

ter says that negotiations with Germany are at an "earlier stage."

US position. Neutron scatterers and materials scientists in the United States remain somewhat disappointed with the pace of US programs. There has been little or no action on the major facilities for materials research recommended last year by the Seitz-Eastman committee (PHYSICS TODAY, September 1984, page 57), and little action on the new capabilities recommended for minor facilities. Gerald H. Lander, director of Argonne National Laboratory's neutron source, observes that no funds have been budgeted for cold-neutron guidehalls at Brookhaven or the National Bureau of Standards, none for an experimental hall at the Los Alamos spallation neutron source and none for enriched-target options at Argonne.

Donald Stevens, director for Basic Energy Sciences at DOE, notes that the Seitz-Eastman report recommended delaying any decision about a new high-intensity spallation neutron source until the value of the field is more firmly demonstrated. By comparison with the analytical techniques used for experiments at steady-state sources, Stevens said, analytical techniques for experiments using neutrons from spallation sources are relatively undeveloped. He indicated that DOE funds for improved capabilities at existing sources would be available before any new project on the scale of Isis or SNQ is considered. The DOE appropriation for 1986 does in fact contain \$1 million toward the design of an experimental hall for the Los Alamos spallation neutron source.

Meanwhile, Stevens said, European neutron-scattering capabilities will remain impressive. Quite apart from SNS, which will be the world's most powerful spallation neutron source for a time, "the ILL reactor at Grenoble alone has experimental capabilities that exceed the totality of what is available in the United States," he pointed out. "In particular they have a complement of low-energy neutron capabilities that is practically nonexistent in this country. So in terms of experimental facilities, the lead has shifted very dramatically from the United States to Europe.... Flux at US reactors is comparable to ILL, and US scientists are able to do very competitive forefront research, but they must rely on European facilities for some classes of experiments. However, when the Los Alamos spallation source becomes fully developed in 1987 or 1988, it will have the potential of being the highest-flux spallation neutron source in the West and possibly the world."

Status of Jülich KFA. Some neutron scientists in the United States and Europe feel that the Jülich Nuclear

Research Facility (Kernforschungs Anlage) shot too high and staked too much on its proposed spallation neutron source, but cancellation of the project is not expected to be a fatal blow to the laboratory. Only 150-200 of its 4500 staff were directly involved in working on the SNQ proposal in the final stages, and they are being reassigned successfully to other work.

Robert Birtcher, an Argonne physicist who recently returned from Jülich, reports that morale remains good in many of the research groups, and he notes that the laboratory has several major programs involving use of large-scale equipment. Among other things, KFA still runs a reactor for neutron-scattering experiments, and it has persisted with work on the conversion of heat into chemical energy by breaking down methane and steam into carbon monoxide, carbon dioxide and hydrogen. The process is to rely on use of helium heated up to 900° C.

An eventual source of heat for the process could be the innovative thorium-fueled high-temperature reactor that has been developed at the KFA and Hochtemperatur-Reaktorbau in Mannheim. The THTR 300, a 300-megawatt demonstration reactor built at Schmehausen near Dortmund, is to come into full operation early next year.

Still, Birtcher says that everybody at Jülich has been affected by cancellation of SNQ. "It would have been the

focus of the laboratory," he observes.

Bauer, deputy director of the SNQ project, agrees. He describes the project's cancellation as "a rather severe blow because the future concept for the laboratory was centered around SNQ. It was the wish to make KFA a center for many-particle research and to establish a new branch of basic research."

The KFA supervisory board, in an announcement of the SNQ decision last June, said that the Jülich laboratory will remain capable of pursuing both basic and applied research "in a balanced relationship."

As promising areas for applied work, the board singled out energy technology, environmental research, materials research based on the laboratory's experience in developing high-temperature nuclear reactors and—as a new activity—information technology. In basic research, the directors said that the laboratory should continue with research in many-particle systems and nuclear physics.

KFA management does not agree that the areas outlined by the directors would provide an adequate overall mission for the laboratory. They have submitted a proposal to the government calling for establishment at Jülich of a new institute for research on thin layers and ion technology to provide basic knowledge for improved production techniques for semiconductors.

