containing genetically modified ingredients, starting later this year. But again, the plan has infuriated U.S. authorities. "The proposed [labeling] regulations have a questionable scientific basis and are ambiguous and impractical," says USDA's Galvin.

Biotech firms go public

Concern about public opinion has led the U.K. government to establish a new panel to develop public consultation on the future of the biosciences. Britain, which held the presidency of the EU for the first half of this year, championed the need to bolster biotechnology. The science minister, John Battle, told a special conference in Brussels in June that issues of public perception had to be addressed. "The debate about biotechnology is still to be won," he said. And Tom Wakeford, a member of the new consultation panel, says it will have to be careful to allow the public to distinguish between genetic engineering directed toward medical, as opposed to agricultural, applications. "There are fundamental differences in each case as to who are the risk takers and who are the beneficiaries," he says.

The biotechnology industry has also begun to take its case to the public. Monsanto has been running a newspaper advertising campaign in Britain and France, which now backs European calls for labeling of genetically modified products. In Britain, the BBSRC has launched a touring exhibit, In-gene-ious, to raise public awareness about biotechnology. Spokesperson Monica Winstanley says the stand has attracted a great deal of interest from farmers and the public wanting to know more about the technology. "We're trying to get to the bottom of what people are concerned about—concerns that are amenable to a realistic response." How the technology has been handled by the multinational companies is one perceived problem, she says. But some protesters have tried to block the message: At Britain's premier agricultural show last month pots of genetically modified wheat were attacked.

But in spite of current stiff resistance, even the European states that have taken the hardest line are keeping the door slightly ajar. "We don't, in principle, oppose the development of biotechnology," says Georg Rebernig, a member of the Austrian representation to the EU in Brussels. "Our concern is that there is greater transparency and harmonization on risk assessment," he says. "The biotechnology industry has huge potential, but it can't force products down people's throats. It's vital the industry does everything possible to regain the trust of the people."

Others also believe the industry can reverse its current fortunes in Europe. "Our view is that we need more time to do more research on the wider impacts of genetically modified crops. This first generation of crops can be seen as quick and dirty. We'd like to see more sophisticated gene modification of crops and their assessment to show that they don't damage the environment," says Johnson of English Nature. "We support the development of genetically modified crops that can bring environmental benefits."

–NIGEL WILLIAMS

RADIO ASTRONOMY

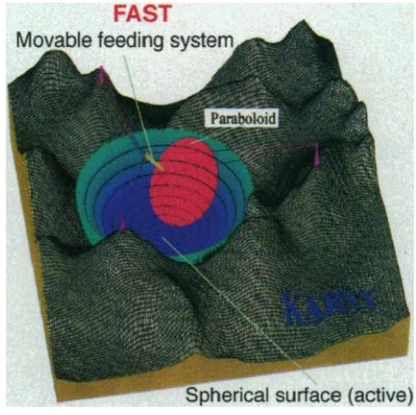
China Hopes to Move FAST on Largest Telescope

Chinese astronomers have the go-ahead to design a 500-meter dish that they hope will anchor a major international project

BEIJING—The terrain in southwest Guizhou Province—hundreds of round depressions, each surrounded by hills a few hundred meters high—already looks like a scene from another world. If astronomers get their wish, it will someday sprout a collection of instruments that would make it look even more like the backdrop to a science fiction movie.

China has embarked on a project to build the world's largest radio telescope, a spherical dish 500 meters in diameter, in this haunting landscape. The facility could make China a major player in the field. "Perhaps we can even achieve something that will bring a Nobel Prize to China," says project director Peng Bo of the Beijing Astronomical Observatory. But Chinese scientists are hoping for even more: They see the telescope as the forerunner of a billion-dollar, internationally funded radio array that would probe the very earliest stages of the universe.

