Astronomy

COASTing to a sharper image

Astronomers have now combined the light from three small optical telescopes to make the sharpest visible-light image to date of a stellar system. The picture shows several times as much detail as the Hubble Space Telescope can reveal and 50 times more than any single telescope on Earth could discern. The largest such telescope is the 10-meter W.M. Keck Telescope in Hawaii.

To accomplish that feat, researchers borrowed a technique from radio astronomy, in which an array of dish-shaped detectors acts as one large radio telescope. By combining light from a trio of telescopes spaced 6 meters apart at the Lord's Bridge Observatory near Cambridge, England, the scientists formed the equivalent of a single optical telescope as large as the total distance between the individual instruments.

Last September, John E. Baldwin of the University of Cambridge and his colleagues used the combination telescope, known as COAST (Cambridge Optical Aperture Synthesis Telescope), to examine Capella, a double star system 40 light-years away. The two stars lie closer to each other than Earth does to the sun, but COAST images clearly separate the stars, track their orbital motion, and even show which member of the duo has a slightly higher luminosity. Baldwin and his collaborators detail their work in the Feb. 1 Astronomy and Astrophysics.

Because it uses small telescopes with limited light-collecting area, COAST can bring its optics to bear only on the brightest stars. Baldwin says his team will soon add a fourth telescope to the array and will ultimately space the instruments as far apart as 100 m, improving resolution further.

Naked came the quasars . . . not!

A year ago, astronomers suggested that some of the brilliant beacons of light known as quasars were born naked, without a galaxy to swaddle them (SN: 1/28/95, p. 56). That notion defies conventional wisdom, since quasars are thought to reside in host galaxies that fuel these powerful energy sources.

Yet Hubble Space Telescope images of 11 of 15 nearby quasars showed no evidence of host galaxies. Announcing these results last year, John N. Bahcall of the Institute for Advanced Study in Princeton, N.J., said, "This is a giant step backwards in our understanding of quasars."

It now appears that quasars aren't naked after all. At about the same time Hubble was picturing nearby quasars in visible light, Kim K. McLeod, now at the Smithsonian Astrophysical Observatory in Cambridge, Mass., and George H. Rieke of the University of Arizona in Tucson, were examining many of the same quasars in the near infrared, using a telescope at the Steward Observatory near Tucson. The images reveal fuzzy blobs that fit the description of host galaxies.

Moreover, when McLeod manipulated some of the Hubble images to distinguish more clearly between the quasars and their environs, she discerned some of the same fuzzy blobs. Follow-up observations at Steward revealed host galaxies in most images analyzed by Bahcall's team, McLeod and Rieke reported in the Dec. 1, 1995 Astrophysical Journal Letters.

Why should near-infrared telescopes on the ground spot host galaxies any better than Hubble, which flies above Earth's blurring atmosphere? McLeod and Rieke note that in the infrared, galaxies tend to be brighter and quasars dimmer, making it easier to pick out a galaxy. Moreover, Hubble's relatively small mirror can't readily detect objects of low surface brightness, including some of the host galaxies.

Contrary to the widespread belief that certain types of quasars are always associated with certain types of galaxies, Bahcall's team presents Hubble images in the Feb. 1 Astrophysical Journal showing that a wide variety of galaxies plays host to different quasars.

Behavior

A monkey's tale of childhood stress

About a century ago, Sigmund Freud proposed that many psychological problems stem from unresolved childhood conflicts, primarily with one's parents. Despite the immense influence of Freud's idea, there is remarkably little scientific evidence of how such a process might work.

Researchers studying macaque monkeys now propose that early rearing conflicts alter what they call the brain's hormonal stress circuit and lead to wide-ranging social difficulties. Similarly, physical abuse or other trauma to a child's connection to caretakers may spark biological responses and contribute to various mood and anxiety disorders, perhaps depending on genetic vulnerability, assert Jeremy D. Coplan, a psychiatrist at Columbia University College of Physicians and Surgeons, and his coworkers.

"Early environmental stress may act as a common precursor to a range of psychiatric disorders," Coplan proposes.

The study consisted of 30 macaque infants whose mothers were put randomly in one of three 12-week foraging regimens: abundant food within easy reach, food that had to be dug out of a wood-chip pile, or shifts every 2 weeks between the two.

Mothers that had to alter their foraging tactics became emotionally distant from their infants and devoted much less attention to child care than did the other macaque moms.

At age 2, monkeys raised by mothers in the variable foraging condition expressed fear in new settings, became distressed if separated briefly from their mothers, and were socially inept with their peers. The cerebrospinal fluid of these macaques exhibited excess amounts of corticotropin-releasing factor (CRF), a brain hormone responsible for triggering the body's stress response. This excess signals hyperactivity of CRF-releasing brain cells, the researchers argue in the Feb. 20 Proceedings of the National Academy of Sciences.

The monkeys also had in their cerebrospinal fluid low concentrations of cortisol, a stress hormone secreted by the adrenal glands.

High CRF and low cortisol concentrations appear in many people with post-traumatic stress disorder (PTSD).

"This is the first animal model I'm aware of in which biological responses to stress mirror those observed in human PTSD cases," states Rachel Yehuda, a psychologist at the Bronx Veterans Affairs Medical Center in New York.

Further work must be done to establish whether the monkeys with aloof mothers receive biological and psychological jolts on a par with those of human trauma survivors, Yehuda holds.

Brain aligns imagination with vision

When a person uses the mind's eye to inspect an object from a different perspective, parts of the brain that detect and analyze real-world items and their movements spring into action, a new study finds. A common brain network may pick up sensations, generate perceptions of one's surroundings, and compose mental renditions of perceptions, assert Mark S. Cohen, a neuroscientist at the University of California, Los Angeles School of Medicine, and his coworkers.

In a series of trials, eight healthy volunteers mentally rotated pairs of differently aligned three-dimensional figures to determine whether they were identical or mirror images. A nonrotation task called for mental comparisons of identical or mirror-image figures oriented at the same angle. Functional magnetic resonance imaging displayed the activity of brain cells during the tests by measuring changes in blood flow.

Only mental rotation activated brain areas employed for visual scanning (SN: 12/2/95, p. 372), tracking, and remembering the location of actual objects, Cohen's group reports in the Feb. 27 Brain.