—WILLIAM SWEET

AIP Corporate Associates meet at Kodak

"The Physics of Imaging" was the focus of the 1985 Corporate Associates meeting of the American Institute of Physics that took place at the Eastman Kodak Research Laboratories in Rochester, New York, on 22-23 October. Kodak Chairman Colby H. Chandler welcomed nearly 200 participants, more than one-third of them leaders of industrial laboratories, calling them the family of "the world's mother science." It so happens that Chandler himself holds a degree in physics from the University of Maine and did post-graduate work at MIT in engineering physics. Taking his theme from the meeting's title, he said an enlarged picture of Kodak was emerging as "we come to depend more and more on physics—in our materials, electronics and optics."

These fields were explained by Kodak scientists during tours of the company's research labs. Visitors saw, for instance, how the company produces ultralightweight optical components and frit-bonded mirror structures that remain dimensionally stable in the wide range of temperatures in space.

In demonstrating research in spin physics, Kodak researchers showed their capability to record 2000 full-image frames per second on special high-density videotape using new solid-state sensors. Indeed, as Kodak's Timothy Tredwell pointed out in his talk, the physics of charge-coupled devices now makes possible solid-state image sensors capable of resolutions of 1 million or more high-quality picture elements in monochrome or color, with sensitivities of 10-50 photons per picture element. Other discussions and demonstrations dealt with algorithms for computer processing of actual and simulated radiographic images, digital enhancement of fuzzy or grainy photographs, such as those taken through telescopes or from satellites, and the latest advances in electrophotography for recording digital information.

Such snapshots of Kodak research reveal how far the business has come since the Eastman Dry Plate Co started in 1881. A glimpse of history came at a reception in George Eastman's 50-room Palladian-style mansion, built in 1905. In it are storerooms, galleries and

exhibits of photographs, optical instruments and cameras from the earliest days of daguerreotypes, tintypes, pin-hole cameras, stereopticons and the ubiquitous \$1 Brownie camera introduced in 1900. Eastman House displays some of the first x-ray plates and paper, marketed by Kodak in 1886, one year after Roentgen's discovery. Among the memorabilia is the story of the Kodak trademark. It seems that the letter K was Eastman's favorite. So, after considering hundreds of combinations of letters involving words beginning and ending with K, Eastman invented the meaningless, whimsical word Kodak.

The first speaker on the AIP Corporate Associates program, Peter Franken of the University of Arizona, brought the house down with a deceptively funny talk on "adaptive optics." Among his one-liners (example: "Top secret documents are often referred to as 'open literature' in Washington and maybe in Moscow as well."), Franken covered a wide array of topics, including the proposed Keck 10-m telescope, which would be four times more powerful than the 200-inch telescope on Mount Palomar, and the use of interferometric and geometric techniques in optics for the Strategic Defense Initiative to compensate for atmospheric perturbations. If the $f/1.75$ mirror called for in the current design of the Keck telescope were a more conventional $f/3.5$, Franken asserted, the estimated \$85 million total cost might easily be \$300 million or \$400 million.

Speaking on "optics in microelectronics manufacturing, its design, fabrication and ultimate limits," Janusz Wilczynski of the IBM Thomas J. Watson Research Center predicted that the resolution of lenses may soon reach 0.25 microns. Francesco Paresce of NASA's Space Telescope Science Institute and the European Space Agency discussed the imaging and resolving powers of the Hubble Space Telescope. The cost of the Hubble telescope, he said, may come to \$1.5 billion when it is finally placed in orbit—about twice the cost originally figured. Its size was determined by the space on board the shuttle Atlantis, which is expected to carry it aloft next August.

Jack D. Cowan of the University of Chicago spoke about the psychobiology of human mental imaging, especially those images produced by such hallucinogens as LSD, peyote and marijuana—a subject seemingly outside the frame of reference of the Corporate Associates meeting. Initially, Cowan explained, the images are all geometric, consisting of spirals, tunnels and funnels, lattices and tiles, or hexagons. Cowan and collaborators have shown that such patterns are generated by a mechanism somewhere in the visual

area of the brain that prefers to make stripes and have constructed hypothetical brain circuits that do this. Such circuits are consistent with anatomical and physiological properties of the visual cortex. Formally, the striped formation is an example of spontaneous symmetry-breaking, as seen in the Weinberg-Salam theory of electroweak interactions or in Rayleigh-Bénard convection patterns.

