansl, the society's president for 1989, "The sense was that APS has everything to gain in trying this."

The council's positive attitude can be attributed partly to the persuasive case the study group made for a planning committee, and partly to the way two especially controversial issues were handled—the question of how a truly representative committee could be constituted, and the question of whether it would be the committee's job, ultimately, to forge a consensus among physics subfields on a single priorities list.

On the first point, while the council accepted the APS study group's proposed charge for the strategic planning committee, it deferred action on how the committee should be composed. The council is soliciting comments on the study group's report and will take up the question of how the group's recommendations should be implemented at its next meeting, on 14 January 1989 (see the box below). "The debate will start in earnest when everything is more concrete," says Fitch.

On the question of priorities, the study group itself recommended against making the planning committee's first or principal mission the ranking of projects in a single list. "While we expect the strategic planning committee to produce a 'coherent package' or plan," the study group says in its report to the council, "it is *not* our expectation that it will order the various physics activities in a one-dimensional priority list."

Instead, the report says, the committee "should articulate the overall goals of physics and how the various programs are designed to attain these goals. This process may require vigorous discussions, internal to the physics community, which may well provide a constructive forum where a subdiscipline can present new ideas and projects."

In the view of study group members and sympathetic observers such as Krumhansl, the value of planning is as much or more in the process as in the documents that come out of it. Hence the motto the study group chose for the cover of the report: "Plans are useless, but planning is essential"—a statement by President Dwight D. Eisenhower.

Proposed mission

The charge for the planning committee, as adopted in a council motion on 30 October, is the following: "To serve as a forum for consideration of the opportunities, plans and problems of the subfields of physics; to formulate an overall strategic plan for the development of physics in support of short-term and long-term goals of the nation; and to present this plan, on an annual basis, to the council and the president of APS for approval."

How is this mission to be fulfilled? In section V(a) of the study group's report, which the council neither accepted nor rejected, the group recommended that it should be the strategic planning committee's job to coordinate plans among what it calls "the six primary subfields of physics." Derived from the eight-volume Brinkman survey of physics, "Physics Through the 1990s," which was released in 1986, they are atomic, molecular and optical physics; astrophysics; condensed matter physics; ele-

Comment Period

The complete report to the APS council of the study group on strategic planning of physics research will be published in the January 1989 issue of the APS *Bulletin*, and the council will consider implementation of the report at its meeting on 14 January. Comments should be addressed to the Panel on Public Affairs, The American Physical Society, 335 East 45 Street, New York NY 10017.

mentary-particle physics; nuclear physics; and physics of plasmas and fluids (see special issue of PHYSICS TODAY, April 1986).

The study group suggested that the strategic planning committee should consist of a chair plus 13 members, six from each of the six major subfields and six nominated by the APS executive committee and approved by the council; the APS president-elect would serve *ex officio*. The six members representing subfields would be appointed by the APS president upon recommendation of the committee's chairperson.

The APS council has asked Daniel Kleppner of MIT to form a small group to review plans for constituting the strategic planning committee, including estimates of the money needed to provide such a committee with staff support. Kleppner regards it as his group's mission to provide commentary on and elaboration of the study group's guidelines for constituting, operating and staffing the planning committee.

Kleppner takes a favorable view of the study group's work and says he would have been quite unhappy if the committee had recommended tapping the existing advisory committees for members of the strategic planning committee. This, he notes, would have "really tied down this committee to existing committees that look after the welfare of certain branches of physics." Kleppner believes that much will depend on the skill of the chairperson and the chairperson's ability to put together a group of physicists who are widely enough respected and whose interests are broad enough to win the confidence of the community.

Study background

The immediate impetus for establishment of an APS strategic planning committee came from the APS Panel on Public Affairs. Sessler, the current chairman of POPA; Brinkman, next year's chairman; and POPA members Pierre Hohenberg of AT&T Bell Labs (Murray Hill) and Eugen Merzbacher of the University of North Carolina all served on the strategic planning study group.

At least two key considerations motivating POPA were connected with the Brinkman committee's physics survey and its impact (or lack thereof). One was a sense that if physicists are to have a real influence on the formulation of science policy, planning "has to be continuous and not just once every ten years," as Brinkman puts it. In Sessler's words: "We can't just throw a Brinkman report over the transom every ten years."

