Alarmed at such talk, Representative Vern Ehlers (R–MI) last week began rallying support behind civilian science. "We are concerned that funding for science may take a back seat" to housing, veterans' health care, and education programs, he wrote in a 20 March draft of a letter to colleagues that is aimed at the House leadership. "We ask you, in the strongest words possible, to assign a high priority to basic scientific research." There is evidence that the leadership is listening. Ehlers and Representative Rush Holt (D–NJ), both physicists, successfully lobbied last week for civilian R&D spending to get a tiny sliver more—some $100 million—of the discretionary budget pie. Although appropriators are not bound by those numbers, "it shows there is political interest" in funding science, one House staffer says.

So despite the inevitable posturing and election-year rhetoric, many observers insist that R&D will ultimately prevail. Last year, for example, NASA's spending panel, after strong pressure from the White House, found a way to restore steep cuts in space science. "The outlook for federal R&D in 2001 is highly favorable," states a preview of the annual budget report published by the American Association for the Advancement of Science (which publishes *Science*). "It seems almost certain," the report predicts, that science and technology will achieve funding levels equal to or even surpassing those requested by Clinton. Even more certain, however, is that it will take a lot of political horse trading for that conventional wisdom to prevail. **–ANDREW LAWLER**

GAMMA RAY ASTRONOMY

Aging NASA Satellite Headed for Fiery End

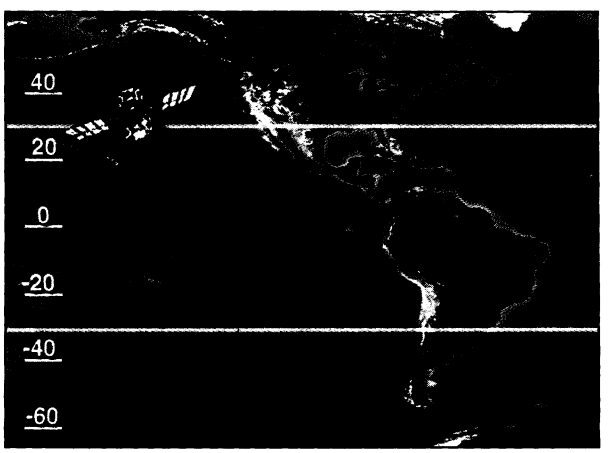
NASA has decided to euthanize an ailing but still functioning satellite rather than risk a slim chance that it could spin out of control and crash in a populated area. Last week NASA described plans for a late-spring maneuver that will cause the Compton Gamma Ray Observatory (CGRO) to enter the atmosphere and break apart across a swath of the Pacific Ocean.

The satellite is equipped with three gyroscopes, one of which failed late last year (*Science*, 21 January, p. 403). Although it needs only two to perform its scientific duties, a second failure—a possibility the Goddard Space Flight Center in Greenbelt, Maryland, puts at 10% in the next 3 years—would make the craft more difficult to control. "It was my decision [to put the craft down]," says Edward Weiler, NASA's associate administrator for space science, noting that his decision follows the original contingency plan. Although the craft is still productive, he says, NASA was faced with trying to calculate "how many papers are worth an increased risk to human life?"

Launched in 1991, the CGRO has already lasted almost twice its intended 5-year life-span. It mapped the sky's gamma rays, found the first gamma ray pulsars, and determined that gamma ray bursts originate beyond the Milky Way and are likely signs of the largest explosions since the big bang. Researchers have published more than 1000 papers based on CGRO data, including a paper last week linking some gamma ray sources to a new class of mysterious objects (see next story).

CGRO's scientific instruments will be turned off on 26 May. Five days later, a Goddard team will execute the first of four burns designed to shove the craft out of its orbit. The final two burns are planned for 3 June. Most of the 15,000-kilogram spacecraft will disintegrate and burn up when it hits the atmosphere, but 30 to 40 pieces will survive, ranging from bolt-sized to some possibly as heavy as 1000 kilograms. The detritus is expected to scatter in an area 25 kilometers wide and 1550 km long in the Pacific Ocean, about 4000 km southeast of Hawaii.

CGRO's demise will temporarily close a window onto gamma rays, which are blocked by the atmosphere. "Astronomers around the world will be quite disappointed," says CGRO project scientist Neil Gehrels. In 2003 NASA plans to launch a satellite, Swift, that will monitor gamma ray bursts, and in 2005 GLAST will focus on high-energy gamma ray phenomena. In the meantime, says Gehrels, "we have 62 days, 19 hours, and 42 minutes left" before the receivers are shut down. "We're going to make the best use of every one of those minutes." **–LAURA HELMUTH**



CREDIT: GSFC/NASA

Ker-plunk. Satellite debris should splash down on 3 June somewhere within a 1550-kilometer swath of the eastern Pacific Ocean.

