German Synchrotron Light Source May Find New Home Somewhere in Middle East

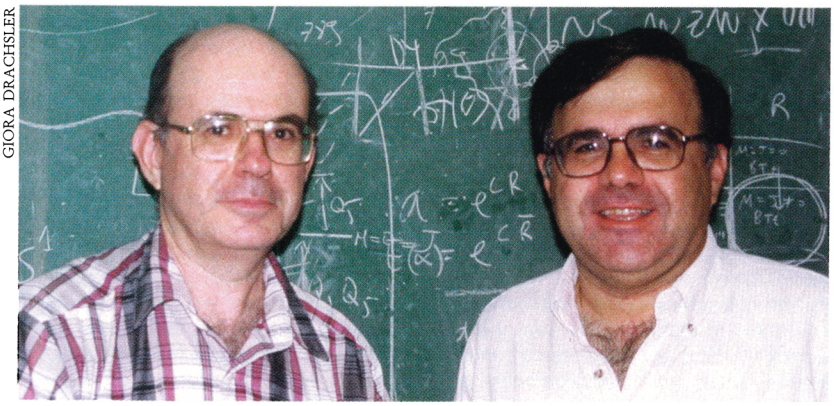
Scientists and policymakers agreed in June to press ahead with a plan to turn a secondhand synchrotron light source from Germany into an international facility intended to promote peace, as well as science, in the Middle East.

That consensus was reached at a meeting hosted in Paris by the United Nations Educational, Scientific, and Cultural Organization (UNESCO). But to make the project happen, a site still needs to be chosen, scientists and engineers from the region need to be trained to run the facility, and funds need to be raised. And things have to move quickly, because the available synchrotron, BESSY I (Berliner Elektronen-Speicherring für Synchrotronstrahlung), has to be cleared out of its building in West Berlin by the end of next year (to make way for the Max Planck Institute for the History of Science).

The idea to relocate BESSY I to the Middle East came from Herman Winick, of the Stanford Linear Accelerator Center: "I thought the region could use something besides killing each other, and scientific collaboration has been a force for peace before—in the cold war, for example. I got excited about promoting the peace process." In 1997, Winick talked to Gustav-Adolf Voss, a retired scientist from the German Electron-Synchrotron (DESY) in Hamburg, who then talked to both the German government and the Middle East Scientific Collaboration, an organization founded about three years ago to foster cooperation among scientists in the region. The idea took hold.

> Enthusiasm needs to be translated quickly into cash if plans to transform a German synchrotron into a Middle East regional scientific collaboration are to succeed.

UNESCO director general Federico Mayor opened the Paris meeting by saying, "UNESCO is ready and eager to help in your efforts," as it did for CERN in postwar Europe. "The Middle East project would in turn become a quite extraordinary example of science overcoming divisions to bring nations together in a spirit of peace and cooperation . . . offering an impressive practical illustration of 'science for peace.' " As a neutral party that has a good rapport with both Arabs and Israelis, UNESCO will, among other things, deal with Germany about BESSY I's transfer. The synchrotron would be the centerpiece of the Middle East's first major research facility, and involvement of scientists from Europe and the US is seen as key for establishing a high scientific level and smoothing interactions among scientists from traditionally hostile countries.



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PHYSICISTS Eliezer Rabinovici (left), an Israeli, and Hanna Hallak, a Palestinian, both attended UNESCO's Paris meeting to discuss a Middle East synchrotron facility.

Settling on a site

At the Paris meeting, five sites were volunteered for the synchrotron: in Egypt, Cyprus, Turkey, Iran, and the Palestinian Authority. A planning council, consisting of up to two representatives from each participating government, will consider official bids and, based on factors such as availability of reliable electric power, is slated to pick a site by November. (Spain and the Ukraine would also like to inherit BESSY I, but the Middle East is the preferred location.)