The other consideration connected with Brinkman's Physics Survey Committee had to do with funding trends and the "wish list" the committee assembled from the various subfields. The committee did not set any priorities, and if one added everything on the list up, naively assuming that everybody would get everything, then a doubling of current government expenditures on physics would be required to cover all the projects desired. In light of that, it seemed sensible to proponents of strategic planning for the physics community to unite and fight for higher budgets—but also to start hammering out priorities, recognizing that the community might have to settle for less than optimal funding.

In a four-day meeting the study group held in Washington on 26–29 September, a majority of the participants came in with misgivings about the whole idea of strategic planning and especially about reaching agreement on priorities. Neal Lane, provost of Rice University and one of the most skeptical of the skeptics, argued, first, that Congress certainly would not be willing to relinquish to the science community its ultimate authority to set science priorities, and second, that an effort to get physics subfields to agree on priorities could only result in aggravating disagreements among the subfields.

In the end, the skeptics were won over and consensus was reached only by "banning the P-word," as Eugen Merzbacher puts it. (Merzbacher is APS president-elect for 1989 and, independently of the planning effort, is heading up an APS committee on governance reform.)

Rather than making it the strategic planning committee's main job to establish a single priorities list, the study group gave the committee the more modest but still very challenging assignment "to convince the public and its representatives that a major increase in science activity over the next decade is affordable and could have unimaginable returns" and to improve understanding among physicists of the physics community's situation as it evolves. "Within the community of physicists, there would be a broadening of the understanding of the goals and objectives of the subfields of physics. . . . An important role for the [committee would be] to track the actual funding of physics in the different subfields and to compare this record with the plans of the previous years so that the community can better understand the state of physics."

While the committee ultimately may or may not set priorities *per se*, it certainly at least could provide broad hints about the needs of the whole physics community, as the APS council has done on occasion in recent years. Sessler points out, for example, that the council has explicitly advocated a doubling of the NSF budget but has not taken a position on the SSC.

During its meeting in Washington, the study group was impressed by statements it heard from a large number of physics policy experts, many of whom favored a greater effort on the part of the physics community to do strategic planning. These included John Gibbons, the director of the Office of Technology Assessment; Robert Roe, the chairman of the House Committee on Science, Space and Technology; Lewis Branscomb, former chief scientist at IBM and former chairman of the National Science Board; NSF Director Erich Bloch; National Academy President Frank Press; and a number of other distinguished science policy experts.

Study Group Members

William F. Brinkman, *cochair*
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Andrew Sessler, *cochair*
Lawrence Berkeley Laboratory
Martin Blume
Brookhaven National Laboratory
Herman Feshbach
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University of North Carolina, Chapel Hill
George E. Pake
Xerox Corporation
Robert C. Richardson
Cornell University
Harvey D. Tananbaum
Harvard–Smithsonian Center for Astrophysics

The committee also was impressed, in its review of how the physics subfields currently formulate priorities and advise the government on policy, that some subfields are much more effectively represented than others. The sense of the study group was that a strategic planning committee could help make the advisory mechanisms for all the various subfields more equally effective.

Expectations

Hohenberg hopes that a strategic planning committee will provide "an arena" in which the physics community can work out its differences. "In a civilized society," Hohenberg says, "fights are resolved in a ring, not in a back alley." Sessler believes such a committee is sorely needed because right now "nobody is speaking for the unanimity of physics—physics is becoming fractionated."

Fitch thinks that if the committee ends up having some clout, it will have a big impact on APS itself. But that depends—and here everybody is in complete agreement—on finding a chairperson who can gain the respect and confidence of the whole physics community.

"I think you need a physicist with the sensitivity, perceptiveness and wisdom of King Solomon to chair the committee," says William W. Havens Jr, executive secretary of APS. "When the physics community was smaller and more well defined, Presidential advisers such as I. I. Rabi and James Killian had the breadth of knowledge and the respect of the scientific community which allowed them to play the role needed. In these more complex times, I wonder if there is one person who can meet all the necessary requirements."

"Nevertheless," says Sessler, "it's exciting that APS has accepted the principle of setting up a strategic planning committee. The details have to be worked out, but clearly the efficacy of the committee will depend very much on its chairman, and there are only a very few people who have the qualities and stature to play such a role. It's important that a person be identified who is willing to accept the responsibility. With the community supporting the strategic planning committee, I believe that we can look forward to a new age in physics."

