SCIENCE NEWS of the week

Mystery Matter: Through a Lens, Darkly

Using faint background light from some of the most distant reaches of the universe, researchers have created the first "map" depicting the distribution of huge clumps of dark matter hidden inside galaxy clusters. The imaging technique, which relies on newly developed computer software to analyze low levels of light and to detect that light's bending by gravity, may one day help astronomers map the concentration of dark matter over large regions of the sky.

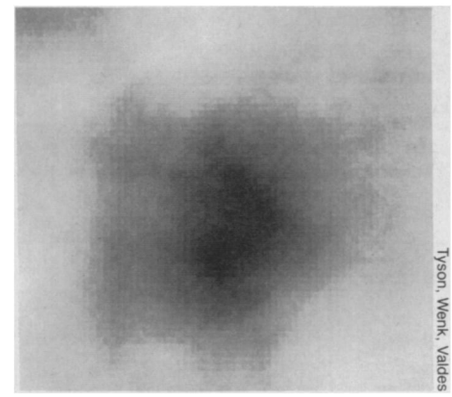
The finding "has the potential to be a major breakthrough," says astrophysicist John N. Bahcall at Princeton (N.J.) University. "What's most exciting is that the observations may be a new handle on [estimates of] dark matter."

Researchers believe that some form of dark matter – mass hidden from view because it does not radiate at any observed wavelength – must exist to explain several puzzles, including why fast-moving galaxies remain clustered together even though their visible mass could not generate the needed gravitational force. Dark matter, theorists say, provides the extra tug. Astronomers estimate it may make up 90 to 99 percent of the universe; exactly how much may determine whether the universe will expand forever or will eventually collapse because of its great mass.

Dark matter, by its very nature, can be detected only indirectly, posing a challenge for astronomers. Imagine a houseguest you can't see, smell or feel, but who eats a daily portion of roast beef from your refrigerator. You might deduce the mystery guest's weight from his or her eating capacity. Astronomers have similarly begun to infer the presence of dark matter through its one observable property: Like all mass, it bends light.

In 1916, Albert Einstein predicted such gravitational bending in his General Theory of Relativity; two decades later, he proposed that a massive object could act as a distorting lens, bending light from a more distant star so that it would appear as a ring or arc of light. Such optical illusions, known as gravitational lensing, were first observed in 1979, and since then astronomers have used the phenomenon to gauge the amount, though not the distribution, of dark matter in a handful of galaxy clusters.

These measurements were limited because observations of the lensing effect required bright light sources precisely aligned with a massive foreground object – a relatively rare occurrence. Now, using fainter, less-aligned light sources and more sensitive detectors, J.A. Tyson of AT&T Bell Laboratories in Murray Hill, N.J., and his colleagues have uncovered unprecedented details about dark matter in a galaxy cluster. They say the new technique, which takes advantage of the vast background of faint, blue light sources, could map the dark matter distribution in many regions of the universe. "We now have a 'palette' of hundreds of faint, blue galaxies" to make dark matter measurements, says Tyson, who describes the findings in the Jan. 20 ASTROPHYSICAL JOURNAL LETTERS with Richard A. Wenk of Bell Laboratories and Francisco Valdes of the National Optical Astronomy Observatories in Tucson, Ariz.



Computer-generated map shows concentration of dark matter inside galaxy cluster A1689 as inferred from its gravitational bending of distant starlight.

The researchers examined gravitational distortions in the faint, blue light of a plentiful array of galaxies located several billion light-years from Earth, near the limits of the observable universe. About midway through its journey to Earth, some of the faint light encounters a massive galaxy cluster called A1689, which acts as a gravitational lens, elongating and reorienting the appearance of the more distant galaxies as viewed from Earth, Tyson says. Using sensitive charge-coupled devices to record the light and software that amplifies and recognizes the characteristic light patterns produced by the lensing, the group mapped both the amount and distribution of dark matter in A1689. They estimate the hidden mass equals at least 10 times the visible mass of the cluster.

Because the distribution of dark matter in A1689 appears to coincide with red light emitted by the cluster – a phenomenon Tyson and his colleagues found in six other clusters they recently mapped – he clumps that match the overall cluster shape. Any indication of whether the dark matter they mapped represents "cold dark matter" – a purely theoretical concept describing matter composed of material other than the elementary particles so far detected – awaits further observations, Tyson says. *– R. Cowen*

Researchers clone anti-inflammatory protein

Scientists say they have identified and cloned a protein that blocks the biochemical cascade causing inflammation and other complications of injury or infection. The feat culminates a six-year race among research laboratories and pharmaceutical companies to characterize and mass-produce the naturally occurring inhibitor, which many believe has great potential as an anti-inflammatory drug.

The protein binds strongly and specifically to cell-surface receptors that normally serve as docking sites for interleukin-1 (IL-1), a potent compound secreted by white blood cells under a variety of biological "emergencies." When IL-1 binds to its receptor, it triggers a series of reactions in surrounding cells, causing inflammation and immune hyperactivity. For example, IL-1 causes much of the swelling and cartilage damage seen in rheumatoid arthritis and plays a key role in organ transplant rejection.

With 10 other colleagues, Charles H. Hannum, Stephen P. Eisenberg and Robert C. Thompson of Synergen, Inc. in Boulder, Colo., isolated the IL-1 receptor blocker from human white blood cells, which produce tiny quantities of the substance as a means of regulating IL-1's activity. In two papers appearing in the Jan. 25 NATURE, they describe their decoding of the inhibitor's genetic sequence and the successful mass-production of the protein in bacteria. Preliminary studies indicate the protein blocks swelling and reduces cartilage degeneration in rats with injury-induced arthritis, without causing toxicity or clinically significant immune suppression, Thompson told SCIENCE NEWS. He says Synergen hopes to begin safety trials in humans later this year in conjunction with Hoffmann-LaRoche, Inc., of Nutley, N.J.

Even if the protein proves disappointing as a drug, it should provide valuable clues to scientists designing synthetic anti-inflammatory agents, the researchers and others say. "Everybody's wanted to clone this baby," says Charles Dinarello of Tufts University in Boston, who in 1984 took part in the first cloning of IL-1 itself. "There's a huge market for this stuff." *– R. Weiss*