GAMMA RAY ASTRONOMY

Sky Survey Finds Mysterious Strangers

Amid the diffuse bath of gamma rays coming from the galaxy, about 200 point sources—tiny gamma ray beacons—twinkle within the haze. For 2 decades, astronomers have been puzzling over what they are. Now astronomers at NASA's Goddard Space Flight Center in Greenbelt, Maryland, have doubled the mystery: They have discovered that these point sources come in two different varieties.

Neil Gehrels and his colleagues at Goddard analyzed the data from more than 4 years of observations with the EGRET telescope aboard the Compton Gamma Ray Observatory. Most of the sources lie along the galactic plane, but a few dozen lie in the middle latitudes, as much as 40 degrees above and below the galaxy's equator. In last week's issue of *Nature*, the team reported that the sources away from the galactic plane turned out to be surprisingly dim. "We didn't know what to make of the middle-latitude sources," says Gehrels. "The new population is much weaker than ones along the plane."

The mid-latitude sources appear to lie in the so-called Gould belt, a broad, expanding ring of stars, gas, and dust about 3000 light-years across. If so, they are our galactic neighbors. The Gould belt formed 30 million or 40 million years ago, probably when a series of stars exploded or some other powerful event disrupted the matter in our region of the galaxy. Clouds of gas, shocked outward, created a burst of new, massive stars. The bright sources in the galactic plane, in contrast, are likely to be tens of times farther away and thus, in absolute terms, vastly more powerful.

Isabelle Grenier, an astronomer at the University of Paris VII, finds the argument compelling. "What [Gehrels] has shown is that there is a clear difference between those out of the plane and those along the Milky Way," she says. "Now we're all convinced that there are two populations." Grenier also agrees that the weak sources are located in the Gould belt. "If you look at the distribution, you can really find that it follows the Gould belt," she says.

If Gehrels's team is correct, then the weak mid-latitude gamma ray sources and the intense equatorial sources may be entirely different types of objects. "The luminosity is so different between the two populations, there must be very different physical mechanisms," says Gehrels. Perhaps the mid-latitude sources are gamma ray pulsars, rapidly spinning geriatric stars that for some reason bathe us in gamma rays rather than the usual lower frequency radio waves. (If

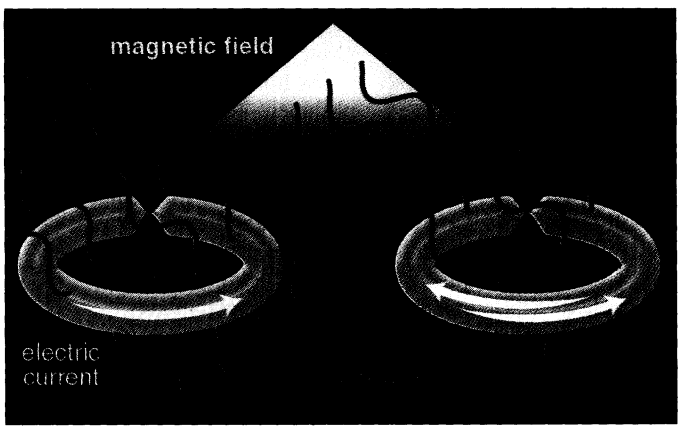
so, the gamma rays should come in periodic bursts, but current instruments cannot tell whether they do.) The galactic-plane sources might be "microblazars," black holes that are spitting jets of mass and energy directly at us, or high-velocity gas clouds emitting gamma rays as they slam into massive stars.

Until new gamma ray observatories, such as NASA's Gamma Ray Large Area Space Telescope (GLAST), start to go into orbit in 2005, astronomers will have to try to solve the puzzle by finding and studying the sources using other kinds of radiation, chiefly x-rays. But if the gamma ray sources are invisible in those frequencies, Grenier says, the mystery will remain unsolved: "If we do not find counterparts, we are forced to wait for GLAST." —CHARLES SEIFE

QUANTUM MECHANICS

Physicists Unveil Schrödinger's SQUID

MINNEAPOLIS—It doesn't purr, but a tiny superconducting ring is the closest thing yet to Erwin Schrödinger's famous dead-and-alive cat. At last week's meeting here of the American Physical Society,* physicists announced that, under the right conditions, such rings can carry current in opposite directions at the same time—a feat never before performed in an object so big.



