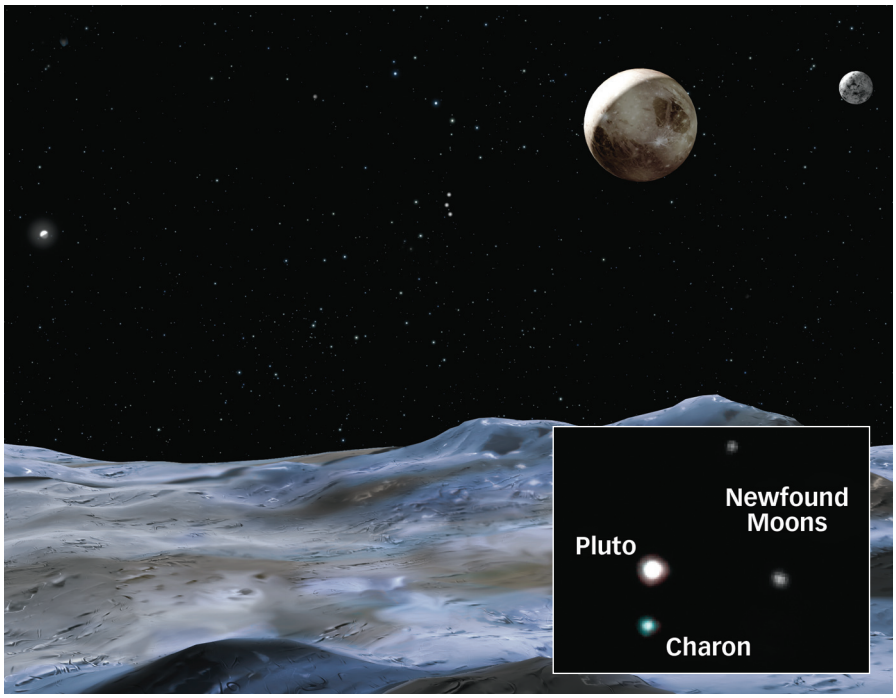
New Partners

Hubble finds more moons around Pluto



PLUTO COMPANIONS The imagined surface of one of two newfound moons of Pluto shows the planet above the horizon. The previously known moon, Charon, lies to the right of the planet, and the other new moon is at the far left. Inset is Hubble's image of Pluto and its moons.

WEAVER, STERN ET AL., NASA, STSCI

Already deemed the oddball among planets, Pluto just got a new wrinkle. Two, actually. This week, astronomers announced that the Hubble Space Telescope has spied a pair of previously unrecognized moons orbiting Pluto, giving this outer solar system body a total of three satellites. If the finding is confirmed, Pluto will be the only object beyond Neptune known to have more than one moon. About 20 percent of the objects in the Kuiper belt, a reservoir of cometlike objects even farther from the sun than Pluto is, have single partners.

Researchers "will have to take these new moons into account when modeling the formation of the Pluto system," says Alan Stern of the Southwest Research Institute in Boulder, Colo. He and Hal Weaver of the John Hopkins Applied Physics Laboratory in Laurel, Md., reported the findings during a NASA press briefing.

"If real, these two new satellites of Pluto point in the direction of the richness of small, icy bodies on the edge of the solar system, bodies that we are just now being able to detect," comments Alan Boss of the Carnegie Institution of Washington (D.C.).

Hubble found the two tiny satellites last May 15 and May 18 during a search for Pluto moons. The researchers caution that more Hubble observations, scheduled for February, are required before they can be certain that the bodies are orbiting Pluto.

However, the scientists already have some corroborating evidence. Last week, team members identified the two objects in Hubble images taken 3 years ago. The objects show up in about the positions that would be expected if they were orbiting Pluto.

One of the moons, provisionally named S/2005 P1, lies about 48,000 kilometers from Pluto and has an estimated diameter of 56 km. The other newly discovered moon, dubbed S/2005 P2, lies about 64,000 km from Pluto and has a diameter of about 48 km. By comparison, Charon, Pluto's previously known moon, is 19,600 km from the planet and has a diameter of 1,270 km, about half that of Pluto.

