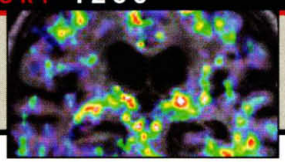
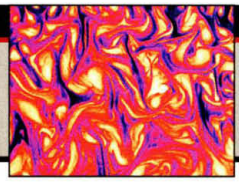
LEAD STORY 1260
Battling Alzheimer's disease



1264
Profiling a profiler



1268
Stirred up about disorder

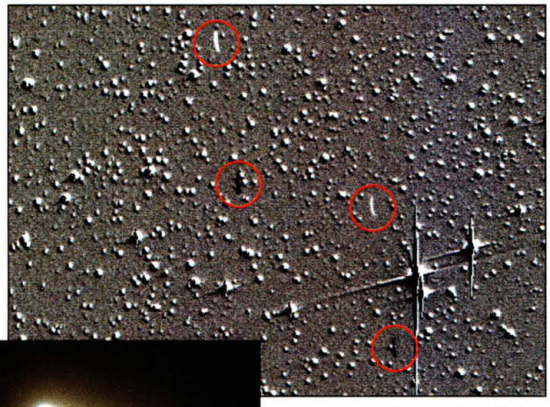
CONTOUR MISSION

Comet Craft in Pieces, Astronomers Fear

Scientists may have lost their best shot at understanding how comets evolve with the apparent destruction of the $159 million Contour spacecraft. The NASA payload is thought to have broken into at least two pieces last week while accelerating to leave Earth orbit.

"We aren't sure that the spacecraft is completely gone," says Contour mission director Robert Farquhar of the Johns Hopkins University Applied Physics Laboratory in Laurel, Maryland, "but this news is not very encouraging."

Contour (short for Comet Nucleus Tour) was launched into Earth orbit 3 July (*Science*, 5 July, p. 44). On 15 August, ground controllers ordered the spacecraft to fire its onboard solid-propellant rocket motor. The rocket burn should have put Contour on a trajectory to comets Encke and Schwassmann-Wachmann 3, one very old and one relatively new. Astronomers had hoped that high-resolution close-ups of the nuclei of the two comets would shed light on the diversity of these small frozen remnants of the solar system's birth.



Shattered? Circled blips (*above*) might be fragments of NASA comet probe.

The rocket maneuver took place 225 kilometers above the Indian Ocean, out of sight of NASA's Deep Space Network antennas. But some 45 minutes later, when Contour's signal should have been picked up again, the screens at mission control stayed black. At first, mission operators were optimistic that radio contact with the spacecraft would be restored. When radar and optical telescopes showed no sign of Contour in Earth orbit, scientists assumed that the rocket burn had occurred on Thursday as expected. "We had a lot of hope," Farquhar says.

But on Friday, astronomers at the University of Arizona in Tucson detected two objects close to Contour's predicted path. Using the 1.8-meter Spacewatch telescope at Kitt Peak, which normally hunts for near-Earth asteroids, they spotted the faint objects some 460,000 kilometers from Earth. The objects were 460 kilometers apart, suggesting that the two pieces are moving away from each other at a relative velocity of just over 20 kilometers per hour. That information might help investigators gauge the force of the explosion that blew them apart, information that could narrow down what went wrong.

"The loss of Contour would be a basic setback for the near future of cometary science," says Gerhard Schwehm of the European Space Research and Technology Centre in Noordwijk, the Netherlands, the project scientist for the upcoming European Rosetta mission to comet Wirtanen. By studying both the old comet Encke and the "fresh" comet Schwassmann-Wachmann 3, whose nucleus split into three parts in 1995, Contour could have shed light on the evolution of these icy objects—something other comet probes are not expected to do. But an even bigger impact, Schwehm says, might be a loss of confidence in the "faster, cheaper, better" approach of NASA's Discovery program, of which Contour is the sixth mission. Earlier Discovery missions also encountered technical mishaps, although none this serious.

The cause of the breakup might never be learned unless mission operators improbably succeed in reestablishing radio contact with Contour. The rocket burn maneuver "was not considered to be very risky," Farquhar says. "I was more worried about the launch." As for taking another shot at the comets, Farquhar says that any proposed replacement would have to rejoin the queue: "By then, it's unclear how this mission would fit in the general scheme" of cometary science.