Astronomers around the world are looking on with interest. Several years ago, an international team of astronomers began putting together plans for such an array, a cluster of instruments that, in combination, would form a collecting area 1 kilometer on a side. Operating at wavelengths of several centimeters to a meter and at frequencies up to 10 gigahertz, the array would be able to peer back in time, looking for traces of atomic hydrogen, the building block of the universe, which emits a very weak spectral line at a wavelength of 21 centimeters. It could also probe for heavier molecules, including carbon dioxide, that indicate star formation, as well as exotic objects such as pulsars and the physics of black holes.



YAN *ET AL.* / FAST PROJECT GROUP

Natural advantage. China's proposed radio telescope could be forerunner of a massive array that makes use of the unusual landscape.

But such collecting power doesn't come cheap. The reigning individual heavyweight of radio astronomy, a 305-meter dish in Arecibo, Puerto Rico, run by Cornell University for the National Science Foundation, would cost about $100 million to replicate. And the square-kilometer array—with a collecting area of 1 million square meters—would require roughly 25 such dishes. (Arecibo has an effective collecting area of 40,000 square meters.) "There is nothing in the square-kilometer array that can't be done, from a technical perspective, except that it would cost many billions of dollars," notes Britain's Peter Wilkinson of the University of Manchester observatory at Jodrell Bank. So finding ways to save money is critical.

Enter Guizhou. Its plentiful limestone formations, called karsts, provide naturally occurring bowls in which the large receiving dishes can be suspended. "The geology is similar to Arecibo, and they have the largest number of such depressions anywhere in the world," says Richard Strom of the Netherlands Foundation for Radio Astronomy, who has visited the site and has been active in planning the array. Having an existing hole in the ground reduces construction costs by as much as 90%, estimates Wilkinson. Still, the costs of scaling up are formidable. "It's a huge global undertaking that's unlikely to be decided before 2010," says Wilkinson.

Chinese officials have decided not to wait before taking the first step, however. This spring, the Ministry of Science and

Technology approved $800,000 for preliminary work on a 500-meter spherical telescope, known as FAST. The money is widely seen as a downpayment on the $10 million facility, which would have twice the sensitivity and sky coverage of Arecibo at a fraction of the cost. If the design phase goes well, scientists hope to earn a place on the government's list of megascience projects that it will fund in the next 5-year plan, which begins in 2000. FAST, they hope, would then be the prototype for the square-kilometer behemoth later in the 21st century.

First, however, the scientists must overcome several logistical problems. Although a parabola is the preferred shape for a movable dish because it can focus radiation of any length at a single point, FAST—the size of 16 football fields—is too large to rotate. Instead, it will use a fixed, spherical reflector, which makes positioning easier by providing identical views along any axis. However, a sphere focuses radiation along a line rather than at a point. To gather the radiation, Arecibo, which also has a spherical dish, uses a long, rodlike waveguide suspended above the dish and kept rigid by a 160-ton platform. Such a waveguide can handle only a narrow range of radiation, however, so Arecibo recently added two special correcting mirrors to focus the radiation to a point, allowing the telescope to operate across a broad spectrum. But it's an expensive technical fix.

The Chinese design embodies a lightweight and less costly solution that, in effect, would turn the spherical dish into a parabola. The idea is to build the dish with hexagonal elements, roughly 12 to 15 meters on a side, that could be independently adjusted. "At this size, the difference between a parabola and a circle is only a few feet," says Strom. Differing combinations of panels would be rearranged as the telescope tracked objects moving across the sky.

The design also modifies the system used at Arecibo and other facilities to collect and amplify the signal before it is processed. (That system, called a feed, moves in tandem with the illuminated part of the reflecting surface.) Lasers will accurately detect the position of the feeding system in real time, and the information will be sent back to the central computer.

More than 40 scientists from research institutes and universities across the country are now working on FAST. "Technologically, we can make the telescope all by ourselves," says Peng. "But we would welcome foreign collaboration." Once the telescope is built, China hopes to convince the international science community that Guizhou, with its geography and its isolation from sources of electronic interference, is an ideal place to build the square-kilometer array.