Initial estimates indicate that for every 12 times that Charon circles Pluto, S/2005 P1 goes around 3 times and S/2005 P2 goes around twice. That orbital relationship suggests that the two moons didn't start out as debris that Pluto captured but instead arose from the same violent collision that formed Charon.

As theorist Robin Canup of the Southwest Research Institute describes it, a massive object walloped Pluto soon after its birth some 4.5 billion years ago. Debris from the collision coalesced into Charon, with a bit left over to make the newfound moons. As interactions with Pluto pushed Charon's orbit outward, that moon's gravity forced the orbits of the two outer moons to synchronize with it.

"We see [the Hubble findings] as a whole new chapter in the Pluto story and the Kuiper belt story," says Stern. —R. COWEN

More Than an Annoyance

Breathlessness could be sign of bigger problems

Everyone runs out of breath from physical exertion. But for people with a condition called dyspnea, even a minor effort makes breathing difficult. A new study suggests that these people are at greater risk of dying of heart problems or other ailments than are people who have chest tightness, a well-known sign of cardiac trouble.

Beginning in 1991, a team led by cardiologist Daniel S. Berman of Cedars–Sinai Medical Center and the University of California, Los Angeles identified more than 1,000 patients diagnosed with dyspnea but who had no history of a heart problem. Other doctors had ruled out asthma or other lung problems in these patients and referred them to the cardiologists for testing.

Berman's team also identified much larger groups of people with angina—chest tightness that can signal an obstructed coronary artery—and of other patients referred for possible heart problems. Most of the patients were in their 60s or 70s.

The researchers gave each person a stress test to measure how well his or her coronary arteries were delivering blood to the heart muscle. After the stress tests, the team removed from the study patients who had a serious coronary blockage, assigning them to treatment that would open or bypass problem vessels.

Among the others, the test revealed some loss of heart function in about one-third of the dyspnea patients and in nearly half of the angina patients. Fewer people in the other group showed any loss.

Over nearly a decade, the researchers tracked 17,991 of the patients for an average of 2.7 years. Of the patients with dyspnea but no sign of coronary artery disease during the stress test, 2.3 percent died annually of cardiac problems during the follow-up years. That made them more than

twice as likely to die of cardiac problems as were similar participants with angina.

Among people whose stress tests had revealed some coronary-vessel disease but not a blockage serious enough to warrant surgery, the dyspnea patients were three times as likely to die of cardiac problems during the follow-up years as the angina patients were, the researchers report in the Nov. 3 *New England Journal of Medicine*.

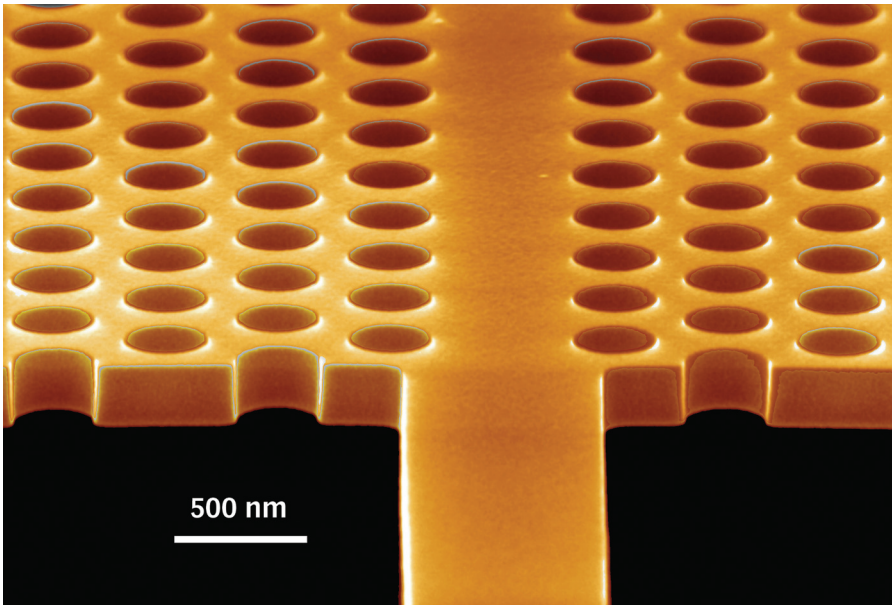
The dyspnea patients were also more likely than those in other groups to die of problems not linked to the heart. Their risk of death remained higher even when the researchers took into account such factors as a history of diabetes.

