NIST is planning and designing three of NSLS-II's eventual total of 58 to 80 beamlines, Fischer says. His team is already working under a Small Business Innovation Research grant with R. Browning Consultants in San Carlos, California, to develop a three-dimensional chemical x-ray microscope for use on the NSLS-II.

The higher brightness of NSLS-II will increase the experimental throughput and reduce the amount of time required for most experiments, Fischer notes. So while the eventual number of beamlines is expected to remain roughly the same, Dierker projects that the number of users will jump "dramatically" from the 2300 annually at NSLS to around 3500 users at the new machine.

NSLS-II will be staffed with experts who will design, build, and operate beamlines in consultation with users. That is a departure from the earlier model, in which DOE built the synchrotron and users were expected to build and equip their beamlines. "Increasingly, [DOE's] facilities have assumed more responsibility for the beamlines and for transporting the x rays to the experiments," Dierker explains. Economies of scale will allow facilities to design and build beamlines more efficiently and at lower cost by using in-house expertise.

Users eager for new sources

Antonio Lanzirotti, a scientist with the University of Chicago's Center for Advanced Radiation Sources (CARS), works with a pair of NSLS beamlines that he calls hard x-ray microprobes. The Earth and environmental scientist was one of several who used the light source to examine tiny comet-tail particles that were brought to Earth by NASA's *Stardust* probe in 2006. Analysis of the particles revealed mineral phases that must have been formed at thousands of degrees, he says. CARS also operates a number of beamlines at Argonne's APS, and Lanzirotti says that the same beamline optics that can achieve a 1-μm-diameter beam on APS can do no better than a 5-μm beam on the current NSLS. But with those optics, the new BNL machine should get down to 600 nm right away, and with time, he says, experimenters hope to improve x-ray optics enough to achieve a beam diameter of 1 nm. CARS has been selected by BNL to advise on the construction of one of the initial six beamlines for NSLS-II.

Wayne Hendrickson, a biophysicist and Howard Hughes Medical Institute investigator at Columbia University, developed a method of x-ray crystallography known as multiwavelength anomalous diffraction while he was at the US Naval Research Laboratory in the 1970s. After moving to Columbia in the 1980s, he opened an NSLS beamline and developed a second, single-wavelength anomalous diffraction method. Those techniques are now used to determine the structures of around 90% of all new proteins. He recently was appointed associate director of life sciences for NSLS-II but will retain his post at Columbia.

Hendrickson says that a brighter and tighter beam will be needed to determine the structures of the large number of proteins that occur in cell membranes, since those molecules often will form only tiny crystals. A tighter beam also will minimize the amount of a biological material that is killed by the high flux of x rays. The NSLS-II, he adds, will bring to the East Coast, which has a high concentration of structural biologists, even higher brilliance than is available at the APS.

At the ESRF, Bill Stirling, who stepped down in December after an eight-year stint as director general, says the seven-year upgrade of the 45-beamline light source will raise its brightness by 50% and add 8 to 10 new beamlines, several of which will be routinely capable of 10-nm or better resolution. The experimental hall will be expanded to accommodate beamlines up to at least 100 m in length. At 6 GeV, the European machine is more comparable in energy to the APS. The NSLS-II will offer a small beam of electrons that are extremely parallel and well-suited for x-ray imaging applications. But the ESRF and the APS produce the hard x rays needed to penetrate beneath the surfaces of materials. "We cooperate and we compete," says Stirling, who knows the APS and the NSLS-II designs well as a member of their respective scientific advisory committees. "All the big facilities think that they are the best; naturally, I believe that ESRF is the best."

By one measure—the number of peer-reviewed papers published about research performed, excluding theses—the ESRF's 1500 probably topped all the world's light sources last year, Stirling says. On the other hand, he concedes that the APS produces more protein crystal structures than the ESRF, which has fewer crystallography instruments.