Long before then, however, foreign scientists say that an operational FAST would provide a big boost for Chinese astronomy. "China would leap to the forefront of radio astronomy," says Wilkinson, part of a delegation from the British Royal Astronomical Society that is scheduled to visit next month. "And people seem to be very impressed with what they've seen so far." —LI HUI

With reporting by Jeffrey Mervis. Li Hui is a reporter for *China Features* in Beijing.

RUSSIAN MUSEUMS

Fight Erupts Over Rights to Profits From Holdings

Zoological Institute leads resistance to efforts by Russian Academy of Sciences to share revenue from exhibits and specimens with a new commercial agency

Russia's premier zoological institute is battling its parent body over control of an important source of research funds—revenue from traveling shows and products that showcase its vast holdings. The fight pits the Zoological Institute (ZIN) in St. Petersburg and like-minded institutes against a new agency of the Russian Academy of Sciences (RAS) called the International Academic Agency (IAA) Nauka. The outcome could affect not only ZIN's 15,000,000 holdings, including a prized mummified baby mammoth named Dima that was unearthed in 1977, but also the operations of dozens of other state-owned institutions struggling to adapt to the free market.

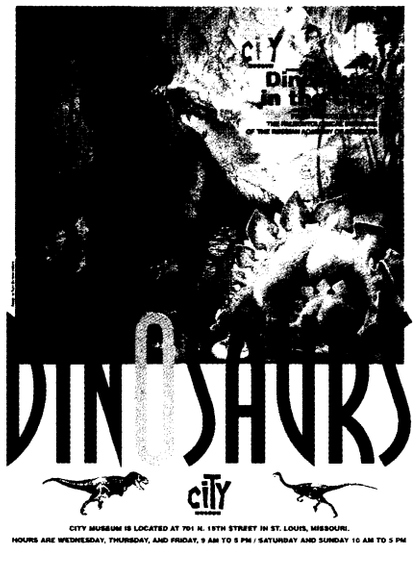
Nauka was created last year after RAS's leadership declared that its "museums, various precious collections, archives, and libraries" were "realizing only feebly" the possible revenue from copies, molds, models, and secondary samples of their collections. RAS set up the agency as a joint venture with Pleiades Publishing Inc., a U.S.–based firm that invested $245,000 in start-up funds. Institutes must receive permission from the academy's presidium to organize any exhibition that bypasses Nauka.

IAA Nauka director Nikolai Parin says that by scouting out new opportunities for exhibitions or by putting together shows involving material from several institutes, his agency should boost revenue flowing into museum coffers. "The whole is always greater than the parts," says Parin, who adds that his agency's cut will vary, depending on the agreement. "We're looking forward to collaborating with every RAS museum, and we hope we will." Some 50 museums are on Nauka's list of potential clients.

But researchers at some RAS institutes aren't convinced. ZIN officials say they fear that Nauka will take a big bite out of scarce revenue that supports ZIN's museum. For example, a 1996 exhibition in Germany commemorating the life of naturalist George Steller, discoverer of the sea cow that now bears his name, netted ZIN 20,000 German marks worth of high-quality microscopes. ZIN argues that Nauka, with the academy's blessing, intends to transform Russia's vast scientific collections into mere commodities, and that Nauka's commercial partner, Pleiades Publishing, stands to profit from Russia's precious collections. "To turn these treasures into property—it is a crime!" says Roald Potapov, director of ZIN's museum.

ZIN director Alexander Alimov has retained legal advisers to help the institute force major changes to the 10-year deal offered by Nauka. One of the lawyers, Konstantin Isakov, says the proposed agreement that Nauka has floated to ZIN and other institutes conflicts with Russian laws on "export of cultural values" and on "guarding cultural monuments."

To make their point, ZIN officials cite the experience of a sister organization, Moscow's Paleontological Institute. PIN has been mired in lawsuits, investiga-



CITY MUSEUM/BUCK COMMUNICATIONS

Curtain closer. St. Louis show was last that Paleontology Institute could broker on its own.