—WILLIAM SWEET

AIP CORPORATE ASSOCIATES MEET AT IBM; DYSON AND RIORDAN ARE HONORED

This year the American Institute of Physics held its annual meeting for AIP's Corporate Associates at IBM's Thomas J. Watson Research Center in Yorktown Heights, New York, on 25–26 October. The meeting provided representatives of the Corporate Associates, researchers from academic and government laboratories, AIP society officers and some AIP staff an unusual opportunity to become more intimately acquainted with the physics being done at one of the world's premier physics laboratories.

The meeting at IBM was infused by a spirit of openness and even irreverence. During the opening morning session on Tuesday, IBM fellow Rolf Landauer took issue with the conventional wisdom about a fundamental concept in information theory; in an after-dinner speech that night, Freeman Dyson told a series of stories that were not altogether flattering to his home town, Princeton; and on Wednesday morning Congressman Don Ritter, the featured public policy speaker and a lone scientist in a legislature full of attorneys, began his speech with four anti-lawyer jokes. ("A bus full of lawyers went over a cliff; the tragedy was that one seat was empty.")

The highlight of the meeting for many of the participants was the laboratory tour, which featured demonstrations of techniques such as electron beam lithography, x-ray lithography and molecular-beam epitaxy, as well as a wide range of other research activities conducted at the Watson center.

CECILIA BRESCIA/AIP

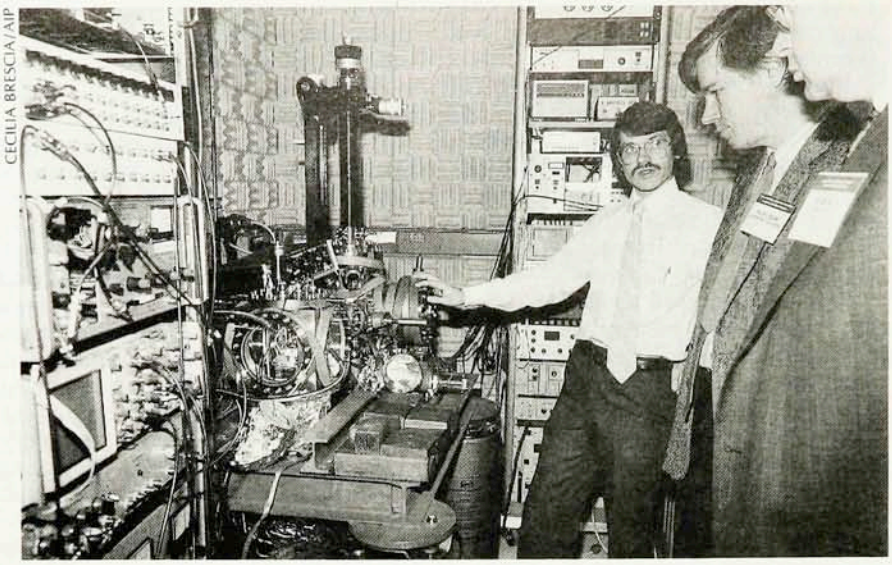
Freeman Dyson, flanked to the left by Kenneth Ford, executive director of AIP, and to the right by Hans Frauenfelder, the head of AIP's governing board, and IBM's Praveen Chaudhari, chair of the Corporate Associates advisory committee.

The meeting also provided participants from universities, the government and AIP an opportunity to become better acquainted with representatives of the institute's Corporate Associates and with the research their organizations sponsor. The Corporate Associates are corporations and organizations that provide advice to AIP on the interaction of industrial and academic research and pay dues in support of AIP activities.

Laboratory tour

In light of the Nobel Prizes awarded IBM physicists for scanning tunneling microscopy and the discovery of high-T_c materials, visitors tended to take a particularly strong interest in the work in those areas. Visitors had a choice of seeing several different kinds of microscopes, and they had an opportunity to talk with physicists doing both experimental and theoretical work in superconductivity.

