onstrated this technique in the laboratory with a test sample consisting of scattered nanocrystals of a fluorescent compound, pyridine. With a burst of an ultraviolet laser, they sparked fluorescence in the crystals. They then sent in the second laser pulse, known as the stimulated emission depletion (STED) pulse, to take a bite out of the first one. The result was dramatic: Where two pyridine molecules appeared as a single blur without the STED beam, they could be distinctly resolved once the STED beam was turned on.

Gu says he is impressed by the 30% improvement in resolution, which allowed the STED microscope to distinguish crystals as little as 100 nm apart. Peter So, a mechanical engineer at the Massachusetts Institute of Technology in Cambridge, thinks the resolution could eventually reach 30 nm, fine enough to distinguish structure in individual DNA molecules. Advances like Hell's are a sign, So believes, "that we are in the midst of a renaissance in optical microscopy."

–MEHER ANTIA

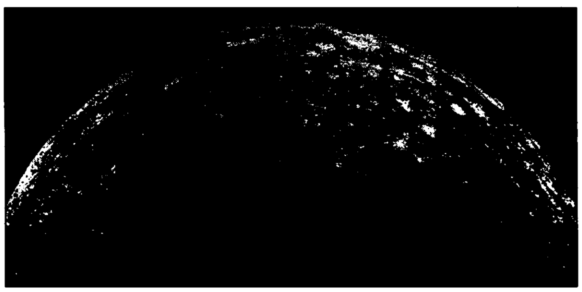
Meher Antia is a writer in Vancouver.

SPACE SCIENCE

NASA Plans Close-Ups Of Mercury and a Comet

NASA last week selected two spectacular shows as part of its Discovery program of quick and cheap space missions. In 2008 and 2009, a spacecraft will scrutinize Mercury, and in 2005, another mission will shoot a massive copper cannonball into a comet to learn more about its innards. The scheduled date for the cometary fireworks, which space enthusiasts can watch from Earth: 4 July.

The spacecraft Messenger, to be launched in spring 2004, will orbit Mercury for 1 year after two brief flybys. Loaded with cameras to map the planet's surface and spectrometers



Pockmarked planet. Messenger will take the first close-ups of Mercury since 1975.

to analyze its crust and tenuous atmosphere, Messenger will transmit the first close-ups of Mercury since the Mariner 10 mission in 1974–75. Messenger should shed light on how planets form and why some, like Mercury and Earth, have retained their magnetic

Smash hit. Deep Impact will fire a copper cannonball into comet Tempel 1.

fields while others, like Mars, have shed theirs, says planetary scientist Sean Solomon of the Carnegie Institution of Washington's Department of Terrestrial Magnetism, who leads the $286 million mission.

The extremely dense planet consists mainly of a large metal core, says planetary geophysicist Raymond Jeanloz of the University of California, Berkeley. A giant impact, much like the one that chipped off Earth's moon, may have splashed off most of Mercury's mantle, he says. Messenger's gravity mapping studies will probe for evidence of crust-busting impact sites. The mission should also reveal whether volcanoes have shaped Mercury's surface and if ice exists in the shadows of its polar craters, says planetary scientist Faith Vilas of the Johnson Space Center in Houston.

In January 2004, a $240 million mission called "Deep Impact" will take off for comet Tempel 1, which circles the solar system every 5.5 years. When it arrives a year and a half later, an observation module will release an "impactor"—essentially a 500-kilogram copper bullet—which will slam into the comet's surface at a speed of 10 kilometers per second. A camera onboard the bullet will transmit images as it hurtles toward its target; the hovering observer module will record both the crash and the size and shape of the resulting crater, and analyze solid and gaseous material released by the blast.

The crash may help answer questions about the composition of comets and their chemical histories, says Lucy McFadden of the University of Maryland, College Park, one of the project's scientists. Comets formed from primordial material condensing at the edge of the solar system, but their interiors may have heated and undergone chemical changes during their tours through the solar system. So far, scientists have only been able to model these processes and simulate comets' internal properties. "This is an in situ experiment that will constrain these theories," says McFadden. Indeed, Deep Impact marks planetary science's graduation from classic, observational studies to active experimentation, notes Alan Stern of the Southwest Research Institute's Department of Space Studies in Boulder, Colorado.

The approval of Deep Impact follows close on the heels of a NASA decision to scrap a mission, called Champollion, that would have attempted a soft landing on Tempel 1. The lander would have drilled into the comet's surface and analyzed core samples at different depths. Although its estimated cost was roughly the same as that of Deep Impact, Champollion fell within NASA's New Millennium Program and was competing for scarcer funds than the Discovery Program missions.

Deep Impact should entertain the Earthbound as well as further space science: If skies are clear, the celestial collision will be visible with a pair of ordinary binoculars. But don't expect too much: The comet will look like a small smudge, and the impact will show up as a mere pinpoint of bright light.

–LAURA HELMUTH

YOUNG FACULTY AWARDS

Keck Helps Five Careers With $1 Million Grants

All spring Yale University biophysicist Mark Gerstein had been on tenterhooks. As one of 10 finalists in the W. M. Keck Foundation's new Distinguished Young Scholars in Medical Research program, Gerstein was on the verge of getting a flexible, $1 million grant—a significant bounty for a researcher of his age (33). But after making his pitch in April, Gerstein's phone went silent—until last week, when he learned that he was one of five junior faculty members in the United States to make the final cut. "I was ecstatic," he says. "But I'm also relieved—that's a lot of grant applications that I won't have to write for a few years." Gerstein's $1 million award will support his research in genomics and bioinformatics.

