you could have any other interpretation" than an impacting meteorite that carried in the noble gases. "There appears to be an extraterrestrial component in the [P-T] boundary layer," agrees Pepin. "I think they've demonstrated that rather convincingly." Still, even noble gas workers want to see more. "This result needs to be replicated by somebody else," says Farley, "as any such measurement does."

–RICHARD A. KERR

ASTROPHYSICS

New Headaches for U.S.–Russia Experiment

MOSCOW—A tug-of-war over 60 tons of precious gallium is threatening to undermine a major neutrino experiment. This week, officials at the Baksan Neutrino Observatory in Prielbrusye are asking a court to stop a government order to sell off some of the liquid metal, which serves as an underground detector. It's the latest round in a long-running battle over the fate of the material, which has a market value of $500 to $600 per kilogram.

Under siege. Major solar neutrino detector may be shut down early if court affirms gallium sale.

A child of the Cold War, the $60 million Soviet-American Gallium Experiment (SAGE) is one of the largest collaborations between Russia and the United States. Its 60-ton gallium detector sits in a mine shaft in the Caucasus, deep below Mount Andyrchi. Run since the mid-1980s by Moscow's Institute for Nuclear Research, the detector studies neutrinos streaming from the sun. Low-energy neutrinos can transform gallium nuclei into germanium-71 atoms, which are extracted and counted. SAGE is best known for confirming an unpredicted shortfall of solar neutrinos.

The tussle over the silvery white metal began in 1997, when the Ministry of Fuel and Power Production asked the Cabinet for permission to sell the gallium, at a third of its market value, to Russia's State Research, Development, and Design Institute of Rare-Metal Industry (GIREDMET) plant in Moscow. It presumably would resell the gallium to foreign buyers—it's used in gallium-arsenide semiconductors—and reap the profits (*Science*, 11 April 1997, p. 193). SAGE officials caught wind of the impending gallium grab and organized a protest letter from 12 Nobel laureates to then–Prime Minister Viktor Chernomyrdin, followed by an appeal from U.S. Vice President Al Gore. The strategy worked: Chernomyrdin halted the transaction.

Later that year, however, a deputy prime minister decreed that at least 7 tons of gallium should be handed over to the fuel ministry. Project scientists resisted, arguing that the detector's sensitivity would be so diminished that the experiment would no longer be worth running. (It's slated to continue through next year.) Shortly after, thieves bungled an attempt to break into the observatory and steal the gallium (*Science*, 14 November 1997, p. 1220).

Last summer, President Vladimir Putin told Prime Minister Mikhail Kasyanov to review that order, which had not been carried out. In the meantime, the fuel ministry and the GIREDMET plant lodged a complaint against Baksan, arguing that observatory officials were interfering with efforts to procure and sell 7 tons of gallium. In December, the Arbitration Court in Moscow ruled for the plaintiffs; a hearing on the observatory's appeal was scheduled to begin on 22 February.

But the GIREDMET plant isn't waiting for the court's decision, which could take weeks. Earlier this month, GIREDMET experts, who accuse Baksan officials of "squandering," or hoarding, the gallium, showed up to measure the metal while escorted by local police. The process involves removing the liquid from its tank and weighing it. Partway into the exercise, however, the GIREDMET team gave up and read the calibration marks on the tank.

Vladimir Gavrin, Baksan's director, believes that he has smoothed things over with local authorities: "Very soon, the militia understood that there was no squandering of the gallium, and we started to treat each other with respect." But he can't say the same for the GIREDMET staff, who he claims were intent on finding some infraction that could be used to justify the gallium's removal.

If the observatory loses its appeal, Gavrin says that his last hope is a government decision to rescind the order.

–VLADIMIR POKROVSKY AND ANDREY ALLAKHVERDOV

Pokrovsky and Allakhverdov are writers in Moscow.

ENDANGERED SPECIES

West's Energy Woes Threaten Salmon Runs

The combination of a dry winter and a power shortage could be bad news for endangered salmon in the Pacific Northwest. Last week, California's energy crisis forced the Bonneville Power Administration (BPA), the region's energy supplier, to exceed federal guidelines for the release of water through its turbines. But with reservoir levels already low, the utility might not have enough water available this spring and summer to help juvenile salmon on their run to the sea.

