

is no problem. But in terms of the technology, you must prove that you can handle scaling up.” The final detector is expected to have about five kilotons of argon, and a price tag of \$71 million.

The tau of neutrinos

Why bother with OPERA and ICANOE, what with the Main Injector Neutrino Oscillation Search in the US expected to go on-line about two years earlier? MINOS isn’t designed to look directly for the tau neutrino. Instead, scientists will compare the number of muon neutrinos spewed out by Fermilab’s Main Injector to the number arriving at Minnesota’s Soudan Mine—coincidentally 730 km away. Any shortfall will be chalked up to oscillation into tau neutrinos.

Indeed, there are scientists on both sides of the Atlantic who believe that the European neutrino beam is a waste of resources, and that the two teams should have joined forces. As CERN physicist Friedrich Dydak puts it, “The CERN–Gran Sasso experiments will confirm what we do not know now, but what we will know long before they give results. Therefore, they will not give new insights unless other experiments fail. Should we build on the anticipation of the failure of others?” But Foa argues that the experiments are complementary: “As somebody said, ‘In order to prove a murder, you need to exhibit the body.’ Here, you need not only to verify that you have disappearance, you need to see the product of the oscillations.”

In fact, the parameters that govern oscillation haven’t yet been pinpointed. We may see a lot of oscillations, notes Pietropaolo, “but if we are not lucky, then we will see only a few events,” and a higher-intensity beam, a more massive detector, or a longer path would be needed to catch neutrinos changing flavor.

Says Luciano Maiani, CERN’s director general, “This is the kind of physics that should be done in several places—the experiments are relatively small.” And, he adds, “If neutrinos really oscillate, then we should start to think about a global facility—a plausible next step involving the whole world.” Foa agrees: “An interesting possibility would be to shoot neutrinos from CERN to Soudan, and from Fermilab to Gran Sasso.” In both cases, that’s about 7000 km.

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Korean Neutrino Observatory Axed

In 1997 the government of South Korea announced an ambitious \$20 million experiment to detect neutrinos. This past June, just 18 months and about \$290 000 later, the High-Energy Astrophysics Neutrino Laboratory (HANUL) was canceled, largely because of infighting among project participants.

HANUL was definitely a worthwhile project, says University of Wisconsin–Madison physicist Francis Halzen, who works on AMANDA, a neutrino observatory far beneath the South Pole (see *PHYSICS TODAY*, March 1999, page 19). “The key was whether they could demonstrate that they could do the physics at [Earth’s] surface. It would have been the experiment that put Korea on the map worldwide.”

HANUL—Korean for “sky”—would have been the first-ever above-ground neutrino telescope. As with other experiments that hunt for the abundant, chargeless particles that may make up much of the universe’s unidentified mass, HANUL would have detected muons arising from collisions of neutrinos with matter. However, unlike other neutrino detectors, which are placed deep underground to minimize cosmic background radiation, HANUL was supposed to combine time-of-flight measurements and Čerenkov radiation to pick out the signatures of neutrinos that have passed through Earth, and reject the ten billion times more prevalent signals coming from atmospheric muons raining down from above.

Rejection of background radiation would have been helped by applying a magnetic field. The idea was to bend the muons’ paths so as to extract their charge, momentum, and energy, and then, working backward, to determine whether a given incident neutrino had originated in Earth’s core, the Sun, the atmosphere, or somewhere outside the Galaxy. Says Columbia University’s Wonyong Lee, one of HANUL’s masterminds, “By combining tracking chambers with magnets, one could in principle get rid of background [radiation].” Having the experiment at the surface would have been much cheaper than running it underground, he adds. “And we could have done gamma-ray physics in addition to neutrino physics.”

Spreading blame

So why was the project axed? Fingers point in all directions—at the scientists, at the science, and at the fund-

ing agency. The official explanation is that the Korea Science and Engineering Foundation (KOSEF, a counterpart to the US National Science Foundation) cut off HANUL’s funding because it didn’t expect the scientists to meet a deadline for building a prototype.

But the real reason, says Lee, was that the principal investigator (PI)—Gyeongsang National University’s Jin Sop Song—refused to resign after project leaders insisted they couldn’t work with him. “He was doing whatever he wanted. The group was not discussing physics, and money was not being distributed. We couldn’t communicate well,” Lee says, adding that before the project got started, he’d been warned that “PIs in Korea act like dictators.” KOSEF’s rules should be changed “to be more democratic and transparent, so everyone knows what’s going on,” he adds. For his part, Song says he was doing his best to make the project successful, that decisions were made by committee, and that it would have been “unreasonable” for him to step down. There was almost no progress on the work Lee was overseeing, he adds.

