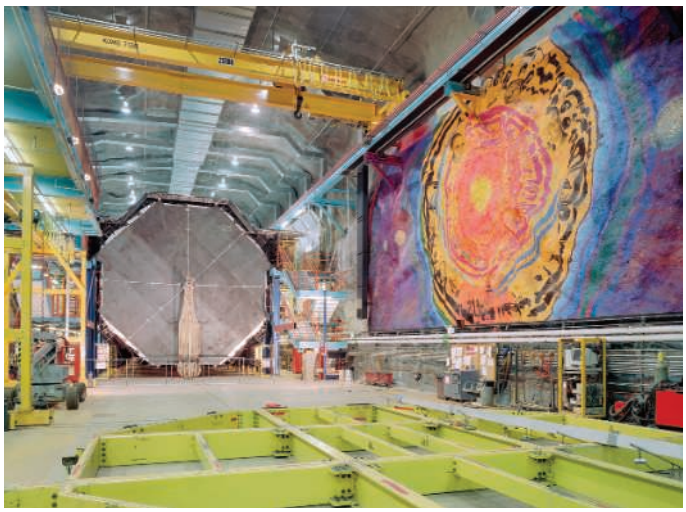
NEUTRINO PHYSICS

Fermilab Experiment Shoots the Muon

BATAVIA, ILLINOIS—Nobody along the 700-kilometer beamline will notice the trillions of particles zooming underfoot—but scientists are certainly taking notice. Last week, a new experiment at the Fermi National Accelerator Laboratory (Fermilab) began sending neutrinos from an accelerator here to a detector deep underground in a Minnesota iron mine. Physicists working on the detector, known as NuMI/MINOS, have high hopes that the experiment will soon eclipse a similar one in Japan and put the most stringent limits on several properties of the mysterious neutrino.



Bull's-eye. Steel plates in an underground lab in Minnesota are designed to capture neutrinos from Fermilab, 700 kilometers away.

"Within a few years of running, we should have of the order of 10,000 events," says Stan Wojcicki, co-spokesperson of MINOS, referring to particle detections. For comparison, the previous best long-distance neutrino-beam experiment, the Japanese K2K, has seen roughly 100 events in the past 6 years (*Science*, 2 November 2001, p. 987). "By summer, we may have a result comparable or even better than K2K," he adds.

At a ceremony at Fermilab last week, Speaker of the House Dennis Hastert (R–IL) officially launched the experiment. "With the launch of this project, Fermilab has positioned itself for the future," he said, shortly before pressing a button on the laptop and getting NuMI/MINOS under way.

NuMI refers to a beam at Fermilab that creates muon neutrinos—nearly massless elementary particles that occasionally change varieties (or "oscillate") into other flavors of neutrino. To create these neutrinos, scientists divert high-energy protons, which ordinarily feed the Tevatron atom smasher, and send them to a graphite target. The protons hit the graphite, creating pions, which are then focused into a beam by two magnetic horns and release muon neutrinos when they decay. Because neutrinos barely interact with matter, most of the muon neutrinos sail through Earth toward Minnesota and out into space. A few times a day, however, one of them strikes an atom in the MINOS detector—a 6000-ton lump of steel plates with scintillator panels sandwiched in between, shielded from stray particles and cosmic rays by nearly a kilometer of overlying rock. When that happens, the neutrino tends to release a muon, which zooms through a few dozen steel plates before running out of steam. The scintillators flash with light when the muon passes through; by tracking the flashes, scientists can figure out the properties of the neutrino that created it.

Sometimes the beam from Fermilab brings electron neutrinos or tau neutrinos, the results of oscillations. By comparing the number of muon neutrinos produced at the source with the number that reach the Minnesota mineshaft, physicists can figure out how often the muon neutrinos change flavor. This, in turn, reveals the mass difference between two varieties of neutrino, as well as one "mixing angle," a value that describes the fundamental makeup of neutrinos (*Science*, 12 July 2002, p. 184).