"What we see time and time again is that when the going gets tough, fish take it on the chin," says Rob Masonis, who heads northwest conservation efforts at American Rivers in Seattle. "That's untenable and irresponsible. We need a real commitment to salmon recovery in the region, not just a few museum fish in the river," he says.

BPA spokesperson Dulcy Mahar concedes that the spring water releases may fall short, but says that the agency has no choice. BPA is required to supply power to its customers. In this case, releasing extra water was the cheapest way to do it. "We are seeking to appropriately balance the needs of fish and electricity consumers during a serious drought," says acting BPA administrator Steve Wright.

In normal years, BPA buys power from California suppliers during the cold winter months, when demand peaks in the Northwest, and sells it back to California in the summer, when demand peaks there. This year, however, California hasn't had a megawatt to spare. What's more, because of low rainfall and smaller-than-normal mountain snowpacks, BPA's system of 29 federal dams has been able to generate only about 80% as much power as usual. The agency has been forced to buy the excess at market rates, at up to 10 times the usual price, putting a big dent in reserves earmarked for repaying its federal mortgage. Says Mahar:

CREDITS: (TOP TO BOTTOM) COURTESY OF THE SAGE COLLABORATION; BPA

Thirst for power. Dam spills to generate more electricity this winter may threaten salmon runs in the spring.

"The stability of BPA is at risk."

Ironically, these developments come on the heels of a decision in December that was intended to balance energy and environmental needs. Choosing not to back a plan to breach four dams on the Snake River to aid salmon recovery, President Clinton instead ordered several agencies to coordinate efforts to increase water releases from reservoirs in the spring and summer. The releases were meant to be part of an overall plan to speed and cool rivers to aid fish migration, restore damaged habitat, limit fishing, and prevent the overproduction of hatchery-reared fish, which can replace wild stocks.

It's now unlikely that those spring guidelines will be met. After declaring an energy emergency twice this winter, BPA has increased water flows at some dams by as much as 60%. Although the need for excess releases should end as winter ebbs, Mahar says that they may reduce springtime river flows by 1.5%.

BPA fisheries biologist Bill Maslen doesn't think that the small drop in flow will have much effect on juvenile salmon migration. But Chris Ross, a fisheries biologist with a National Marine Fisheries Service (NMFS) office in Portland, Oregon, says they make an already bad water year even worse for the salmon. "We're in the thick of trying to figure out what it means," says Lynn Krasnow, another fisheries biologist at NMFS.

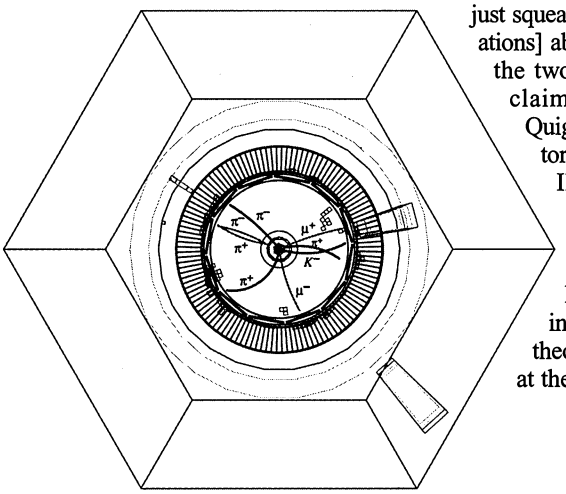
Even a season of good rains, however, is unlikely to make the problem evaporate. It will be years before power plants fueled by natural gas, now under construction in California, Oregon, and Washington, come on line. That leaves hydropower with the burden of filling the energy demand for a growing region—and of keeping its salmon population afloat. **–ROBERT F. SERVICE**

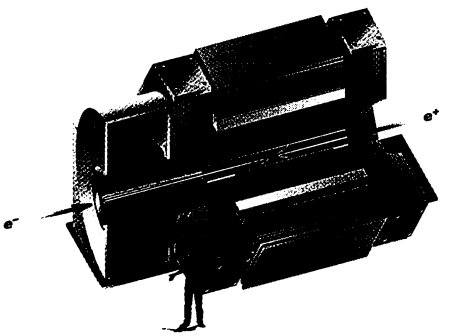
HIGH-ENERGY PHYSICS

B-Meson Factories Make A "Number From Hell"

