

Have Milky Way MACHOs Been Found?

More than 20 years ago, astronomers came face to face with an unsettling finding: The tug exerted by all the visible material in our galaxy is not nearly enough to keep it intact. To explain why the rapidly rotating stars and gas at the edge of the galaxy don't simply fly away, scientists have been forced to assume that a vast halo of dark matter, extending thousands of light-years beyond the Milky Way's visible outline, envelops the galaxy. The identity of this unseen material has remained under wraps.

Now, two teams of astronomers report that they may have glimpsed some of the veiled stuff, and it might be nothing more than elderly white dwarfs—the dim, compact remains of ordinary stars like the sun. The dwarfs could account for about half the Milky Way's dark matter and may be some of the long-sought MACHOs (massive compact halo objects) that scientists have suggested reside at the outskirts of the galaxy (SN: 4/29/95, p. 261).

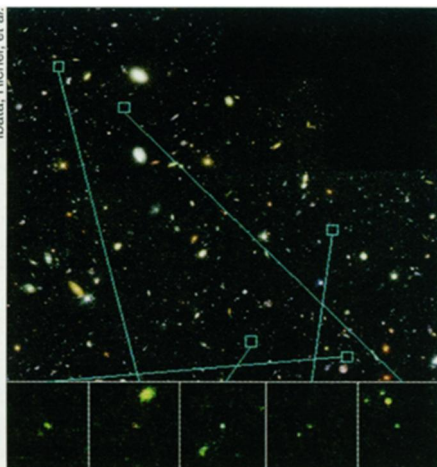
With only 20 objects imaged, the researchers say they must do follow-up observations to verify their conclusions. If the findings hold up, they could revolutionize the way astronomers think about the Milky Way and perhaps the structure of all galaxies.

However, the results won't solve the mystery of dark matter throughout the universe. The Big Bang theory predicts that most dark matter must be of some exotic form not made from protons and neutrons.

Both teams went hunting for MACHOs in postage-stamp patches of sky photographed by the Hubble Space Telescope. Rodrigo A. Ibata of the European Southern Observatory in Garching, Germany, Harvey B. Richer of the University of British Columbia in Vancouver, and their colleagues used Hubble to reexamine the Hubble Deep Field North 2 years after the telescope first imaged this region of sky (SN: 1/20/96, p. 36).

By comparing the two image sets, they picked out five extremely faint objects that had moved slightly. Remote galaxies do not move perceptibly across the sky, so the objects must reside in or near the Milky Way. Their particular motion, brightness, and bluish color suggest they are faint white dwarfs a few thousand light-years from Earth, the international team reports in an article scheduled for publication in the *ASTROPHYSICAL JOURNAL LETTERS*.

Richer cautions that the findings will remain speculative unless Hubble observations scheduled for December show that the objects continue to move in the same way. "We want to be pretty conservative," he says, "because the objects we're look-



MACHO images? Located in the Hubble Deep Field North, the central green objects in the five small frames could be white dwarfs in the galaxy's dark-matter halo.

ing at are extremely faint, and the motions . . . are very small."

Taking a different approach, René A. Méndez of the Cerro Tololo Inter-American Observatory near La Serena, Chile, and Dante Minniti of the Pontificia Universidad Católica de Chile in Santiago analyzed sin-

gle images of both the Hubble Deep Fields, North and South. They found 15 point-like sources of light whose bluish color is indicative of old white dwarfs. These objects are likely to lie in the halo less than 6 thousand light-years from Earth, the researchers report in an article to be published in the *ASTROPHYSICAL JOURNAL*.

The team couldn't determine whether the 15 objects have detectable motion, but tests show that they aren't remote galaxies, Méndez says. A preliminary analysis by Ibata's team suggests that these 15 objects do not include the 5 found by comparing old and new images.

Halo populations of white dwarfs pose serious problems, Richer notes. Formation of such objects would have thrown into interstellar space far more carbon, oxygen, and nitrogen than observations show. In addition, the appearance of galaxies today does not indicate that they once had enough sunlike stars to form a large population of halo white dwarfs.

Theorist Bohdan Paczynski of Princeton University says the findings are intriguing, but he notes that by invoking the white dwarfs, the researchers "are trading one set of difficulties for another that is equally as difficult." —R. Cowen

Berry good protection for aging brains

It's depressing to contemplate the memory loss and physical infirmity that so often accompany aging. Federal scientists, however, now report that the blues may constitute a palatable prescription for fighting the ravages of growing old—if, that is, those blues are berries.

The body creates oxidants, chemically reactive molecular fragments, to eliminate old cells, infectious agents, and damaged tissue. When all goes well, natural antioxidants quickly step in to limit the process before it gets out of hand. As animals age, however, their antioxidant production wanes. Indeed, oxidation underlies many degenerative changes that come with aging (SN: 8/10/96, p. 95).

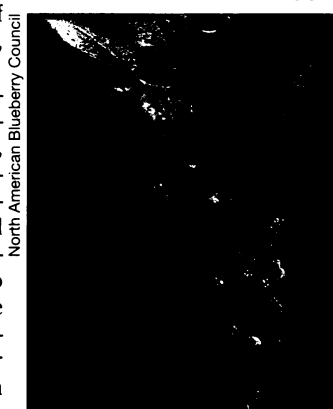
Last year, chemists at the Agriculture Department's Human Nutrition Research Center on Aging (HNRCA) at Tufts University in Boston found that blueberries are a rich source of pigments, called flavonoids, that show strong antioxidant

activity. Their earlier data showed that spinach and strawberries contain copious amounts of other antioxidants.

Colleagues in a neighboring lab have now supplemented the standard rodent food with a powdered form of blueberries, strawberries, or spinach. The researchers added the supplements in amounts having equal antioxidant activity. Ten 19-month-old rats received each type of supplemented rations. In terms of life span, these animals were on par with people in their 60s.

After 8 weeks, the scientists put each animal through a number of tests. These included mazes, walking a narrow plank, and balancing on a spinning rod. Afterward, the researchers removed and examined each animal's brain.

Though all supplemented animals performed better on memory tests than the 10 rats that got undoctored chow, only the blueberry group showed notable im-



Anthocyanin pigments give blueberries intense color and antioxidant power.