The Los Angeles–based foundation,

CREDITS: (TOP) BALL AEROSPACE; (BOTTOM) NASA created in 1954 by the founder of the Superior Oil Co., has long been a supporter of higher education and research. But last year its trustees decided to take advantage of a growing endowment, now $1.4 billion, to back the next superstars of biomedical research—a total of 25 over the next 5 years. "We wanted to identify the people who seem likely to become the really outstanding scientists over the next 20 to 30 years," explains William Butler, chancellor of Baylor College of Medicine in Houston, Texas, and chair of the scientific advisory board that helped to design the program and select the first batch of winners. "Keck deserves a lot of credit for coming up with such an exciting concept."

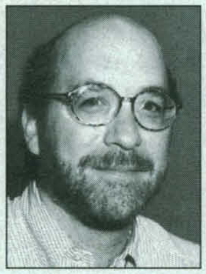
The four other winners are: Bruce Clurman, a cancer biologist at the Fred Hutchinson Cancer Research Center in Seattle; Judith Frydman, a biochemist at Stanford University working on protein folding; Partho Ghosh, a structural biologist at the University of California, San Diego; and Phyllis Hanson, a cell biologist at Washington University in St. Louis who studies protein and membrane dynamics in the neural system. All have taken up their first faculty position within the last 3 years, and all say that the money will allow them to scale up their research in a way that would otherwise be impossible.

The new program outdoes all other private efforts to support young faculty. The size of the awards beats the $625,000 over 5 years offered by the Packard Foundation and dwarfs the typical start-up grant from private and public bodies. Its closest competitor is a one-time awards program sponsored by the James S. McConnell Foundation, which earlier this year selected 10 Centennial Fellows to receive $1 million each as part of the 100th anniversary of its founder (*Science*, 29 January, p. 629). "We wanted to give them a chance to go forward full-bore, and our advisers said that a million dollars should buy them what they need," says Roxanne Ford, who heads Keck's medical program.

For Gerstein, the money means a chance to hire a crackerjack computer programmer and systems analyst to design and maintain a database to analyze the entire genomes of various pathogenic organisms. "I'm looking for someone who could command $150,000 in Silicon Valley," he says. "I can't pay that much, of course, but I want someone who can create a computational environment that my students and postdocs can take advantage of and not have to do it themselves."

The competition was by invitation only. Keck asked 30 top-ranked universities and medical institutions to submit one application from their single most promising young faculty member. From those, the foundation chose 10 finalists for face-to-face interviews. Next year Keck will make the same offer to another group of 30 institutions, with some holdovers, and after 5 years its board of trustees will evaluate the impact of the program and decide its fate.

—JEFFREY MERVIS





First class. Clockwise from top left: Clurman, Frydman, Ghosh, Gerstein, Hanson.

ELECTRONICS

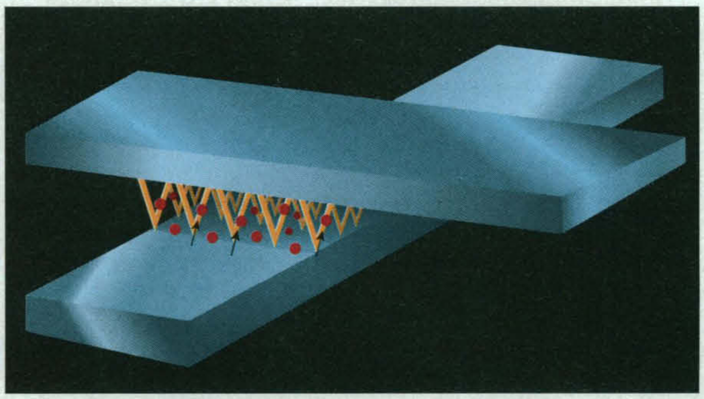
Organic Molecule Rewires Chip Design

Only one thing hasn't changed over the decades in the computer industry: the equation smaller equals faster. But as the transistors and other circuitry on computer chips continue to shrink, errors become easier to make. And a single broken wire or faulty transistor in the millions of devices on a chip will often render it useless. Now a team of California-based researchers is offering a revolutionary—and potentially cheap—way to sidestep the need for precision as circuit features get still smaller: a strategy for laying down millions of wires and switches without worrying too much about quality control, then electronically configuring the best connections, akin to the way the developing brain strengthens active neural connections while allowing inactive ones to wither away.

The key to the new design is its simplicity. Instead of spending billions of dollars on fabrication plants to ensure patterning perfection, the new approach would lay down its millions of wires and switches in a simple grid and then allow a computer to use those wires to configure the grid into proper circuits. At this point, the researchers, led by Jim Heath at the University of California, Los Angeles, and Stan Williams at the Hewlett-Packard Laboratories in Palo Alto, remain a long way from configuring millions of switches; the network that they describe on page 391 contains just four switches. And the five connecting wires are up to 11 micrometers wide, a hefty size compared to those in today's chips. Nevertheless, the novel approach "is pretty remarkable," says Dan Herr of the Semiconductor Research Corp., an industry-backed center in Research Triangle Park, North Carolina. "If something like this pans out, it would have a tremendous impact on the semiconductor market."

Chip designers worry that when the size of features on individual chip components drops below 100 nanometers—perhaps by the middle of the next decade—engineers will have little room for error: A wire misplaced by just a few tens of nanometers could cause a circuit to fail. And although patterning technology is improving, "we do not have the ability to make highly intricate patterns on that length scale," says Paul Alivisatos, a nanoscale patterning expert at the University of California, Berkeley. "But we can make simple patterns of that size."

So that is what Heath and his colleagues did. Instead of trying to precisely control the positioning of wires and switches, they opted to lay down a simple grid of devices, all electronically linked. Later, they figured, they



Simple switch. The electronic state of V-shaped organic molecules controls whether electrons can hop from the bottom to the top wire.