–GOVERT SCHILLING

Govert Schilling is an astronomy writer in Utrecht, the Netherlands.

CREDITS: THE SPACEWATCH PROJECT, LUNAR AND PLANETARY LABORATORY, UNIVERSITY OF ARIZONA; NASA/JHU-APL/CORNELL UNIVERSITY

MATHEMATICS

Medals Honor Work on Linkages and Proof

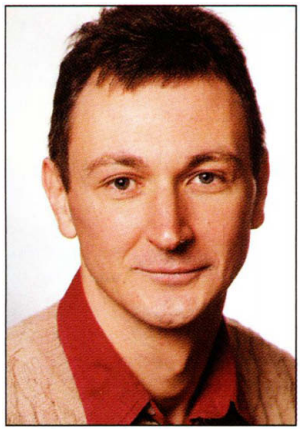
Two bridge builders have won mathematics' highest honor. The 2002 Fields Medals—presented this week at the opening ceremonies of the International Congress of Mathematicians in Beijing—went to Laurent Lafforgue of the Institute for Advanced Scientific Study in Bures-sur-Yvette, France, and to Vladimir Voevodsky of the Institute for Advanced Study in Princeton, New Jersey. Madhu Sudan, an information theorist at the Massachusetts Institute of Technology (MIT), received the Rolf Nevanlinna Prize, an analogous award for work in computer science.

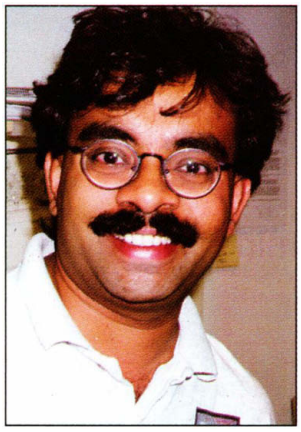
The Fields and Rolf Nevanlinna awards are presented together every 4 years at the congress, traditionally to researchers under 40 years of age. Both Lafforgue and Voevodsky worked on questions that linked seemingly dissimilar subdisciplines of mathematics.

Lafforgue, age 35, was honored for his work on the Langlands Program, an ambitious mathematical quest begun in 1967 by Robert Langlands, then a young professor at Princeton University. Langlands conjectured that two different-looking mathematical beasts—automorphic forms and Galois representations—were intimately connected. Broadly speaking, automorphic forms are mathematical objects that can be distorted in certain ways and still retain their original properties. Galois representations, on the other hand, reveal the relations between solutions of equations.

These two abstract ideas live in very different sections of the mathematical zoo, yet both are related to some of the deepest problems in mathematics. When Princeton mathematician Andrew Wiles proved Fermat's Last Theorem in 1994, for example, he relied on a proof that the Langlands Conjecture was true

under very specific conditions. "A very strange thing about the Langlands Program is that it is so beautiful, that it is so seductive, that what it sets forth is so simple, and that it puts together so many different phenomena," says Lafforgue. "Since the formulation by Langlands, everybody is absolutely convinced that the set of conjectures is true."





Honored. Fields medalists Voevodsky (*left*) and Lafforgue took laurels for finding hidden connections in mathematics; Nevanlinna winner Sudan (*right*), for wedding probability to proof.

In 1999, Lafforgue won mathematical acclaim by proving the Langlands Conjecture for a very broad class of objects known as function fields (*Science*, 4 February 2000, p. 792). "I knew that it was an important result. For the following 2 years, many mathematicians around me thought that it would receive the Fields, but I preferred not to think about that," says Lafforgue. "Today, of course, I feel deeply honored and happy to obtain so much recognition for my work."

The other new Fields medalist, 36-year-old Vladimir Voevodsky, toiled at the intersection of two other mathematical subjects: topology, which studies shapes in space, and algebra, which studies the symmetries and relations of abstract mathematical operations. Mathematicians have had remarkable success in trying to teach the two fields to speak the same language, but some areas still can't communicate, even though they seem to have similar structures. In 1970, mathematician John Milnor of the State University of New York, Stony Brook, conjectured that two such uncommunicative realms—ways of describing properties of different kinds of surfaces known as Galois cohomology and K-theory—were in fact related. The Milnor Conjecture remained the biggest problem in that area of mathematics until 1996, when Voevodsky created new mathematical tools that enabled him to solve the conjecture.

