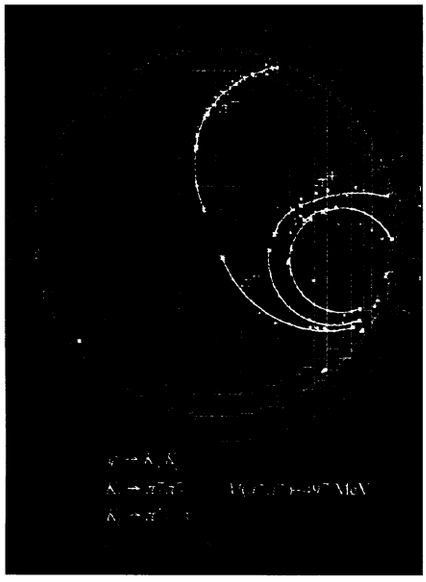


A matter of imbalance. KLOE's first K-short K-long event.

tracks of particles are recorded—surrounded by a calorimeter to measure their energy and a huge 6-meter superconducting solenoid, which bends the paths of charged particles. "Essentially it is a very simple detector, but very large and very precise," says Juliet Lee-Franzini, physics leader at INFN.

The hunt for a matter-antimatter imbalance was sparked in 1964 by Val Fitch and James Cronin. They were studying the neutral kaon, a short-lived particle that cannot decide whether it is matter or antimatter—it switches continually between the two states. Fitch and Cronin, in collisions at Brookhaven National Laboratory on Long Island, found that for a small fraction of neutral kaons the "mixing" between particle and antiparticle followed a different path, resulting in different decay products. This suggested a breakdown of so-called "charge-parity symmetry" and became known as "indirect" CP violation because the CP violation takes place in the "mixing" and not in the decay itself. In the late 1980s, researchers at CERN detected the first hints of "direct" CP violation, in which some kaons and their antiparticles decayed in different ways. Those hints were strengthened earlier this year when the KTeV group at Fermilab made the first clear observation of direct CP violation in kaons produced by colliding protons (*Science*, 5 March, p. 1428). And another CERN group, the NA48 collaboration, is now analyzing data in search of CP violation.

Despite these high-profile efforts, the researchers at Frascati hope to steal a march using what KTeV co-spokesperson Bruce Winstein of the University of Chicago calls "a completely different way of studying the [neutral kaon] system and CP ... violation." Whereas the Fermilab and CERN groups produce kaons by colliding protons with a fixed target, DAFNE speeds electrons and their antiparticles, positrons, to an energy of 510 million electron-volts in two 100-meter-long rings and collides them inside the KLOE detector. They annihilate and produce short-lived entities called phi particles, which is why DAFNE is sometimes called a "phi factory." The creation of phi particles is normally very rare, but DAFNE is designed to produce them at high rates by using electron and positron beams of very high intensity. The advantage of this relatively low-energy approach is that it produces much less background noise in the detector than higher energy collisions.

The phi particles decay into kaon-antikaon pairs, and KLOE locks onto any pairs of neutral kaons. Each kaon in such a pair has two components, a K-short that decays almost instantaneously into two pions, and a K-long that can travel for several meters before decaying into three pions. This, explains Lee-Franzini, is why KLOE is so large: It can capture the decay of both varieties. About one in 1000 K-long particles should change spontaneously into a K-short, which in turn produces two pions—an indirect CP violation. But the Frascati team will also look for K-long particles that decay directly into two pions instead of three—a direct CP violation. This is predicted to happen once in every one million events.

Paolo Franzini of Rome University, KLOE's spokesperson, says it will take some time to record enough events to get a good fix on CP violation. "For a first measurement, which is of the same accuracy as KTeV, we will need 6 to 9 months of collecting data," he says. To improve on that, "we have to collect at least 500 million events, and so far we have seen five events." Over the next few months, engineers will fine-tune the detector and adjust the energy of the colliding electrons and positrons to produce the maximum number of phi particles. "Our ultimate aim is to collect 50 billion events," says Franzini. This would increase the accuracy to 10 times that of the present KTeV result, a level all three groups will try to achieve. "We have just started, the machine is new, the detector is new, and everything is working very promisingly." **–ALEXANDER HELLEMANS**

Alexander Hellemans is a writer in Naples, Italy.

