RUSSIA

Gallium Sell-Off Threatens Detector

MOSCOW—An extraordinary confrontation between scientists and a Russian government ministry is taking place at a mine in the north Caucasus. Deep underground, the Soviet-American Gallium Experiment (SAGE)—one of the largest collaborative research projects between the two countries—has been measuring neutrinos from the sun's nuclear processes since the mid-1980s. But a government effort to confiscate the detector's 60 tons of ultrapure gallium, a valuable metal that researchers suspect would be sold to pay salaries in cash-strapped state businesses, could end SAGE's vigil.

With the help of Vladimir Fortov, a deputy prime minister until mid-March, when he was made minister of science, researchers managed to stave off the threat when officials showed up unannounced at the site in February. But talks between research representatives and officials of the ministry of fuel and power-production industries—which is carrying out the order—are at an impasse. Confiscation of the gallium, the Russian head of the SAGE collaboration, Vladimir Gavrin of the Institute of Nuclear Research (INR) in Moscow, wrote in a letter to Fortov, "would mean the ruin of the [neutrino] telescope and the Baksan neutrino observatory as a whole." U.S. collaborators at Los Alamos National Laboratory also wrote to Fortov expressing their alarm at the situation.

SAGE is one of two solar neutrino detectors built in the 1980s to try to resolve a major crisis for solar theorists. When the first generation of detectors began capturing solar neutrinos in the late 1960s, they detected only one-third of the number of neutrinos predicted by theory, casting doubt either on theorists' models of the sun's interior or particle physicists' understanding of neutrinos. These early detectors, however, could not pick up the low-energy neutrinos from the sun's primary power source, the fusion of hydrogen into helium—only those produced in tertiary nuclear reactions of heavier elements. SAGE and its rival GALLEX, in the Gran Sasso laboratory beneath the Italian Apennines, were designed to see whether the solar neutrino problem extends to proton fusion.

Both detectors rely on gallium, because a low-energy neutrino from proton fusion can transform a gallium nucleus into radioactive germanium-71, which can later be extracted from the detector material and counted. The GALLEX team opted to use gallium chloride, but in the late 1970s, a team at INR developed a technique for extracting tiny amounts of germanium-71 from pure gallium. In 1979, researchers persuaded the Soviet government to increase gallium production from 1 ton to more than 5 tons a year so that 60 tons of the metal could be made into a neutrino detector. In return, they promised to keep the gallium intact as a national reserve of the metal, which later could be used by the defense and electronics industries. The project got another boost in 1986, when the United States agreed to collaborate on the project and eventually contributed $9 million to the experiment's $60 million cost.

The first results of both SAGE and GALLEX, published in the early 1990s, confirmed the reality of the solar neutrino crisis, but researchers say there is much more science to be done. SAGE's ultimate aim is to keep running up until 2002, so that it can look for possible variations in neutrino flow during the 11-year cycle of solar activity.

In February, however, officials from an experimental chemical metallurgic plant of the Institute of Rare Metals came to the SAGE site under orders from the ministry of fuel and power-production industries to confiscate the gallium. The government order for the fuel ministry to seize the gallium came from the Cabinet level and appears to contravene rules covering the movements of national reserves. The fuel ministry has refused to state publicly what it intends to use the gallium for. "I can only guess that it is meant to be sold abroad," Gavrin told *Science*. "Its minimum price on the market is $200 per kilogram."

The researchers' reaction, however, was unequivocal: They refused to give up the gallium and stated that they would rather burn themselves in the mine shaft than let the plant officials take the metal. Observatory administrators immediately informed Fortov, emphasizing the threat not only to the experiment but to the gallium reserve. "During construction, the metal was highly purified and stored deep underground to protect it from radioactive contamination. This makes it a unique material for further research," wrote Gavrin.

As a deputy prime minister, Fortov was able to halt the order on 6 March. On 14 March, however, first Deputy Prime Minister Alexey Bolshakov issued a new order, calling for the removal of a smaller amount of gallium—7 tons. Bolshakov later lost his government seat in a Cabinet reshuffle, but the threat of this second order also hangs over SAGE.

Last week, Fortov met with representatives of the fuel ministry, the chemical metallurgic plant, and the Russian Academy of Sciences. Each side stuck to its original position, and the fate of SAGE still hangs in the balance.

–Andrey Allakhverdov and Vladimir Pokrovsky

Allakhverdov and Pokrovsky are writers in Moscow.

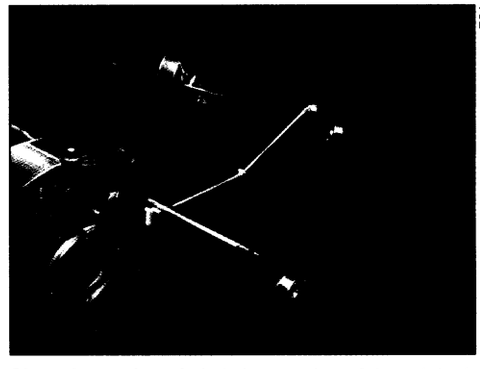
SPACE SCIENCE

Resurrected Cluster Gets the Green Light

PARIS—Ten months ago, European space scientists saw one of their most important projects disappear in a fireball when Europe's Ariane 5 rocket, carrying a quartet of satellites called Cluster, exploded on its first voyage. Last week, they got some good news: A key European Space Agency (ESA) committee gave final approval for a plan to launch a full complement of replacement satellites in 2000.

The Cluster mission is composed of four probes designed to fly in formation around Earth mapping its magnetosphere in unprecedented detail. Since the explosion, however, ESA has struggled to find funding for a second try, and it has mulled proposals for scaled-down versions of the project. Last December, ESA proposed freeing up funds for a full Cluster mission by pushing back launch dates on future missions, but three countries—France, Germany, and the United Kingdom—were unwilling to ante up a total of $45 million to replace the scientific payload.

The project was given a new lease on life when ESA's science program committee announced two measures last week: The agency will finance about 40% of the scientific payload—relieving some of the burden on the three reluctant space agencies—and it will cap the mission's cost at $248 million. The extra $20 million ESA is providing for the payload comes in part from raiding an $11.5 million contingency fund, and the rest by using spare parts from the four satellites that were destroyed. "It is an exceptional measure," says John Credland, former Cluster project manager and now act-



ESA

Close formation. Artist's impression of the original Cluster spacecraft mapping the magnetosphere.