Because of the large number of neutrinos produced at Fermilab as well as the bulk and sensitivity of the MINOS detector, physicists believe that NuMI/MINOS will yield orders of magnitude more information about neutrino properties than similar experiments performed in the past. "This is really a new regime in neutrino physics," says Robert Plunkett, deputy project manager for NuMI. "It's a very hot beam. It has to be to do this."

Fermilab's outgoing director, Michael Witherell, says the NuMI/MINOS project, some proposed neutrino follow-ons, and a bid to design and build a huge linear accelerator known as the International Linear Collider (ILC) are the keys to the lab's future. "Neutrinos and the ILC are the headline items," he says. **–CHARLES SEIFE**

CREDIT: FERMILAB PHOTO

ScienceScope

Battelle Bows Out of Race to Run Los Alamos Lab

Battelle won't compete for the management contract of Los Alamos National Laboratory, the nonprofit corporation said this week. The withdrawal of the Columbus, Ohio, research giant, which currently manages five Department of Energy (DOE) labs, is good news for the University of California (UC), which has managed the New Mexico facility since its inception 62 years ago. UC is expected to seek another term; other rumored players include Northrop Grumman and General Atomics.

UC's contract expires on 30 September, and DOE plans to release the official request for contract bids shortly. In the wake of complaints from Capitol Hill over the equity of the bid process, DOE recently changed the proposed contract language to require that the new contractor must create a new corporate entity and separate pension fund. The changes, which would dull UC's strengths, have been criticized by New Mexico legislators who want to preserve UC's generous retirement benefits.

Nevertheless, says a former Los Alamos manager, "at this stage UC is still the big entity." **–ELI KINTISCH**

Italian Science Agency Gets Revamp

ROME—A sweeping overhaul of Italy's main science funding agency—the National Research Council (CNR)—will give the system "a more structured approach" and align scientists' work with national goals, research minister Letizia Moratti told *Science* this week. The changes, due to take effect at the end of this month, will group all existing research under 85 "strategic programs." Scientists say they're concerned that the scheme will favor applied research, especially projects endorsed by industry. Moratti insists that fundamental science will be protected, noting that the Berlusconi government has put investigator-driven research on a permanent legal foundation. But some CNR scientists and officials are furious with the new layers of bureaucracy and centralization of power.

Headed by Fabio Pistella, who took office last autumn, CNR will get increased power in its 11 central departments, which will oversee the 108 individual institutes of the old CNR. Contrasting this approach to the U.S. model, one high-level source commented that it "would be unimaginable" for the government to tell the National Science Foundation "what to do." **–SUSAN BIGGIN AND JACOPO PASOTTI**

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leukemia that contained insertions in both *LMO2* and *gamma c*, the gene corrected by the X-SCID therapy (*Science*, 16 January 2004, p. 333). The two genes seem to "cooperate" in causing cancer, Davé said, suggesting that gene therapy for diseases not involving *gamma c*—which itself may be oncogenic when expressed by a retrovirus—may be safer.

Indeed, panelists noted, no leukemia cases have yet been seen in trials of ADA-SCID, which does not involve the *gamma c* gene. Nor have leukemias appeared in an X-SCID trial in the United Kingdom that has treated 7 patients. However, the French leukemias appeared roughly 33 months after treatment, and the U.K. patients have not reached that point.

The panel concluded that if two X-SCID trials now on hold in the United States resume, they should enroll only children who have failed bone marrow transplants. "That's going to be a very small number," said panelist Daniel Salomon of the Scripps Research Institute in La Jolla, California. But the panel suggested FDA could lift its hold on a U.S. trial for ADA-SCID. Researchers will be watching closely to see whether any leukemia cases turn up in the British trial. If not, "that would certainly change things" because it would suggest conditions specific to the French trial are leading to the leukemias, concluded Rao.

–JOCELYN KAISER

PALEOANTHROPOLOGY

Skeleton of Upright Human Ancestor Discovered in Ethiopia

Scientists working in the remote badlands of Ethiopia have found the oldest known skeleton of an upright walking hominid, roughly dated to nearly 4 million years ago. The remarkably preserved partial skeleton includes many bones of the pelvis, leg, back, and arms, as a team led by paleoanthropologists Yohannes Haile-Selassie and Bruce Latimer of the Cleveland Museum of Natural History in Ohio announced last week at a press conference in Addis Ababa, Ethiopia.