NSLS-II and the ESRF are alike in at least one respect: Their users gain access to the machines based on peer review of the scientific merit of their proposals, not by nationality. Americans will be considered, says Stirling, but not many come to the European machine because of the availability of excellent US facilities. **David Kramer**

North Carolina institute offers to archive old astronomy data

Is digitizing astronomical photographic plates worth the time and money?

A survey last year of North American institutions holding photographic plates used from around the 1880s until the 1990s to record astronomical data revealed—to nobody's surprise—lots of plates getting little use. The survey's findings bolstered the case for a national archive of plates—a role the Pisgah Astronomical Research Institute in Rosman, North Carolina, wants to take on. PARI is volunteering to archive such plates and to digitize them to make the data easily accessible to researchers. So far, though, PARI lacks the funds to digitize, and some astronomers say money would be better spent on new science.

Carried out under the auspices of the American Astronomical Society's working group on the preservation of astronomical heritage, the survey collected such information as numbers and types of plates, locations, storage conditions, availability for use, and actual use over the past 10 years. Nearly 2.5 million photographic plates were identified in North America, with 97% of them in the 16 largest collections. About a third of spectroscopic plates are at Canadian institutions.

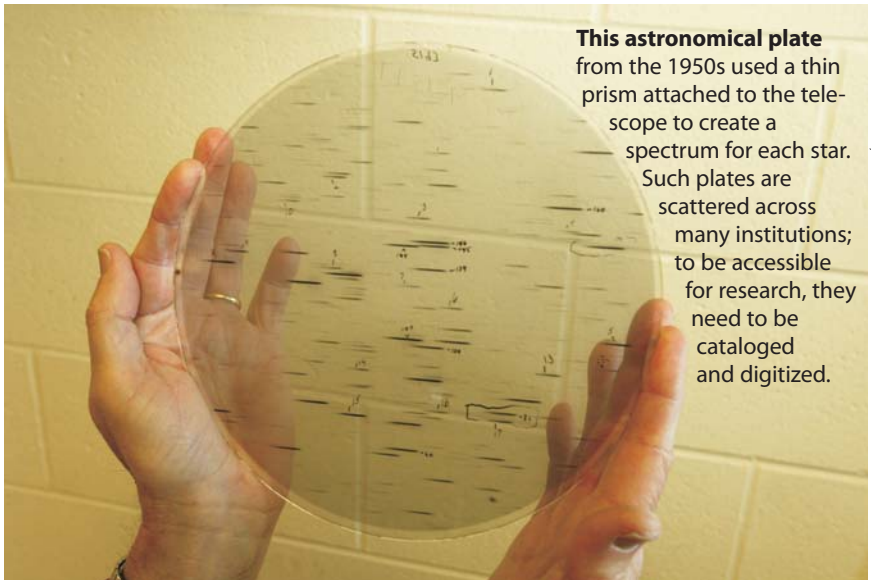
"We'll house them"

PARI started out as a NASA satellite-tracking site and then served as a US Department of Defense communications center during the cold war. It was later turned into a nonprofit radio astronomy and K–12 outreach center (see PHYSICS TODAY, March 2001, page 26). PARI has designated one of its 50 or so buildings for archiving astronomical photographic plates. "It's perfect," says Wayne Osborn, an emeritus professor at Central Michigan University and coauthor of the survey report.

"If you have plates and don't know what to do with them, we'll house them for you," says PARI astronomy director Michael Castelaz. "People have a choice of donating or storing, where they maintain ownership." So far, he says, PARI

is home to some 50 000 glass plates. As PARI secures funding, he adds, "we will scan and digitize the plates."

"Most institutions have thought about throwing away their plates. They don't have the moral courage, but often they can't provide the necessary environmental conditions for storing them," says Caty Pilachowski, an astronomer at Indiana University. "On a couple of occasions I have gone back to look at archival data. I do care about it. But [archiving takes] a lot of money." As for PARI, she says, "will they get the budget to follow through [and digitize]? I think it's more expensive than they anticipate. And, is the amount of information recovered ultimately worth the cost?"