The findings match those of a smaller study reported in the June 16, 2004 *Journal of the American College of Cardiology* by Patricia A. Pellikka, a cardiologist at the Mayo Clinic College of Medicine in Rochester, Minn., and her colleagues.

Together, Pellikka says, the reports are a wake-up call for family practitioners. "Patients who come into the office with unexplained shortness of breath that occurs with exertion deserve cardiac evaluation and some kind of stress test," she says.

In Berman's study, people with dyspnea were more likely than the others to have an enlarged left ventricle, the main pumping chamber of the heart. In elderly people, such an enlargement is a sign of chronic stress on the heart that weakens it and increases susceptibility to heart failure.

Even so, Berman and Pellikka concur that the biological link between difficult breathing and increased risk of death remains unclear. —N. SEPPA



SLOW POKES Edge-on, false-color view of a silicon photonic crystal whose hole-pocked structure slows down light long enough to be stored as data.

Light Pedaling

Photonic brakes are vital for circuits

Just as optical fibers have replaced most electrical wires for long-distance telecommunications, light-based circuits may replace electrical ones in applications involving vast flows of data within computers and networks. Now, a team of industrial researchers has taken what may be a crucial step toward such photonic circuitry: They've found a way to dial down the speed of light within microchip components.

Because any photonic circuit must store information temporarily, scientists have in recent years developed numerous ways to slow light pulses, effectively holding on to them for brief periods of time. In the new work, Yurii A. Vlasov and his colleagues at IBM T.J. Watson Research Center in Yorktown Heights, N.Y., have demonstrated on-chip control of the duration of those delays.

Future photonic computers or other circuitry will need such controls to choreograph light pulses in much the same way as automobile drivers apply their brakes in order to merge, turn, and synchronize with other vehicles.

"Being able to tune and control the retardation opens whole new avenues for manipulating light on a chip," comments Laurens Kuipers of the FOM Institute for Atomic and Molecular Physics in Amsterdam.

Unhindered, light tools along at 300,000 kilometers per second (kps). Six years ago, physicists demonstrated the ability to slow light to a full stop using clouds of specially prepared atoms (*SN: 3/27/99, p. 207*). Since then, other scientists have shown that light can be slowed—although not stopped—by means of a microchip component called a photonic crystal (*SN: 10/4/03, p. 218*). That technology lends itself to practical applications because it relies on silicon processed by standard manufacturing methods.

Vlasov and his colleagues have added another level of control to on-chip light slowing. Using a photonic crystal—in this case, a sliver of silicon punctuated by tiny holes—they have slowed light down to as little as 1,000 kps. The drop in light speed enables the component to retard pulses long enough to store a few bits of data in a network operating at 10 billion bits per second, a common data-handling rate for today's systems.

Moreover, the IBM team has added what's in essence a brake pedal: By placing electrodes of a nickel-silicon alloy on each side of the photonic crystal, the team provided a means to send small currents through the silicon. Those flows heat the crystal, altering the amount of delay that passing light pulses undergo. The IBM team describes its new device in the Nov. 3 *Nature*.

"The ability to actively and rapidly tune the delay is very important and is one of the hardest parts" of creating light-storage components, says John R. Lowell, who heads a program of the Defense Advanced Research Projects Agency (DARPA) in Arlington, Va., that has funded the IBM work. "They've tackled [that part] in a very novel way," he adds.

DARPA has also funded efforts to find other ways to slow and store light in chips and optical fibers. —P. WEISS

Bad Readout from DNA

Genes that act on brain may promote dyslexia

Four independent studies from the United States, Germany, and England implicate two genes in fostering dyslexia. The genes contribute to early brain development.

Dyslexia, a learning disorder that afflicts at least 5 percent of elementary school children, is characterized by difficulties in perceiving sounds within words, spelling and reading problems, and troubles with written and oral expression.

Both of the newly implicated genes normally trigger production of proteins that

IBM RESEARCH