

Lasers Abandoned by Nuclear Power Industry Could Become Core of a New South African Laser Facility

Physicists in South Africa are lobbying for the creation of a national laser facility using equipment from an abandoned uranium enrichment project.

The National Laser Facility (NLF) would rent out lasers and provide technical support and training to university and industrial researchers, undertake research in laser technology and perform research for pay, according to a proposal submitted last November to the government's Department of Arts, Culture, Science and Technology (DACST). The NLF would also offer educational opportunities, in particular to black students and researchers, and, the proposal argues, the center would benefit the country socially and economically. As PHYSICS TODAY went to press, the government's decision on whether to commit about 7 million rand (\$1.2 million) a year for five years to the project was imminent.

A laser cache

The idea for the NLF began taking shape in late 1997, when Cogema, the French nuclear reprocessing company, pulled out of the Molecular Laser Isotope Separation (MLIS) project for uranium enrichment of nuclear fuel, a joint effort with South Africa's Atomic Energy Corp (AEC). The project collapsed, leaving a collection of unused lasers, among other things.

Initially, the plan was to sell the lasers, recalls University of Stellenbosch physicist Erich Rohwer. "But that would be a dead loss." The available equipment, worth more than 20 million rand, includes excimer lasers, copper vapor lasers, helium-neon lasers, diode lasers, argon-ion lasers and continuous and pulsed carbon dioxide lasers, as well as diagnostic tools such as spectrometers. So university, industrial and former MLIS researchers approached the government and asked that "a sale be put on hold," says Rohwer, who chairs the group that wrote the NLF proposal and advises the AEC regarding ex-MLIS equipment and staff. "We realized that local and international developments in the laser field are inevitable, and that South Africa should therefore not waste the opportunity to establish a facility for education and research purposes." Adds AEC's Hubertus von Bergmann, "We are trying to salvage whatever possible in terms of equipment and expertise."

Lasers for a proposed facility in South Africa are available, but operating funds are still needed.

Many of the lasers are a decade or so old. Says Rohwer, "It's really nothing spectacular, compared to what Europe and America would have." But if the NLF flies, he adds, "an enormous amount of equipment that the average university can't afford would be available for people to use."

The AEC would lend its lasers to



THE ATOMIC ENERGY CORP in Pelindaba is the most likely site for South Africa's proposed National Laser Facility.

the proposed facility indefinitely, says von Bergmann. Only for the locally developed, high-power, high-repetition-rate CO₂ lasers, he says, would access require AEC's special permission, "not only for the sake of nonproliferation, but also for the protection of intellectual property." In fact, five or six of the 75 or so lasers have been loaned out to universities already, notes von Bergmann, who, with about 3 million rand in stopgap money, is overseeing the upkeep of the instruments as well as paying salaries to keep on some former MLIS scientists and engineers until a decision is taken on the proposed facility. Running the full-scale NLF would require 20 to 25 people, von Bergmann says. Many of those who worked on the MLIS project have left, "but some would be prepared to come back."

Fuzzy on the details

So what structure would the proposed NLF take? This—like many other details—still needs to be sorted out. Explains Rohwer, "The government has clearly indicated that they will have the last word. We are totally in the dark as to what the exact outcome could be." Adds Anthon Botha, a con-

sultant for the Foundation for Research and Development (FRD), a government funding agency, "Once the government sanctions the NLF, then the real planning will begin." Many worry that the government discussions on the NLF's fate could be messy, what with national elections scheduled for this spring and several government departments having a say: In addition to DACST, both the Department of Minerals and Energy Affairs, which is responsible for the AEC, and the Department of Trade and Industry are involved. Nevertheless, Botha sees "no major stumbling blocks at the political level."

Rohwer and other scientists hope that the NLF will be given "national research facility" status. That would mean more government funding and financial stability, and likely land the laser lab under the auspices of the FRD (probably soon to be remade and renamed the National Research Foundation), which oversees the country's three such existing facilities—the National Accelerator Centre, the Hartebeesthoek Radio Astronomy Observatory and the South African National Astronomical Observatory.

At first, the NLF would most likely operate from the AEC's Pelindaba site, about 30 km west of Pretoria. Another possibility would be to house it in Pretoria at the publicly funded Council for Scientific and Industrial Research (CSIR), whose laser group may merge with the new facility. Either way, says Manfred Hellberg, the University of Natal's dean of sciences and president of the South African Institute of Physics, "the laser facility could make use of existing infrastructure—buildings, water and so on." And, he adds, "It would be divorced, management-wise, from the AEC and CSIR."

The NLF proposal also includes establishing a satellite campus in the Cape Town area, about 1400 km from Pelindaba. Says University of Natal laser physicist Max Michaelis, "It isn't at all realistic to imagine numbers of research students commuting to Pelindaba. I and my Capetonian friends would like to see a laser loan pool similar to that run by the UK's Central Laser Facility at the Rutherford Appleton Laboratory." That, he adds, would provide laser access to people "in all the far-flung regions of South Africa."