After dinner, at which the AIP Prize for Industrial Applications and the Karl Taylor Compton Medal were awarded (see page 72 for details on these awards and the AIP science writing award), Duncan T. Moore of the University of Rochester discussed the impressions of education and business in Japan he gathered during a year in the country. In Japan, Moore stated, it is common for industrial companies to employ physicists and other scientists who are college educated, yet they are all expected to receive further on-the-job training. The "Japanese challenge," which is sometimes characterized as the cleverness, vision and hustle of Japan's business managers, is a strategy they learned from such American scientists and engineers as Deming Lewis. Still, Japan invented one aspect of the strategy: Rather than try to preserve its whole industrial base, Japan introduced industrial policies that sought to propel it into the future, and at the same time to cast off older industries that were in decline. The emphasis is on promoting high-technology industries, with MITI (the Ministry of International Trade and Industry) being careful to preserve domestic competition. In this way, MITI stimulates both quality and cheapness while giving firms equal access to research carried on jointly by government and business.

Moore noted that industrial companies hire the best and brightest science students. Whether the subject be rapid adjustment to job opportunities for university students or changing industry to penetrate world markets, said Moore, the US can learn from Japan.

At least one Japanese practice is taking hold in the US, the audience was told by Beverly Fearn Porter, AIP manager of manpower statistics: "Students are going where the industries offer the greatest opportunities." Thus, according to surveys of bright college students, she said, the "hot" fields are engineering, biotechnology, computer science and business management. "Physics is perceived as academically too hard. Physics is perceived as a PhD field, with deferred income." Porter cited statistics indicating that the number of BS degrees in physics is still significantly lower than 15 years ago, though the number has increased modestly in the last few

years to around 4800. By contrast, computer science degrees have grown from 1500 in 1969-70 to some 25 000 in 1982-83. "With the projected decline in the number of 18-24-year-olds through the mid-1990s, competition will escalate for bright young minds in science, engineering and other disciplines," said Porter. "Physics will have to make strong efforts to maintain even its current levels of enrollment."

She spoke of the "graying of academic physicists" and the current "precarious balance" between the supply of physicists and the demand for them. As demand outstrips supply in the 1990s, said Porter, competition between academic and industrial employers for the limited talent pool may be expected to increase. Accordingly, she argued for the need to attract into physics more able students, especially those from such underrepresented groups as women and certain ethnic minorities.

An innovative program to upgrade high-school science and math education and thereby both encourage better teaching and produce more scientists was described by Donald S. McCoy, vice president at the CBS Technology Center in Stamford, Connecticut. His laboratory has been providing refresher courses for local junior-high teachers, who, if the videotapes of sessions and interviews that McCoy showed are any indication, have now awakened to science education. McCoy reported that teachers and students seem to be turned on by five topics: electricity, magnetism, optics, sound and astronomy. "The thing that surprised us most was the enthusiasm of both teachers and students," he said.

Two speakers dealt mainly with new machines. Charles E. Till, associate director of reactor R&D at Argonne National Laboratory, told of the Integrated Fast Reactor, a breeder using a ceramic-clad fuel, uranium oxide. It underwent successful tests of fuel meltdown at the Idaho experimental reactor station last May. Dean E. Eastman of the IBM Thomas J. Watson Research Center discussed two synchrotron-radiation accelerators, one at 6 GeV and the other at 1-2 GeV, that were given highest priority for government funding by a National Research Council committee studying new materials research facilities (PHYSICS TODAY, September 1984, page 57).

As usual, AIP is offering hour-long videotapes of the talks containing all projections and film used by the speakers. Tapes may be purchased at \$200 each or rented for two weeks at \$85 per tape. A 25% discount is given on the sale or rental of four or more tapes. Orders should be placed with David Kalson, AIP, 335 East 45th Street, New York, NY 10017. —IRWIN GOODWIN