PEGGY BRISBANE, CMU

This astronomical plate from the 1950s used a thin prism attached to the telescope to create a spectrum for each star. Such plates are scattered across many institutions; to be accessible for research, they need to be cataloged and digitized.

Looking forward and back

That's the central question, says David Monet, an astronomer at the US Naval Observatory in Flagstaff, Arizona, who spent 20 years digitizing plates. "How much of your budget is it worth to go chasing science in old plates? CCDs promise huge amounts of stuff we couldn't dream of doing with photographs. I'm voting with my feet. We are on the threshold of amazing advances. I don't care about plates anymore." But, he adds, "if PARI can come up with a plan to survive the cost-and-effort test, then great."

Scientists at Harvard University have built a scanner that can handle two plates in one and a half minutes with "phenomenal accuracy," says Josh Grindlay, who leads Digital Access to a Sky Century at Harvard. He estimates that digitizing the university's full collection—which at more than half a million plates is "one-third of all the astronomical plates in the world"—will take about four years and cost up to $5 million. So far, the team has scanned just a few thousand plates, but DASCH has already made discoveries, including "variable stars of a sort we have never seen before," says Grindlay. Starting anew, "it would take 50 years to get the data and time coverage we already have. Why wait that long?"

Elizabeth Griffin of the Herzberg Institute of Astrophysics in Victoria, Canada, has been working to save plates for some years (see PHYSICS

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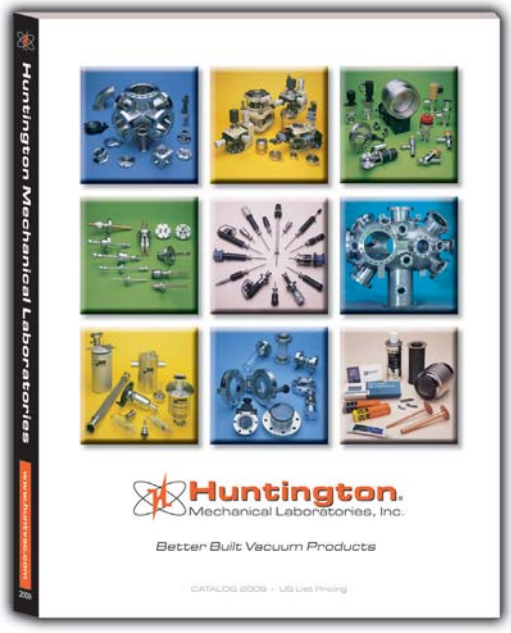

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TODAY, June 2003, page 30). "Every now and then something happens where you need suddenly to know about a relatively bright star and what it was like earlier—say a supernova goes off," she says. "Or you want to measure the orbit of a near-Earth object—if you just use a few days' worth of observations, there are huge errors. You need to go back. The old data is extremely valuable." Another example is Griffin's own research looking at old spectra for evidence of past concentrations of Earth's ozone. "If you've got a change that is irreversible, what were things like in earlier years? This you cannot get from modern observations, however wonderful they are," she says. "Historic UV spectra of hot stars provide a unique resource for that purpose."

The cost of digitization is "nothing compared to a space shot," Griffin says. "Not only are the plates deteriorating slowly because of the natural aging and poor environmental conditions, but the expertise and knowledge of how to deal with them is also being lost. We are trying to energize a recovery movement."

Toni Feder

FutureGen could make a comeback

The fortunes of FutureGen, the $1.8 billion clean-coal demonstration plant canceled more than a year ago by the Bush administration, could be changing—if the project can shake off being labeled "the biggest earmark in history." The Senate-passed $838-billion economic stimulus bill includes what appeared to be a thinly disguised earmark of $2 billion for the near-zero-emissions project. It was to have been built at a site in Mattoon, Illinois, but in January 2008 Samuel Bodman, then US Department of Energy secretary, pulled the plug (see PHYSICS TODAY, September 2008, page 26). Shortly after inauguration day, a group of six Midwest senators, led by Illinois Democrats Richard Durbin and Roland Burris, wrote to DOE Secretary Steven Chu, urging him to restart FutureGen, which would demonstrate carbon capture and storage (CCS) technology on a commercial scale. Specifically, the lawmakers asked Chu to formalize the project's environmental impact statement, which had okayed construction of the plant.