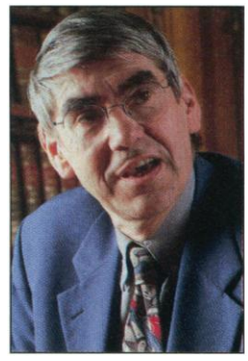
CREDITS: (LEFT TO RIGHT) INFN; ANNA COPLET/BLACK STAR

PHYSICS LABS

What Future for France's IN2P3?

PARIS—French physicists are nervously awaiting plans for a major shake-up of French research in nuclear and particle physics. An unpublished report, prepared by particle physicist Jean-Jacques Aubert at the University of the Mediterranean in Marseilles at the request of science minister Claude Allègre, is said to recommend some form of merger between the two main bodies responsible for subatomic physics in France: the National Institute of Nuclear and Particle Physics (IN2P3), which is part of the giant CNRS basic research agency; and the Atomic Energy Commission's (CEA's) Department of Astrophysics, Nuclear Physics, Particle Physics, and Associated Instrumentation (DAPNIA). Although this marriage would be consistent with Allègre's long-stated desire to end duplication of research efforts and enhance scientific collaboration, some physicists argue that it would weaken the role of the CNRS and give the CEA too much influence over research priorities.

Vincent Courtillot, the science ministry's director-general for research, told *Science* that although no final decisions have been made, a "soft merger" between IN2P3 and DAPNIA is the leading candidate among several proposals that have been discussed. Such a union would create a physics powerhouse: IN2P3 employs about 500 researchers in 18 laboratories throughout France, while DAPNIA's 200 physicists work at accelerators and other facilities across Europe and the United States. Both have their headquarters in Paris. Under the "soft merger" plan, the two organizations would come together under single administrative and scientific councils, but physicists would maintain their current status as either CNRS or CEA researchers.



Fears "not warranted." Research director Vincent Courtillot.

Proponents of the merger say that many CNRS and CEA physicists already work closely together and that formalizing this arrangement would strengthen these collaborations and increase efficiency. "The labs often work in common," says Edouard Brézin, president of CNRS's executive board. "If this common work is concretized with a joint scientific council, it would be a good idea." Brézin points to the GANIL heavy-ion accelerator in the northern city of Caen—which is jointly run by the CNRS and CEA—as a model for future collaboration "that works extremely well."

But many physicists are not so sure. IN2P3 researchers are already upset by Allègre's decision not to name a new IN2P3 director when Claude Detraz left the institute's helm last October to take a position at CERN, the European particle physics center near Geneva. Ministry officials have said they do not want to appoint a replacement for Detraz while IN2P3's future is still being discussed, but last month leading CNRS physicists wrote to French Prime Minister Lionel Jospin to protest that the lack of a director was "par-

alyz[ing] the activities of our laboratories."

And many researchers say they do not believe the proposed merger is necessary. "I do not see a reason to upset everything," says André Rougé, a particle physicist at the Ecole Polytechnique in Palaiseau, outside Paris. "There are already collaborations and joint labs. If the structures become too complex, it could stifle new initiatives." Researchers are particularly concerned that a rapprochement between IN2P3 and DAPNIA might be a first step to IN2P3 being swallowed up by the CEA. With responsibility for research into nuclear energy and atomic weapons, the CEA is seen by many scientists as having different priorities from the basic science mission of the CNRS. "We will get lost in the CEA's objectives, even in basic research," says physicist Harry Bernas of the University of Paris at Orsay, a former director of the IN2P3 laboratory on that campus. Bernas adds that such a development would present a "great danger," especially in politically sensitive areas such as nuclear waste research, where the "CNRS provides the only independent evaluation" of government policy.

Courtillot counters, however, that CNRS researchers' fears about the CEA's nuclear priorities are "not warranted," arguing that DAPNIA has long had a reputation for doing independent fundamental research on its own. The question should be settled sometime in the next month or two, when Allègre is expected to take action on the Aubert report's recommendations. Says Brézin: "France cannot have two research strategies in this domain. There must be one French policy." –MICHAEL BALTER

GENETICS

Discovery of 'Gay Gene' Questioned

Six years ago, molecular geneticist Dean Hamer and his colleagues at the National Cancer Institute (NCI) announced to great fanfare that they had found a genetic link to male homosexuality. Their work indicated, they said, that an as yet unidentified gene on the X chromosome influences who develops the trait (*Science*, 16 July 1993, p. 321). Researchers were excited by the possibility of one day learning the biological basis for sexual orientation but also wary, given that initial reports of genetic linkages for other complex traits, such as manic depression and schizophrenia, had fallen apart under further scrutiny. Now the "gay gene" linkage may be suffering a similar fate.