Even with federal support, the NLF

would need to earn an extra 2 or 3 million rand a year by doing contract work for medical and other industries, and the government's contribution would also decrease over time. Break-even is projected after ten years of operation, von Bergmann says. Wicus Olivier, who heads the company Hitech Lasers/SDI and is involved in planning the NLF, believes industry will make use of the facility. "South Africa cannot compete with the rest of the industrial world if laser technology is not kept alive," he says. But for the facility to be successful, he warns, "one proviso is that it not directly compete with the private sector."

The emphasis on industrial links

has some academics worried that education may get short shrift. Says Michaelis, "I regard education as purpose number one. Most young South Africans have never seen a helium-neon or diode laser." Poorer universities—"like mine"—Michaelis continues, are at a disadvantage because "there is no point in having a beautiful laser if I haven't got students to run the thing." But, notes Botha, the lab's ability to redress past inequities under apartheid is one of the things on which the proposal will be judged. And so, he adds, "One of the NLF's first objectives would be to proactively involve black researchers, giving them preferential bursaries."

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Germany Weighs Barring Bomb-Grade Uranium at Research Reactor

Should the research reactor being built by the Technical University of Munich at Garching, Germany, be converted to use low enriched, instead of highly enriched, uranium? The country's new Social Democrat-Green coalition government has charged a panel of six scientists to tackle this question.

The move is part of a broader overhaul of the country's nuclear laws, including plans to phase out nuclear energy. But by January, less than three

The FRM2, intended for neutron scattering experiments, has been controversial among both scientists and the general population from the outset because it was designed to burn weapons-grade, highly enriched uranium fuel, or HEU. The critics' main concern, explains Alan Kuperman, a senior policy analyst for the Washington, DC-based Nuclear Control Institute, "is the domino effect. It would send a message to industrializing countries that state-of-the-art research reactors require HEU, undermining the RERTR program"—that is, the international Reduced Enrichment for Research and Test Reactors program initiated by the US in 1978.

What's more, low enriched uranium (LEU) could have done the job, according to Armando Travelli, who says that, with increased thermal power, fuel developed by his group at Argonne National Laboratory could have safely provided the same neutron flux that the FRM2 is designed to deliver using HEU.

But now that construction of the FRM2 is so far along, switching to LEU would be a big deal technically, financially and politically. With the reactor slated to start up in 2001, more than half of its roughly DM 800 million (\$465 million) price tag has been spent or committed, says spokesman Gert von Hassel. And the reactor design team—which has all along sworn by HEU—maintains that

switching to LEU would mean starting from scratch, and building "FRM3." With FRM2 officials keen to make such a switch ever more prohibitive, von Hassel adds, "We are pushing construction ahead full speed."

The government-appointed panel will look at the options for switching to LEU. To get the desired neutron flux of $8 \times 10^{14} \text{ cm}^{-2}\text{s}^{-1}$, the reactor core would have to be modified, and the power upped. Says University of Dortmund physicist Franz Fujara, a longtime neutron user, "Some optimum has to be found by playing with the three parameters—time, money and neutron flux. What is really important, however, is that the fuel enrichment not exceed 20% uranium-235." (The HEU fuel is enriched to 93%.)

The panel members are neutron users Peter Armbruster, of the Heavy Ion Research Center in Darmstadt, and Richard Wagner, of the Jülich Research Center; reactor operators Wilfried Krull, who oversaw the HEU-to-LEU conversion of a reactor at the Geesthacht Research Center near Hamburg in the 1980s, and Ekkehardt Bauer, who heads the reactor at the Institut Laue-Langevin in Grenoble, France; and nonproliferation specialists Annette Schaper, of the Peace Research Institute in Frankfurt, and Wolfgang Liebert, of IANUS (Interdisciplinary Research Group in Science, Technology and Security) at the Technical University of Darmstadt. The panel is being overseen by the deputy minister of research, Wolf-Michael Catenhusen, and observers from other ministries and from the host state of Bavaria are being invited.

The panel has until June to weigh such factors as scientific value, technical feasibility, cost, time delays, licensing procedures and nuclear proliferation risk, and to make recommendations as to whether, and how, the FRM2 should be converted to burn LEU.

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THE CONTROVERSIAL RESEARCH REACTOR FRM2 (for Forschungsreaktor München 2) is being built next to its predecessor, the Atomei (atom egg) in Garching, north of Munich. This photo was taken last July.

months into the new government's term, some of the proposals of the environment minister, Jürgen Trittin, had already been set back: Attempts to cancel nuclear waste reprocessing contracts with France and the UK had faltered, and research reactors had been excluded from draft legislation to stop licensing new reactors—a victory for the FRM2, as the Garching reactor is known.

IN BRIEF

Three new centers have been established by the International Centre for Scientific Culture-World Laboratory—two in Egypt and one in Texas. They are a center for the study of extreme weather events, at Cairo's Meteorological Authority; a center for coastal marine modeling, at the University of Alexandria; and a center for Pan-American collaboration in science and technology, at the University of Houston. The brainchild of physicists Paul Dirac, Piotr Kapitza and Antonino Zichichi (the organization's current