predicts a much more massive partner for every type of particle known today.

But the true cause of the discrepancy is far less exciting. Misled by an extra minus sign, theoretical physicists underestimated the predicted value of the muon's magnetism. To find that value, physicists must add up the results of a series of hugely complicated calculations, one for each combination of particles emitted and reabsorbed by the muon.

In 1995 two groups independently calculated the contribution for a combo known as "hadronic light-by-light scattering," but both got the sign of the answer wrong. If the negative results are made positive, the theoretical prediction for the muon's magnetism

$$a_\mu^{\mathrm{LbyL};\pi^0} = -e^6 \int \frac{d^4q_1}{(2\pi)^4} \int \frac{d^4q_2}{(2\pi)^4} \frac{1}{q_1^2 q_2^2 (q_1+q_2)^2 [(p+q_1)^2 - m^2][(p-q_2)^2 - m^2]} \times \left[\frac{\mathcal{F}_{\pi^0\gamma^*\gamma^*}(q_1^2, (q_1+q_2)^2)\, \mathcal{F}_{\pi^0\gamma^*\gamma^*}(q_2^2, 0)}{q_2^2 - M_\pi^2} T_1(q_1, q_2; p) + \frac{\mathcal{F}_{\pi^0\gamma^*\gamma^*}(q_1^2, q_2^2)\, \mathcal{F}_{\pi^0\gamma^*\gamma^*}((q_1+q_2)^2, 0)}{(q_1+q_2)^2 - M_\pi^2} T_2(q_1, q_2; p) \right]$$

Are you positive? The sign of this elaborate expression originally led physicists astray.

goes up enough to shrink the discrepancy by nearly half. That leaves the difference only slightly bigger than the theoretical and experimental uncertainties, spoiling the case for new particles.

The sleuths who cracked the case were Marc Knecht and Andreas Nyffeler of the Center for Theoretical Physics in Marseille, France. The pair repeated the calculation after improving a key mathematical ingredient called a "form factor." "We thought perhaps with our better description we could get an improved value. But we didn't expect to get the opposite sign," Nyffeler says.

Knecht and Nyffeler's paper appeared on 6 November on the Los Alamos preprint server, leading the other two groups to double-check their work. Both found mistakes that affected the outcome.

In a paper posted on the Los Alamos server on 6 December, Masashi Hayakawa of the KEK laboratory in Tsukuba, Japan, and Toichiro Kinoshita of Cornell University in Ithaca, New York, report that in their 1995 calculation they had inadvertently introduced an extra minus sign when using a specialized computer program to help grind through the staggering quantities of algebra. "We misunderstood the program in a subtle way," Kinoshita says.

Meanwhile, Johan Bijnens of Lund University in Sweden says that in 1995 he and collaborators Elisabetta Pallante of the International School for Advanced Studies in Trieste, Italy, and Joaquím Prades of the University of Granada in Spain performed the calculation in two different ways, and now they think they've found a different mistake in each approach. "We're still checking it, but it seems that we have an overall sign error, too," Bijnens says.

The winnowing of the discrepancy is disappointing, says Lee Roberts, an experimental physicist at Boston University and spokesperson for the Brookhaven team: "You always want to be the first to discover something new and exciting." However, the discovery of the mistake has an upside, Roberts says. The scrutiny that unearthed the mistake has also improved the various calculations in ways that put the theoretical prediction on firmer ground. "I view it as a positive step that we have a lot more confidence in the theory than before," Roberts says.

The Brookhaven experimenters hope to publish an even more precise measurement for the muon's magnetism in March based on four times as much data as they used in their original measurement. Those results should allow physicists once again to say whether the magnetism of the muon adds up to a tiny sign of something big.

–ADRIAN CHO

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CREDITS: (LEFT TO RIGHT) M. KNECHT AND A. NYFFELER; COSTANTINI/AP

GERMAN RESEARCH

Helmholtz Reforms Mollify Scientists

BERLIN—A controversial plan to inject more competition into Germany's largest research organization, the Helmholtz Association of National Research Centers, has been modified to ensure that basic research remains a priority. Physicist Walter Kröll, the newly elected president of the association, discussed details of the plan last week at a press conference following the first meeting of the reorganized Senate.