Israel, the only country in the region with a sizable number of synchrotron users (roughly 100), is not vying to host the facility. Says Eliezer Rabinovici, a physicist at the Hebrew University of Jerusalem, "The reasons for having it in any other country are stronger than to have it in Israel. I'd be glad to have it where several countries meet, or to have the Palestinians host it—one attraction would be to have it in the West Bank." For their part, Palestinian scientists feel a sense of entitlement and believe that by their serving as host, the facility would have the greatest potential for promoting peace in the region. Says Bethlehem University physics chair Hanna Hallak, "Our people have paid the highest price [in the Arab–Israeli conflict]. The situation has stunted our technical development." Adds Said Assaf, who heads the Arafat National Scientific Centre for Applied Research in Ramallah, "Siting the synchrotron in Palestine would be fantastic beyond imagination. And it's central. It would be driving distance for many."

Selecting a site is a delicate matter, notes Herwig Schopper, a former director general of CERN, who is chairing the planning council: "We must be careful. I've seen projects fail because no site was agreed to." However, all the contenders have said they will support the project whether or not they get to host it.

Good as new

The plan would be to upgrade the 17-year-old BESSY I, much as Thailand is doing with a synchrotron light source it got from Japan (see next story). Specifically, the circumference would be expanded from 62 m to 101 m, and the machine would be fitted with more wigglers and undulators, which, along with an increase in the electron storage energy from 800 MeV to 1 GeV, would extend the spectral range to hard x rays up to 20–25 keV; a new vacuum system, a more powerful radio frequency accelerating system, and a new computer control system

BESSY II's construction in Berlin is the reason that the city's older synchrotron light source, BESSY I, is up for grabs. The new third-generation light source went on-line last January in Adlershof, a budding research and industrial area in East Berlin.

would also be installed.

The rebuilt machine, for now called BESSY IA, "would be at least as good as new, and it would be proven and debugged," says Voss. Adds Winick, "It would be a 'two-and-a-half' or a 'super second' generation machine. Newer [so-called third-generation] machines have a smaller beam focus, but that isn't necessary for everything—it's not necessary for studies in structural biology, environmental science, or other hard x-ray applications."

Germany would donate the synchrotron. Relocating and refurbishing it would cost about $21 million, or about one-third the price of a comparable new machine, says Voss. That estimate includes packing, shipping, reassembling, and upgrading the synchrotron, as well as minimal local infrastructure. But it doesn't include the salaries for 35–60 scientists and engineers to run BESSY IA, which would add up to several million dollars a year, money that everyone agrees will be tough to raise. Says Voss, "Only if annual [operating] funds can be secured over a reasonable period such as ten years does it make sense to go through the trouble of upgrading and relocation."

It's not clear where the money would come from, except that it's not likely to be from the Middle East. Unless the region's wealthier countries, such as Saudi Arabia and the United Arab Emirates, can be persuaded to join the project. But they and several other Middle East countries did not attend the Paris meeting, which participants ascribe variously to Israeli–Arab relations, Arab–US relations, or internal problems; in addition, science is a low priority in much of the Middle East. The project's planners hope to drum up funding from the European Union and the US. Assaf, who is heading up a committee to look into financing the project, has his sights set on a chunk of the $1.7 billion or so associated with last October's Wye River Memorandum between Israel and the Palestine Liberation Organization. However, if it is okayed by the US Congress, the Wye money would be tied to specific steps being taken toward peace, and would go toward building infrastructure such as roads and schools. An undeterred Assaf says, "Palestinians are in the best political position to raise the money." (Some of Assaf's colleagues are floating a proposal for equipment to prepare and study materials—such as crystal growth equipment, microscopes, and spectrometers—that they are hoping to piggyback on proposals to fund BESSY IA.)