SAN FRANCISCO—Humanity—and everything else in the universe—exists because matter and antimatter forged in equal amounts during the big bang may have decayed into slightly different sets of particles, giving matter a competitive edge. This tiny imbalance of one part per billion arose from a process called charge-parity (CP) violation, and there's a vigorous debate among particle physicists about its origin. New data reported here last week* at the annual meeting of the American Association for the Advancement of Science are at odds with the imbalance predicted by the reigning model of particle physics—but not by enough to settle the argument. "It's the number from hell," says Stewart Smith, a physicist at the Stanford Linear Accelerator Center (SLAC) in California, home to one of the two experiments.

Physicists discovered a simple form of CP violation in 1964 within the decays of K mesons, which are short-lived mixtures of matter and antimatter. For the last 2 years, teams at SLAC and the High Energy Accelerator Research Organization (KEK) in Tsukuba, Japan, have probed for a deeper signal of CP violation in B mesons, the heavy brothers of K mesons. Special machines dubbed "B factories" create tens of millions of B mesons by smashing electrons into their antimatter counterparts, positrons. However, only about one out of 10,000 collisions are "golden events"—pairs of B's and anti-B's that spawn an easily measurable spray of certain mesons and offer the clearest signature of CP violation. As of January, physicists had seen 630 such events at SLAC and 260 at KEK.





Hard to B sure. Particles (*above*) fly from an electron-positron smash inside the Stanford Linear Accelerator Center's B-meson detector (*right*). Analysis of 630 such "golden events" reveals a tantalizing but inconclusive difference in the properties of matter and antimatter.

CREDIT: BABAR COLLABORATION/STANFORD LINEAR ACCELERATOR CENTER

That's enough for a preliminary analysis, reported SLAC physicist Patricia Burchat. The Standard Model, which describes nature's basic particles and their interactions, predicts that the dimensionless value of CP violation should be 0.72 on a scale from –1 to 1, in which 0 represents symmetry between matter and antimatter. SLAC's value to date is 0.34, but the error range is large: ± 0.20. That means there's a 5% chance (twice the error bar, or two standard deviations) that the real value could match the prediction of the Standard Model, but it also could be 0. "It's not the most exciting of possible values," admits Burchat. KEK's preliminary number, 0.58, is closer to the Standard Model value, but with a bigger error bar of ± 0.33. Both teams presented their results in more detail this week at a conference in Ise-Shima, Japan.

However, a "meta-analysis" of all B-meson decays in the world to date offers some intriguing results. After combining data from SLAC, KEK, and other facilities and weighting them according to their errors, Burchat derives a value of 0.48 ± 0.16. "That just squeaks in at three sigma [standard deviations] above zero," she says. But neither of the two B-factory teams can make that claim by itself, says physicist Chris Quigg of the Fermi National Accelerator Laboratory (Fermilab) in Batavia, Illinois. "The first people who do that will have a party," he observes.

Despite the uncertainties, other physicists applaud their colleagues' rapid progress. "It's starting to get interesting," says Fermilab theorist Joseph Lykken. "We're almost at the point of challenging the Standard Model and its explanation of CP violation." Theorist Michael Dine of the University of California, Santa Cruz, had hoped for something else: "It's depressing. I desperately wanted it to be 0." That result, far out of whack with the Standard Model, would have worked well with a sweeping but untested theory of particles and forces called supersymmetry, Dine says.

Burchat notes that imminent upgrades will lead to vastly improved statistics. For instance, SLAC's B factory has churned out 23 million pairs of B's and anti-B's so far, but physicists expect it to produce 80 million in 2002—far beyond the machine's initial goals. There is some urgency to do so: The new Tevatron accelerator at Fermilab may start spitting out billions of B pairs per year when it is turned on next month. However, the swarms of B's will be embedded within a complex tangle of other particles from the collisions of massive protons and antiprotons. That jumble will make the analysis far more complex than at SLAC and KEK—and in all likelihood add further fuel to the debate. **–ROBERT IRION**

* 2001 AAAS Annual Meeting & Science Innovation Exposition, San Francisco, 15–20 February.