The reforms, to take effect in 2003, will replace a system of block grants for the 15

ScienceScope

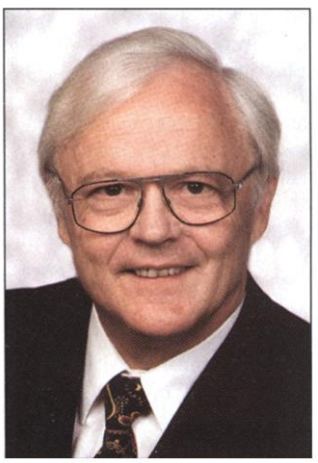
No-Confidence Vote In a straw poll, some 150 genome scientists, physicians, and ethicists voted 3:1 in favor of ending the government-backed Human Genome Project when it finishes its work in 2003. The informal tally, taken last week at a meeting of human genome experts in Warrenton, Virginia, reflects concern among some scientists that proponents of the decade-long, $300 million effort have oversold its immediate benefits to biomedicine. But Francis Collins, director of the National Human Genome Research Institute, which funded and coordinated much of the sequencing effort, warned voters that "ultimately, you aren't going to decide this."

MOSE Advances Venice's lagoon may get its floodgates after all. Italian officials earlier this month approved a controversial plan to spend $2.3 billion to build MOSE, a set of inflatable floodgates designed to protect the historic city from tidal flooding. In March, officials had requested revisions in the plan after researchers complained that the project hadn't accounted for the latest predictions for sea-level rise due to climate change (*Science*, 6 April, p. 28).

Critics still argue that MOSE, which will take at least 8 years to build, will be an environmental and economic disaster. Some experts say that reengineering the lagoon's outlets would do better—and save money. And the environmental group WWF-Italy calls MOSE a "presumptuous technological bet." A separate controversy over contracting is likely to delay construction—and prolong debate.

Lander Take Off? Look for the renowned Whitehead Institute in Cambridge, Massachusetts, and its genome center run by Eric Lander to go their separate ways in 2002. The center served as the flagship organization in the Human Genome Project with its more than 200 employees and a vast collection of sequencing machines. With the bulk of that project complete, new Whitehead director Susan Lindquist and Lander are contemplating making the center into its own institute, affiliated—like the Whitehead—with the Massachusetts Institute of Technology, according to sources familiar with the talks. Whitehead spokesperson Seema Kumar acknowledges that "informal discussions" are under way to examine "organizational models" to best make use of the center's genomic expertise.

member institutes, among them the DESY synchrotron in Hamburg, the German Cancer Research Center (DKFZ) in Heidelberg, and the Earth Sciences Research Center in Potsdam. Instead of each institute receiving its own grant, the federal and state governments will divide the association's $1.5 billion yearly budget into so-called program areas. A review committee will determine how to distribute each program's budget between the centers based on each center's performance and its research priorities.



New president. Walter Kröll takes over at the revamped Helmholtz Association.

In May, more than 4300 scientists and other Helmholtz employees signed a petition protesting the reorganization (*Science*, 11 May, p. 1038). They feared that the new system would give too much power to the federal government to decide research priorities and would reduce the ability of scientists to follow the hottest areas. In response, the government has modified the association's constitution, including making "basic research" a fundamental goal and bolstering the presence of scientists in the 22-member Senate, a governing body that also includes bureaucrats and politicians.

Molecular immunologist Peter Krammer of the DKFZ, one of the most outspoken opponents of the plan last spring, says the changes have satisfied many of his concerns. Particularly important, he says, the new constitution states that institutes may spend up to 20% of their total expenditures on research unrelated to their central focus—allowing scientists at the DKFZ, for example, to pursue promising research in immunology or developmental biology. "I see no basis for fundamental opposition at the moment, but let's see how it works," he says.