There is broad agreement that tensions ran high between the experiment’s Korean and Korean–American participants. News of HANUL’s cancellation gained wide attention this past November after an angry letter originally published by the Korean Physical Society’s monthly magazine *Physics and High Technology* was reprinted in English in the on-line newsletter *Korean American Science and Technology News*. Written by Chungnam National University’s Haeshim Lee, who had been the leader of HANUL’s theory group, the letter accused foreigners—that is, the Korean–Americans involved—and their supporters of arrogance, politicking for jobs in Korea, and bad science. “Even the site of the lab could not be agreed upon,” Haeshim Lee wrote. “In my opinion, those who proposed and supported the project seemed to lack basic understanding of both the cosmic ray physics and astrophysics.”

Song also points to the “deep intervention” of KOSEF, and says the funding agency bears “an essential responsibility for the demise of the project.” Joo Sang Kang, a high-energy physicist at Korea University, who, although not directly involved in HANUL, is active in South Korean science policy, agrees: “Yes, the schedule did slip. Yes, HANUL members

did have discord among themselves. But it wasn't any worse than collaborations in, say, the US or Japan. And it should not be the reason for cutting off already-allocated funding."

Scientists in South Korea are worried that HANUL's cancellation has sullied their reputations, both as individuals and as a community. "It is domestic physicists who are left to bear sorrows, take blame, and are unjustly victimized," says Kang. "We have a long way to go to build up a sound research infrastructure in Korea and we badly need a lot of high-energy programs including HANUL-like ones." In addition to the cancellation's giving South Korean high-energy physics a bad image, Song notes the greatest loss "is not being able to give young people the opportunity to join this project."

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IN BRIEF

Antiquarian annals. The sale of the Turner collection by the UK's Keele University was legal, and the price was alright, but the university should have discussed the matter more openly. Those are the main conclusions of an internal review completed late last year in response to public outcry over the university's secret July 1998 sale of some 1600 rare math and physics texts (see PHYSICS TODAY, April 1999, page 64). In the case of comparable future sales, the review recommends "wider and more formal consultation should take place, both internally and externally, notwithstanding any adverse effects which may be envisaged." Scholars had protested that in taking the collection from the public domain, the sale flew in the face of the intentions of the late Charles Turner, who

had donated his collection to the university in 1968. They feel somewhat vindicated by the review's findings, but are disappointed that "Keele University still hasn't accepted that it made grave errors of judgment and management," as John Fauvel, a member of the British Society for the History of Mathematics, puts it. Meanwhile, some sources say that much of the Turner collection went to Microsoft Corp cofounder Paul Allen, who was also the anonymous buyer two years ago of the 10th-century Archimedes palimpsest.

Nuclear accident victim dies. Of the three workers present when a uranium solution went critical at a nuclear fuel reprocessing plant on 30 September in Tokaimura, Japan (see PHYSICS TODAY, December 1999, page 52), Hisashi Ouchi, 35, was the

Middle East Synchrotron Project Moves Ahead

Funding has been found for dismantling Germany's synchrotron light source BESSY I. The pieces will be carefully packed and tracked in preparation for putting the facility back together somewhere in the Middle East (see PHYSICS TODAY, August 1999, page 54).

Meeting a Christmas Eve deadline imposed by the German government, in December the eleven member countries of SESAME (Synchrotron-light for Experimental Science and Applications in the Middle East) each pledged \$20 000 toward the synchrotron's orderly disassembly, documentation, and packing. The US and Sweden also plan to contribute, and Koichiro Matsuura, the new director general of the United Nations Educational, Scientific and Cultural Organization (UNESCO), which is serving as midwife to the project, has kicked in \$400 000. The German government can now formally approve the gift, says Herwig Schopper, a former director of CERN, and chair of the SESAME interim council. "They wanted assurance that people are really engaged in the project."

The immediate financial crunch has been met, but the SESAME participants still need to come up with about \$21 million to move, set up, and upgrade the synchrotron. Then, over the next few years, they'll have to find the same amount again to build beamlines and user laboratories. "One step at a time," says Schopper. "I have asked project delegates to work on their governments to redirect some of the funds which have been promised [in aid from other countries]—for water projects and other things—to SESAME."

In the meantime, seven governments have formally bid to host

SESAME. The seven—Egypt, Iran, Jordan, the Palestinian Authority, Turkey, and new members Armenia and Oman—have proposed a total of 18 sites. "All of the sites would fulfill the technical conditions for the establishment of an international center," says Schopper. "So political and financial considerations will be taken into account."

Delegates from SESAME member countries—which, in addition to those that have submitted site proposals, include Cyprus, Greece, Israel, and Morocco—will choose the final site. They've all committed to participate in SESAME's activities regardless of where the facility ends up. A final decision is expected by June.

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WHERE MIGHT SESAME OPEN? Jordan's King Abdullah II (second from right) proposed that his country host SESAME after he and Prince Ghazi ben Mohammad (far right) met last fall with the SESAME interim council chair, Herwig Schopper (left), and UNESCO's Maurizio Iaccarino. (Courtesy of the Jordanian Royal Court.)