On page 665, clinical neurologists George Rice and George Ebers at the University of Western Ontario in London and their colleagues report failing to find a link between male homosexuality and Xq28, the chromosomal segment implicated by the NCI team's study. In addition, unpublished work from a group led by psychiatrist Alan Sanders at the University of Chicago does not provide strong support for a linkage. Taken together, Rice says, all the results "would suggest that if there is a linkage it's so weak that it's not important." He adds that genetics may still contribute to homosexuality, but researchers should be looking elsewhere for the genes.

Hamer disagrees that the Xq28 linkage is weak, citing possible problems with how Rice's team selected their study subjects. And other observers say that the jury is still out. Elliot Gershon, a psychiatric geneticist at the University of Chicago, calls the Ontario team's finding "interesting and important" but cautions that more data are needed. "Failure to find linkage in this study does not mean it doesn't exist," he says.

The challengers. From left to right are Western Ontario team members Keith Cousins, George Ebers, Holly Armstrong, George Rice, and Harriet Margalies.

That genes may contribute to homosexuality in males became clear in 1991 when psychologist Michael Bailey of Northwestern University in Evanston, Illinois, found that fully 52% of the identical twins of gay men were also gay, compared to just 22% percent for fraternal twins. Then in 1993, Hamer's team pointed to a place where a putative "gay gene" might reside.

They homed in on the X chromosome, which males inherit only from their mothers, because they noticed a preponderance of gay relatives on the maternal side of the families of the gay men they studied. When the researchers took a closer look at the X chromosomes of 40 pairs of gay brothers from the families with maternal gay relatives, they saw that the brothers were far more likely to share certain DNA signposts, or markers, on the Xq28 region of the chromosome than would be expected by chance. The team confirmed the linkage in a second study of 33 new families with gay brothers, published in *Nature Genetics* in 1995. In this X chromosome snippet, the researchers concluded, lay a gene that could nudge males toward homosexuality.

Meanwhile, intrigued by the initial report, Rice and Ebers undertook their own study to see if the result would hold up. They recruited families with two or more gay brothers through ads in Canadian gay news magazines. The families responding to the ads included 52 pairs of brothers willing to donate blood, which the researchers examined for the presence of four markers in region Xq28, using methods similar to those employed by Hamer's group.

But the Ontario team found that gay brothers were no more likely to share the Xq28 markers than would be expected by chance. And although a statistical analysis of the data could not rule out the existence of a gene in this region with a small influence on the trait, it could exclude the possibility of any gene in Xq28 with a major genetic influence, say, doubling a male's chances of being gay. Ebers interprets all these results to mean that the X linkage is all but dead. "What is troubling is that there is no hint or trend in the direction of the initial observation," he says.

Hamer, however, thinks that the way the Ontario researchers selected the families would tend to hide the Xq28 contribution. He always said, he points out, that the gene does not influence all cases of male homosexuality but only those that are transmitted maternally. And in contrast to his group, Hamer says, the Ontario team did not select families based on the presence of maternal transmission. "Maybe there was an X chromosomal linkage in some families, but those families weren't analyzed," Hamer says.

Ebers says they didn't select their families based on maternal transmission because they found no convincing evidence for such transmission in the family pedigrees. What's more, even after his group removed two families that might wash out an X chromosome effect because there were signs of the trait in females or in the father, the results remained the same. Nor was the effect evident in a study led by Sanders, which he reported last June at a meeting of the American Psychiatric Association. His team had found only a weak hint—that wasn't statistically significant—of an Xq28 linkage among 54 gay brother pairs.

A much larger study, using, say, 200 gay brother pairs, could probably resolve the issue, researchers say, but funding for such a project has been hard to obtain. So could any successful efforts to pluck out a gene in Xq28, something Hamer's group is pursuing. But the Ontario team doubts that route will pay off. "We're looking for a link on other chromosomes," Rice says. –INGRID WICKELGREN

CREDIT: DONNA GREER