Albrecht Wagner, director of DESY, says his initial concerns over long-term funding for large-scale projects such as the planned TESLA linear accelerator were addressed in a letter from federal research minister Edelgard Bulmahn to Kröll promising that labs would be free to sign international agreements extending beyond the normal funding cycle.

Kröll, the head of the German Air and Space Research Institute in Cologne, said last week that the reforms will strengthen the society. "There is no getting around it; the reforms must be implemented as soon as possible," he said. "We want the Helmholtz Association to be a leading pillar of European research and to make a globally recognized mark."

Most scientists would agree, especially now that their concerns have been acknowledged. "The old system definitely had to be changed," Krammer says. "If the new system fulfills the purpose, that is, to stimulate more dynamite research, then that's wonderful."

–GRETCHEN VOGEL

CANADIAN BUDGET

Most Initiatives Stalled; Health Research Grows

OTTAWA—A 7% increase when many other budgets are being squeezed might seem cause for celebration. But to Marc Renaud, the head of Canada's Social Sciences and Humanities Research Council, the 7% boost in his 2002 budget falls so far short of what a recent parliamentary committee agreed was needed that he is thinking about heading back to academia. And Renaud might have company: Last week's budget blueprint from federal Finance Minister Paul Martin served up more losers than winners for a scientific community with a long wish list fueled by a once-robust economy.

To nobody's surprise, the biggest new wrinkle in Canada's $86 billion budget for the year beginning 1 April 2002 is $1.1 billion for counterterrorism initiatives. Those programs will gobble up a big chunk of the overall budget increase of 4.7%, putting a squeeze on the rest of the government. As a result, astronomers were shut out in seeking money for some $100 million in new facilities over the next decade. Separate proposals to create the National Academies of Canada (*Science*, 27 October 2000, p. 685), the Biomolecular Interaction Network Database (*Science*, 8 June, p. 1813), and a program to improve university information technology departments (*Science*, 20 April, p. 413) also failed to win support.

At the same time, Canada's three research councils that fund academic research fared well, at least on paper. The Canadian Institutes of Health Research, the largest of the three, will receive a 15% increase, to $353 million. "It'll allow our institutes to continue the momentum and the gains they've made over the last year," says a pleased Alan Bernstein, who took over the newly constituted body some 18 months ago (*Science*, 8 September 2000, p. 1675). The budget for the Natural Sciences and Engineering Research Council will go up 7%, to $327 million.

The new budget leaves astronomers up in the air, however. First on their list of proposed projects is a 5% stake in the $650 million Atacama Large Millimeter Array radio telescope, which the United States, Europe, and Japan are building in Chile's Atacama desert. The National Research Council still hopes to "scratch and save up" $31 million over 5 years, says NRC president Arthur Carty—but only if it can get the Canada Foundation for Innovation to chip in nearly half the total.

Even the long-rumored federal foray into providing overhead costs for publicly funded research (*Science*, 27 October 2000, p. 687) was watered down in the battle against terrorism. Dreams by university administrators of a permanent $250-million-a-year program turned into a "one-time" allocation of about $125 million. Left unresolved is whether to give small universities a bigger slice of the pie to help expand their research capacity.

Still, educators hail the government's recognition of its role in supporting the indirect costs of council-funded research. "It is a substantial start," says Martha Piper, president of the University of British Columbia in Vancouver. And they're not giving up on their campaign for a permanent fund. "We might get it all 2 or 3 years down the road," says Robert Giroux, president of the Association of Universities and Colleges of Canada.

Renaud is not so sanguine about the budget prospects for his council. Earlier this year legislators joined a consensus that the social and behavioral sciences have been chronically underfunded and proposed a rapid doubling of the council's budget. So the $6 million increase, to $91 million, was a big disappointment. "There seems to be

Heading home? Social sciences head Marc Renaud says the tight budget may drive him from Ottawa.

CREDITS: (TOP TO BOTTOM) HELMHOLTZ-GEMEINSCHAFT; SOCIAL SCIENCES AND HUMANITIES RESEARCH COUNCIL