The Rolf Nevanlinna Prize honors MIT's Madhu Sudan, age 35, for his work on the very concept of mathematical proof. A proof is a series of logical statements, each linked to the next according to strict rules of inference. If the statements are correct and the links obey the rules, the proof is valid; otherwise it is flawed.

Sudan added shades of gray to this black-and-white dichotomy by showing that, in theory, a mathematician could figure out the probability that a new proof is correct. He knew that, in a sense, valid proofs are points floating in an abstract space that describes all logical statements. "Distance" makes sense in the abstract space of logical statements, just as it does in familiar geometric space.

Sudan was among the first to realize that the concept of logical distance could be used to measure how far from truth a putative proof might be. "You can show whether any proof is completely correct, [whether it] can be formulated into one that is completely correct, or whether it is so distant from correctness that it is unfixable," Sudan says. And although the idea isn't going to lead to automatic proof-checkers, it has helped Sudan make inroads against the most important question in computer science, the P = NP problem (*Science*, 26 May 2000, p. 1328).

–CHARLES SEIFE

EVOLUTIONARY BIOLOGY

Cool Cats Lose Out In the Mane Event

The image of a roaring male African lion with full flowing mane is for many people the very icon of wild nature. But precisely why lions have manes has never been nailed down. On page 1339, researchers provide evidence for the often-cited assumption that the mane is a signal advertising the animal's condition, which females use to choose mates and males use to assess rivals.

In an apparent evolutionary tradeoff, however, manes also impose a cost on males by increasing their heat load. "This is one of the few cases of a sexually selected trait where a physiological cost has been demonstrated," says evolutionary biologist John Endler of the University of California, Santa Barbara.

Animal behaviorist Craig Packer of the University of Minnesota, Twin Cities, has studied lions at Serengeti National Park in Tanzania for 24 years, continuing the program that pioneering zoologist George Schaller began in the 1960s. Over the years,

ScienceScope

Rights Reconsidered The National Institutes of Health (NIH) has put on hold a controversial plan to curb foreign grantees from patenting and licensing their discoveries. Last March, NIH announced that it would limit foreign grantees to patenting discoveries only in their home nations. To make sure U.S. taxpayers reaped the benefits of federally funded research, all other rights would be held by U.S. collaborators or NIH. But critics—including the U.S.-based Association of University Technology Managers and Australian science officials—said the policy would hinder collaboration and discourage the development of discoveries (*Science*, 28 June, p. 2316).

On 8 August, NIH backed off, saying that it will take another year to "explore more fully the ramifications" of the policy, which was slated to take effect at the end of the year. "There's no point in rushing," says NIH extramural research chief Wendy Baldwin. Her office will consider arguments that, for example, most drugs end up being manufactured in the United States, so the profits end up there, too.

New Hire A top government science chief has agreed to oversee science programs at the beleaguered Smithsonian Institution, which has been shaken by the departures of senior administrators and controversial reorganization plans (*Science*, 13 July 2001, p. 194). Physical oceanographer David Evans (right), currently assistant administrator for research at the National Oceanic and Atmospheric Administration (NOAA), will become the Smithsonian's undersecretary for science on 9 September. He replaces Dennis O'Connor, who resigned in April. Evans, 56, has been at NOAA since 1993 and helped organize the government's climate research program. He also spent 5 years as a program manager at the Office of Naval Research.

Evans told *Science* that his experience will help him tackle the task of stabilizing the Smithsonian's science programs, including boosting budgets squeezed by construction and renovation expenses. "I've dealt with a lot of fiscal crises," he says, and he is "optimistic" that he can convince Congress or private donors to improve cash flows. He also needs to hire a new head of the natural history museum and hopes to smooth out currently rocky relations between some administrators and researchers. His past work, he says, "has taught me that you lead scientists, you don't push them around."

CREDITS: (LEFT TO RIGHT) CLIFF MOORE; MIT LABORATORY FOR COMPUTER SCIENCE; NOAA