Chang C. Tsuei showed visitors a system for making and studying high-T_c films, which consists of a deposition chamber, a transport mechanism and an analysis chamber. The



CECILIA BRESCIA/AIP

IBM physicist Robert Hamers shows one of the lab's scanning tunneling microscopes to Phillip Schewe, AIP's acting manager of public information, and Arthur Fisher of *Popular Science* magazine. Isolation of the microscope from vibration, by means of the shock absorbers and lead bricks seen in the photo, is crucial to its effectiveness.

deposition chamber contains three electron guns, three electronic shutters, three monitors and an ion source. The analysis chamber is equipped to do x-ray and ultraviolet photoemission spectroscopy, and the system is designed to operate at 10^{-10} Torr.

Jochen D. Mannhart gave a short talk in which he said that grain boundaries have been identified as the limiting factor on critical-current density in polycrystals. Grain boundaries depend on tilt in the *ab* planes, he said, with positive implications for making Josephson junctions with high-T_c crystals.

William J. Gallagher, who leads a group of about ten physicists working on high-T_c SQUIDs, provided an overview of efforts to develop, fabricate, study and use sensitive dc SQUID-based instrumentation for scientific studies. Gallagher said he and some of his people have been continuing fundamental research that began during IBM's old Josephson project.

The tour also included exhibits and lectures on lasers and ions, low-temperature spin dynamics in random magnetic systems, and star formation in galaxies. Presenting a series of color slides in a darkened auditorium, Bruce G. Elmegreen demonstrated how computer manipulation of color-enhanced images could be used to bring out the large structural features of galaxies. Unwinding a spiral galaxy vividly revealed, for example, the interference pattern generated by a gravitational wave from a nearby galaxy.

After the tour, many visitors commented on the large proportion of foreign-born physicists who made presentations. Although it was no surprise to anybody to see large numbers of physicists of Chinese, Indian and European origin or descent working at IBM, almost everybody was struck by the enormous contribution foreign-born physicists are continuing to make to the most advanced physics research in the United States. Many visitors came away with the impression, rightly or not, that IBM generally gets the physicist it wants, wherever it may find him or her.

Paul Horn, who is serving as acting head of the physical sciences at IBM while Praveen Chaudhari takes a one-year leave of absence, warns that one should not overgeneralize from the cross section of physicists seen on the tour. Horn says that perhaps 25% of the lab's postdocs are brought in through an international program managed under the aegis of IBM World Trade; IBM's Zurich laboratory and its new lab in Tokyo, which currently employs about 200 researchers, also provide recruits. Even so, says Horn, the overwhelming majority of IBM's postdocs are trained at US universities.

Technical talks

The initial morning of the meeting was devoted to four technical talks on the physical limits to computation. Dean Eastman, vice president for logic, memory and packaging in the IBM research division, delivered introductory remarks in which he noted that the number of bits per chip has been increasing since 1970 at a steady rate of about 400% every two-and-a-half years. As we move from today's 1-micron world to a 0.25-micron world by about the end of the next decade, density will go up two orders of magnitude and performance will continue "straight ahead," Eastman said. The capabilities of workstations will approach those of mainframes for many applications in the next decade, he predicted, and parallelism will provide added improvements in performance by a factor on the order of 100–1000.

Robert Stratton, vice president and director of central research at Texas Instruments, traced the steady increases in chip performance back to 1958, when the integrated circuit was invented by Jack Kilby at TI (and simultaneously by Robert Noyce at Fairchild Semiconductor Corporation). In a talk called "Beyond the Limits of Ultra-Large-Scale Integration: The Post-Shrink Era," Stratton described the limits to scaling on the path to realization of a 256-million bit DRAM.

John Neff, a former program manager for optical computing at the Defense Advanced Research Projects Agency who is now at Du Pont, described how optical fibers will be used to make multiplexed links between chips attached to boards, instead of the connects being routed through the boards, a "slow and power-hungry process." He also described how holograms could be used to distribute connects to points on a chip.

Richard Webb of IBM discussed non-local quantum transport in small structures. (See page 46 for an article by Webb on the same subject.) Landauer discussed fundamental energy dissipation limits in computation and communication. Reversible processes that do not throw away information and can be undone were the essential theme of his talk. Landauer argued that computation and communication can take place with as little increase in entropy as desired. This is a departure from the standard view of energy dissipation in information systems as it generally, but perhaps naively, has been interpreted on the basis of work that Claude Shannon did at AT&T in the 1940s.

In response to a question from the audience, Landauer said: "Many of us in this building probably assume that in the really long run computers will go to low temperatures, if not 4 K, then 77 K."