As PHYSICS TODAY went to press, Chu hadn't responded to the senators. But DOE press secretary Stephanie Mueller said Chu was reviewing FutureGen "along with a range of options to move [CCS] technology forward and help address the climate change crisis." Chu, she said, "strongly believes" that CCS is needed to reduce carbon dioxide emissions from US coal-fired plants. "But equally—if not more importantly—breakthroughs in this technology are essential for addressing the ever-greater threat posed by the greenhouse gas emissions from a growing number of coal-fired plants in China, India, and the developing world," Mueller said.

FutureGen cropped up in an unflattering light during the contentious Senate debate on the economic stimulus bill. From the bill's more than 700 pages, Sen. Tom Coburn (R-OK) unearthed a two-line provision that designated $2 billion for "one or more near-zero emissions powerplant(s)." Coburn pronounced the provision the largest earmark ever.

But Coburn's attempt to excise the FutureGen funding failed. At press time, it was uncertain whether the provision would survive the House–Senate conference committee. Both bills would allocate funds for other CCS demonstration projects.

FutureGen was to have teamed DOE with a consortium of 13 electric utilities. Bodman, who wasn't at DOE when the project was proposed in 2003 with a price tag of $950 million, canceled the project because he believed it had grown too expensive. He redirected DOE's 74% share of FutureGen funding into a new $1.3 billion cost-shared initiative to support up to three commercial-scale CCS demonstrations. No awards have yet been made.

David Kramer

news notes

Medical isotopes. It is technically and financially feasible to use low-enriched uranium to produce medical isotopes on a commercial scale. That is the conclusion of a National Research Council (NRC) report released in January.

Congress commissioned the report to explore the conflicting goals of restricting exports of highly enriched uranium (HEU) for medical isotope production, per the Energy Policy Act of 1992, and ensuring a reliable supply of isotopes, to which end a later law lifted the export restrictions (see PHYSICS TODAY, May 2008, page 22). "The question we pursued was the feasibility of achieving both," the chair and vice chair of the study write in the report.

The most common radioisotope used in medicine is technetium-99m, a decay product of molybdenum-99, which is obtained from uranium fission. The NRC report finds that facilities can convert from HEU, which poses a proliferation risk, to LEU to produce ^{99}Mo with a cost increase of less than 10%, and that the cost increase is "much less important than is reliability of supply." Moreover, the increased cost to patients for radioisotope pharmaceuticals would be less than 1%.

"I think Congress is likely to adopt the report's two main recommendations—restoring restrictions on HEU exports and enacting incentives for

web watch

To suggest topics or sites for Web Watch, please visit http://www.physicstoday.org/suggestwebwatch.html. Compiled and edited by Charles Day

http://www.gigapan.org

GigaPan NASA's Mars rovers, Spirit and Opportunity, are equipped with gigapixel cameras that create seamless, panoramic views of the Martian surface. The camera system is now available for terrestrial applications through a spinoff organization called **Gigapan**. Photographer David Bergman used a Gigapan camera to generate an image of President Barack Obama speaking at his inauguration. You can find and explore that and other images on Gigapan's homepage.

http://www.ymec.com/hp/pref2/

YMEC is a Tokyo-based company that develops sound measurement and analysis software. The company's virtual **Sound Preference Audition Room** provides audio files to help you determine how much reverberation you like when you listen to various kinds of music. The sound of a full orchestra in an anechoic room is particularly striking.

http://www.ameslab.gov/60thanniversary/60thhome.htm

The Department of Energy's Ames Laboratory turned 60 in 2007. To mark the anniversary, the Iowa lab put together the online exhibit **Ames Laboratory—Shaping Science for 60 Years**. The exhibit charts the lab's expanding mission from purifying uranium in the 1940s to carrying out a broad range of materials science research today.