Strange appetite. A SQUID with two-way currents absorbs microwaves that a SQUID with one-way currents can't.

For decades, Schrödinger's cat has been the stock example of a paradoxical but fundamental property of quantum mechanics: that an object can be in two or more states at the same time. But physicists' favorite feline remains purely hypothetical, because objects much bigger than individual atoms, photons, and molecules generally interact strongly with their surroundings, which force them to choose one state or another. Now two teams of researchers have induced millions of electrons to flow simultaneously both ways around a small superconducting ring with a nonsuperconducting notch in it, a gizmo known as a superconducting quantum interference device, or SQUID.

A SQUID prefers the total amount of magnetic field passing through it to equal an exact multiple of a fundamental constant known as the flux quantum. Add or subtract a fraction of a flux quantum by changing the field the SQUID sits in, and the ring tries to round off to the nearest whole value by creating an electric current that adds or subtracts from the imposed magnetic field. Because SQUID can round up or down, the current can flow in either direction.

It's when the SQUID tries to polish off exactly half a flux quantum that quantum oddities begin. In that case, the energy in the ring is equal for current flowing either way, clockwise or counterclockwise, and the SQUID cannot absorb energy by jumping between the two. However, the both-ways-at-once case is different. Such mixed quantum states come in pairs, one with slightly higher energy than the other. As a result, a SQUID can consume energy by hopping from one mixed state to the other.

To test whether they had really achieved a two-way flow, the two teams of researchers fed their SQUIDs energy by shining microwaves on them. Physicists Hans Mooij, Caspar van der Wal, and their colleagues at Delft University of Technology in the Netherlands used microwaves with just enough energy to make their SQUID jump between one mixed state and its partner and took the absorption as evidence that the mixed states were there. In contrast, physicists James Lukens, Jonathan Friedman, and colleagues at the State University of New York, Stony Brook, gave their SQUIDs microwaves with an even bigger energy boost. The SQUID absorbed at two nearly equal frequencies, revealing a pair of mixed states well above the energy of the initial state. Without mixed states, it would have absorbed only one frequency. Both teams concluded that their SQUIDs had achieved the mixed state of two-way flow.

Their both-ways-at-once currents may earn SQUIDs a starring role in the processors of quantum computers. Whereas ordinary computers use bits that can be either 0 or 1, quantum computers require "qubits" which can be 0, 1, or 0-and-1. Researchers have fashioned handfuls of qubits out of individual atoms, molecules, and photons. But SQUIDs should be easier to manipulate, Friedman says, because they can be a million times bigger than an atom and mass-produced on silicon chips. Still, Eli Yablonovich, an electrical engineer at the University of California, Los Angeles, says SQUID researchers face the same daunting challenge as others trying to develop practical qubits: preserving the mixed quantum states in a hostile world. "They've got to get down in the trenches with the rest of us to solve that problem." —ADRIAN CHO

SPACE SCIENCE

Lab Accident Damages Solar Flare Satellite

A NASA mission to study solar flares has suffered a rough ride even before it leaves the ground. A vibration test of the High Energy Solar Spectroscopic Imager (HESSI) went mysteriously awry on 21 March, damaging the spacecraft's solar panels and possibly other components and forcing NASA to postpone its launch from July to next January. "It's devastating," says principal investigator Robert Lin, a physicist at the University of California, Berkeley.

The unusual incident also was bad news for NASA managers, who last week were busy on Capitol Hill answering questions about a spate of recent agency failures and snafus. The HESSI program to date has been a model of NASA Administrator Dan Goldin's faster, cheaper, better approach to science, say program officials. The $70 million mission to explore the physics of particle acceleration and energy releases in solar flares was conceived and executed in 3 years, and the spacecraft was slated to go up this summer, in time to monitor the solar maximum later this year.

It's not known what went wrong, says Lin. He and his team contracted with the Jet Propulsion Laboratory in Pasadena, California, to conduct various tests at the lab's sophisticated facilities. During a vibration test, a standard procedure to mimic the stresses and strains encountered during launch, HESSI was mistakenly subjected to forces more than 10 times the appropriate level. Before the test could be halted, the solar panels cracked and the structure was damaged. "We still don't know what's been damaged," says Lin, or how severely. "We'll have to take everything apart."

A January launch will still give researchers good data on the nature of solar flares, he says, as some of the most violent typically occur shortly after the peak of solar activity. "But we wanted to get the maximum of flares," he adds. NASA has asked a team of investigators to report by May on what went wrong. —ANDREW LAWLER

CREDITS: ILLUSTRATION BY C. CAIN

* APS March Meeting, 20 to 24 March.