More apparently available than cash is training, another necessary ingredient for the project's success. Synchrotron users from around the world—including Germany, France, Italy, Israel, Greece, the US, and Iran (home to the region's only synchrotron light source, a small, 0.3 GeV machine used for medical and agricultural research)—are offering to help train sci-

Thailand Recycles Japanese Synchrotron Light Source

A hand-me-down synchrotron light source from Japan is being beefed up for use in Thailand, with startup scheduled for 2001. Located 250 km northeast of Bangkok in the city of Nakhon Ratchasima, the Siam Photon Source will be Thailand's first synchrotron light facility and is intended to serve scientists throughout Southeast Asia.

Thailand's Ministry of Science, Technology, and Environment got the machine *gratis* and is investing about $14.9 million to move and upgrade it, including doubling the circumference to 81 m and tailoring the machine to produce narrow bright beams of soft x rays and ultraviolet radiation (longer-term plans to add a superconducting wiggler to produce hard x rays are not included in this estimate). By comparison, building such a facility from scratch would have cost at least $35 million. The facility's acting head is Weerapong Pairsuwan, a physicist at the nearby Suranaree University of Technology, with which the light source will be loosely affiliated.

The orginal synchrotron light source, called SORTEC, was located in Tsukuba Science City, near KEK, Japan's High Energy Accelerator Research Organization, whose scientists have helped in the redesign and are training scientists from Thailand to operate their new facility. The Japanese government closed SORTEC following a 1995 decadal review, partly because some of the 13 companies that used it—mainly for microlithography—had acquired their own machines.

The plan is to use the Siam Photon Source for physics and chemistry research, with some industrial research in semiconductors, medicine, pharmaceuticals, and agriculture, says Takehiko Ishii, a retired director of the University of Tokyo's Synchrotron Radiation Laboratory who was key in orchestrating the donation and is overseeing technical and scientific aspects of the synchrotron's transfer and upgrade. The idea to have a synchrotron light source in Thailand was homegrown, Ishii notes. At this stage, however, he adds, "Users are not real, but potential. We are now enlightening and stimulating scientists in various research fields to come and use the facility."

THE SIAM PHOTON SOURCE, shown here in an architect's rendering, is scheduled to go on-line in 2001.

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entists from the Middle East and the Mediterranean, who have little experience running a large research facility or using synchrotron radiation. Winick announced in Paris that he's received positive preliminary feedback about bringing scientists from the region to work at the US Department of Energy's four synchrotrons. (However, scientists from some participating countries could have trouble gaining entry to US labs due to DOE's recent security woes.)

Science large and small

Then there are the questions of whether a big project is the best way to boost science in the Middle East, and whether the region has enough potential synchrotron users to sustain a large facility like BESSY IA. "If everybody knew they needed a machine, it would be easier," says UNESCO's Siegbert Raither. The advantage of this particular project, he continues, "is the opportunity—the Germans are making a gift. It's a large project, in terms of cost, size, and sophistication. But the fact that you can do tabletop experiments is a powerful argument in its favor."

Khaled El-Shuraydeh, of Jordan's Council for Science and Technology, guesses that about a dozen scientists from his country would use the synchrotron. That's Assaf's estimate for the number of potential Palestinian users, too—out of 400 science PhDs, including 70 physicists, he notes. That's enough, says Schopper. "We don't have to start big." And the region's scientists hope that the center would lure home their colleagues, many of whom are working in the US and Europe.

At the end of the Paris meeting, the participants set up committees to look into the scientific, technical, and financial aspects of the proposed Middle East facility. An Israeli nominated a Palestinian to serve on one of them, which "wouldn't have happened ten years ago," observes Israel's Rabinovici, a string theorist who says his main interest in the project is its potential for fostering peace. About the hurdles ahead, Rabinovici sums up, "We have to make sure we have the human resources in the region. We have to build a first-class machine that will attract people from around the world. And we have to raise the finances. None of these obstacles is insurmountable. But it's important to me that if we do this, it should succeed." Or, as Palestinian physicist Ghassan Saffarini puts it, "We don't want to end up with a cathedral in the desert."