Early walker. The owner of this shinbone walked upright in Ethiopia 4 million years ago.

CREDIT: ANTHONY MITCHELL/AP PHOTO

The shape of the top of the lower leg bone and pelvis have already convinced the discoverers that this hominid walked on two legs, which is the traditional hallmark of being a member of the human family rather than an ancestor of apes. "It's a once-in-a-lifetime discovery," says Haile-Selassie.

The skeleton so far also includes precisely the anatomical parts below the neck that can allow scientists to distinguish whether it walked like a modern human or in a more primitive manner. "It's a monumentally important skeleton, a real key to understanding hominid origins," says paleoanthropologist Carol Ward of the University of Missouri, Columbia, who cautions that she has not seen the as-yet-unpublished skeleton. "The bits from the skeleton are exactly the pieces we need to see if we came from something like a chimp or something more primitive."

The skeleton was found on 10 February near the village of Mille in the central Afar Depression, where a sharp-eyed fossil hunter named Alemayehu Asfaw spotted an elbow bone. Soon team members found the other part of the arm bone, the pelvis, leg bones, ribs, vertebrae, clavicle, and scapula. Extinct pigs found with the skeleton suggest that it lived 3.8 million to 4 million years ago, a critical time when humans were evolving the ability to walk. The team is now dating samples of volcanic rock taken from layers above and below the fossil and studying fragmentary fossils, including leg and toe bones, from 11 other individuals.

The identity of the new skeleton is still unclear, in part because the specimens are still embedded in matrix and also because most of the known fossils of this age are so fragmentary. There are only four other partial skeletons of human ancestors older than 1 million years. Contenders for the new skeleton's identity include the slightly younger *Australopithecus afarensis*, whose most famous member is Lucy, a partial skeleton that lived 3.2 million years ▶

ScienceScope

Brazil OKs Stem Cell Work

The way is clear for Brazilian scientists to work with human embryonic stem (ES) cells. On 3 March, the Brazilian legislature passed a wide-ranging biosecurity bill that legalizes work with the cells, sending it to President Luiz Inácio Lula da Silva for his signature. It allows scientists who receive permission from a national ethics board to work with existing ES cell lines and to derive new ones from frozen embryos left over after fertility treatments. It also outlaws nuclear transfer experiments using human cells.

Geneticist Mayana Zatz of São Paulo University says she hopes to begin work soon on muscle and nerve studies using ES cells. The bill also allows for the sale of genetically modified seeds.

–GRETCHEN VOGEL

New Trade Rules on Sturgeon

The world's most valuable fish—the beluga sturgeon, a target of human predators who sell its eggs for $100 an ounce—may get help from the U.S. Fish and Wildlife Service (FWS). Officials ruled last week that nations wishing to continue selling beluga caviar to the United States (which consumes 80% of legal exports) must file plans with FWS in 6 months showing how they will stem the species' decline. Those that don't comply will face a trade ban on the fish. Most directly affected are Kazakhstan, Iran, and Russia. Environmentalists decry the new rule, urging an immediate U.S. import ban.

–CHRISTOPHER PALA

Insider Nominated to EPA

A nominee to lead the Environmental Protection Agency (EPA) has succeeded in gaining the unlikely support of both environmentalists and industry groups.

Last week President George W. Bush chose Stephen Johnson, 53, to replace Michael Leavitt as head of EPA. Johnson, who holds a master's degree in pathology, would be the first administrator with scientific training.

Those pleased by the decision include the Environmental Working Group and a pesticide trade group called CropLife America, both based in Washington, D.C.

"He's coming into the job with a stronger grasp of the science than any past administrator," says Lynn Goldman of Johns Hopkins Bloomberg School of Public Health in Baltimore, Maryland. The main question, she adds, is whether he will have any clout in the White House.

–ERIK STOKSTAD

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