Astronomy

A bunch of really cool objects

A mammoth sky survey designed to map the location of more than 1 million galaxies and 100,000 distant quasars has uncovered two extremely faint objects—right in our own astronomical backyard. The two dim red dots imaged by the Sloan Digital Sky Survey belong to a class of brown dwarfs, objects too big to be planets but too small to be stars. Another large survey, known as 2MASS (2-Micron All Sky Survey), has discovered an additional four of these enigmatic objects.

Brown dwarfs don't have enough mass to sustain full-scale nuclear fusion, the process that keeps stars burning. However, they are massive enough—10 to 70 times as heavy as Jupiter—to burn deuterium, endowing them with a gentle glow for the early part of their long lives.

Follow-up observations of the newly discovered brown dwarfs reveal that all six contain methane, a sign that they are extremely cool. Methane cannot form in objects warmer than about 900° C, notes Adam Burgasser of the California Institute of Technology in Pasadena. The low temperatures suggest that the dwarfs have had a long time to cool down and are more than 300,000 years old.

Only one other so-called methane brown dwarf has ever been found. That object, Gl229B, orbits a star. In contrast, each of the six new methane dwarfs travels alone in our galaxy.

Burgasser, with J. Davy Kirkpatrick of NASA's Jet Propulsion Laboratory in Pasadena, discovered four of the dwarfs among millions of celestial objects imaged with the pair of near-infrared telescopes, one in Arizona and the other in Chile, that comprise 2MASS. Spectra taken with one of the Keck telescopes on Hawaii's Mauna Kea revealed the methane, the 2MASS team reported on May 31.

Kirkpatrick estimates that the dwarfs found with 2MASS are only 30 light-years from Earth. "Because our telescopes can only see the closest examples, this means the Milky Way must be brimming with objects like these," he says. David Golimowski of Johns Hopkins University in Baltimore, a member of the Sloan team, calculates that 200 to 400 methane brown dwarfs may lie within 30 light-years of Earth.

Astronomer Gibor S. Basri of the University of California, Berkeley agrees that methane brown dwarfs could be plentiful. They are difficult to detect only because they are extremely faint and show up only in the infrared, he suggests.

Using the Sloan survey's 3.5-meter telescope at Apache Point, N.M., Xiaohui Fan and Michael A. Strauss of Princeton University found one of the brown dwarfs earlier this spring, and last month, Zlatan Tsvetanov, Golimowski, and their Johns Hopkins colleagues spied a second one. Other researchers discovered the methane in these two dwarfs by examining spectra taken at the United Kingdom Infrared Telescope on Mauna Kea. The Sloan team reported its findings on May 31 at a meeting in Chicago of the American Astronomical Society. —*R.C.*

Exploring an accelerating universe

Throughout his remarkable career, the late cosmologist David N. Schramm sought to unite the very tiny—the study of elementary particles—with the very big—the origins of the universe. At a recent conference honoring Schramm, NASA Administrator Daniel S. Goldin, along with representatives of the National Science Foundation and the Department of Energy, urged scientists to develop space missions that would explore the profound connections between these two realms.

One such example has just been put on the drawing board. Saul Perlmutter of the Lawrence Berkeley (Calif.) Laboratory proposes a mission that he says could determine unequivocally whether the universe is expanding at an increasing rate, as some recent observations have suggested.

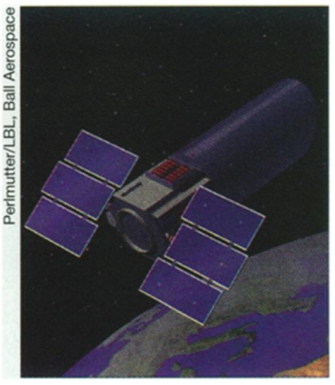
Perlmutter leads one of two teams studying distant type 1a supernovas, a class of exploded stars. These supernovas appear dimmer than would be expected if the universe's rate of expansion was constant or slowing down (SN: 12/19 & 26/98, p. 392). However, researchers have only studied about 100 supernovas and have not ruled out other explanations. For example, distant supernovas might be intrinsically fainter than nearby ones.

"We're really trying to nail down the supernova story and make sure that all possible variables are covered," he says.

A space-based telescope with a huge field of view—one square degree, or twice the apparent size of the full moon—could within a year hunt down and extensively study 2,000 type 1a supernovas, Perlmutter said at the Schramm memorial meeting, held in late May at the Fermi National Accelerator Laboratory in Batavia, Ill.

Crucial to the proposed mission, which Perlmutter calls SNAPSAT (Supernova/Acceleration Probe Satellite), are the size and sensitivity of its light detectors—large mosaics of solid-state sensors known as charge-coupled devices. Such detectors are now common, but Lawrence Berkeley scientists have figured out a way to stitch together several hundred of the largest ones, allowing for an unusually wide field of view, Perlmutter says. They have also devised a way to manufacture the detectors at less than a fourth their current cost, he adds.

"It's a great idea," says Wendy L. Freedman of the Carnegie Observatories in Pasadena, Calif., who notes that such a mission would avoid the vicissitudes of weather and the atmospheric blurring that plague ground-based studies. Perlmutter notes that if the universe is indeed accelerating, SNAPSAT may shed light on the nature of the "funny energy" that is driving the cosmos to speed up its expansion —*R.C.*



The proposed SNAPSAT craft.

Astronomical screw-ups

Astronomers are usually eager to get credit for the heavenly pictures they take. At a new Internet gallery, however, each celestial image is anonymous and the scientists who contributed them would like to keep it that way.

It's not a pretty site. The images are the results of mishaps and goofs at several optical and near-infrared telescopes.

Those dark streaks around a cluster of stars? Moisture on the solid-state detectors. Stars appear triangular rather than spherical? Too little air in the airbags that support the telescope's primary mirror. A dark, circular region that moves in synch with the telescope? A dead ladybug in the light path.

Graduate student Kaspar von Braun of the University of Michigan in Ann Arbor and two classmates compiled the astronomical bloopers to help novices—like themselves—learn from mishaps of more experienced observers.

Most errors, von Braun notes, occur when an observer is "doing everything he or she was supposed to," but some piece of technology fails. The images, accompanied by an explanation of what went awry, may suggest an immediate solution.

Von Braun and his colleagues unveiled the motley collection June 1 at a meeting of the American Astronomical Society in Chicago. The 80 or so pictures are available at http://www.astro.lsa.umich.edu/users/kaspar/obs_mishaps/mishaps.html. The team welcomes contributions from professional astronomers willing to share their telescopic tribulations. —*R.C.*