Toni Feder

Germany Narrows Reactor Fuel Choices

Converting the Technical University of Munich's new research reactor, the FRM2, to burn low enriched uranium (LEU) instead of highly enriched uranium (HEU) is feasible. That is the key finding of a six-member panel commissioned by Germany's Social Democrat–Green coalition government in its effort to reduce the risk of nuclear proliferation (see PHYSICS TODAY, March, page 78).

In its 21 June report, however, the panel ruled out converting the FRM2 to burn LEU (less than 20% uranium-235 enrichment) with the originally planned neutron flux of 8×10^{14} cm^{-2} s^{-1}, since the changes would require upping the reactor power from 20 MW to 32 MW, which would be tantamount to starting over.

The panel outlined other conversion options that would not require increasing the power. The reactor could be refitted before startup to burn LEU or a medium enriched uranium (MEU, 26% ^{235}U), and later be switched to burn a new type of LEU. Specifically, low enriched uranium molybdenum alloys, with higher uranium densities than the uranium silicide fuels currently used, are expected to become available around 2005. Or the reactor could be started up in 2001 with weapons-usable HEU (93% ^{235}U) as originally planned, and eventually be switched to burn high-density LEU or MEU (50% ^{235}U).

Not surprisingly, the FRM2 team is pushing for the HEU-to-MEU option. Requiring the least modification, it would be the cheaper choice (DM 12 million, or about $6.2 million), and operations would barely be disrupted, says Klaus Böning, the FRM2's deputy head. Using MEU (50% ^{235}U) would reduce the neutron flux by 7%. "We are not very happy about that, but we could accept it," says Böning. With the LEU options, on the other hand, the neutron flux would drop by about 25%, resulting in a great loss for cutting-edge experiments, he claims. Depending on who's calculating, converting the FRM2 before startup, as most of the panel members favor, would cost less than DM 100 million or as much as DM 300 million—the panel and the FRM2 team disagree about the cost, as well as the neutron flux reduction and time delays associated with the conversion options.

Burning HEU would be bucking an international trend: Last fall, for example, the Institut Laue-Langevin in Grenoble, France, announced plans to convert its reactor, the world's premier neutron source, to LEU. Panel members argue that switching the FRM2 to LEU now would not only best meet international nonproliferation goals, but would also be safer and cheaper than modifying a "hot" core; the fuel would be available; and the spent fuel could be disposed of. Indeed, notes panel member Peter Armbruster, of the Heavy Ion Research Center in Darmstadt, "Germany cannot get rid of the HEU spent fuel—this has to be safely stored in a now nonexisting long-term deposit for HEU fuel. The Technical University of Munich may be surprised to see the future fuel bill eating up the necessary investment budget for the FRM2." And if the FRM2 starts off using HEU, worries panel member Wilfried Krull, director of the Geestacht Research Center reactor, "conversion will never take place even if there are political commitments. There will be enough reasons to delay and delay."

Germany's federal government, together with the Bavarian state government, which has put up most of the DM 800 million for the FRM2, is expected to decide among the conversion options by the end of the year.

Toni Feder

Bean Counting Begins in UK Universities

Universities and colleges in the UK must now account for how they spend their money, a requirement the government attached to a budget hike last year, and for which it adopted a plan this past June.

The so-called transparency review requires academic staff time to be attributed to teaching, research, or administrative and other activities, and for funds from public and private sources spent in those categories to be tracked separately. Says Jim Port, whose consulting firm in Bristol devised the procedures to be followed, "We tried to come up with something that is sufficiently rigorous and auditable to satisfy government, but at the same time is sensitive—academic time is a rather more subtle thing than other commodities."

The plan is for heads of departments to ensure that their colleagues' time is tallied retrospectively at least once a year, with surveys or diaries being filled out periodically as validation. The costs of maintaining infrastructure such as buildings, libraries, and computing facilities are also supposed to be folded into the ledgers. Eight universities will test the new record keeping this coming academic year, followed in 2000–1 by the country's 30