the team devised a cultured cell system they could use to screen rapidly for compounds that block this activation. Several dozen of the 10,000 synthetic chemicals so tested had the desired effect, and about one-fifth of these were not toxic to cultured cells. One member of this group—PFTα—looked particularly promising. It blocked apoptosis triggered by radiation as well as by four chemotherapeutic drugs, and it also inhibited growth arrest induced by radiation. But it had no effect on the responses of p53-deficient cells—an indication that it works as postulated. "That satisfied us a lot, because it was what we expected," Gudkov says.

The Gudkov team went on to test PFTα in mice barraged with a near-lethal dose of gamma radiation. "Amazingly," he says, "a single injection rescued [normal] mice completely" from a radiation dose that usually kills 60% of the animals, while having no effect on p53-deficient animals. What's more, the treated mice have survived more than 8 months—about half the normal mouse lifespan—and none have developed any tumors.

The group has begun testing PFTα to see if it also protects mice from chemotherapeutic drugs, and Gudkov says the "preliminary data are promising." Moreover, other potential p53 inhibitors are in the pipeline. Still, before any of them can be used in the clinic, more long-term animal studies are needed to make sure that the drugs don't induce tumor formation or have other dangerous side effects, warns medical oncologist Ronald Bukowski, director of experimental therapeutics at the Cleveland Clinic.

But if the new compounds pan out in humans, it would be great news for cancer patients. "What it means is that there may be ... a selective way to decrease side effects and give optimal doses of treatment," Bukowski says. "That's what we're all looking for."

–DAN FERBER

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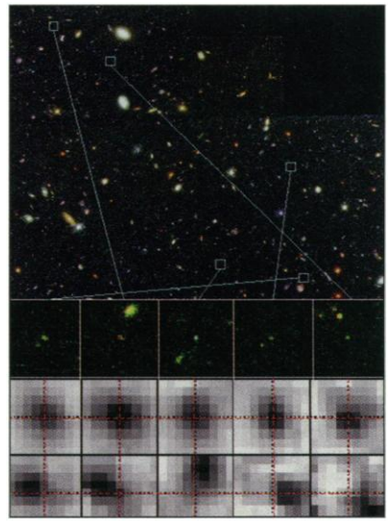
ASTRONOMY

Hubble Snaps Some Moving MACHOs

The name may suggest swagger, but MACHOs have been frustratingly reclusive. For the past decade, teams of astronomers across the globe have been scouring the halo of old stars that surrounds our galaxy for MACHOs (massive compact halo objects)—hypothetical objects that might make up the invisible "dark matter" pulling on the galaxy's visible stars. The results have been tantalizing but ambiguous. Now a team of astronomers led by Rodrigo Ibata of the European Southern Observatory (ESO) in Munich, Germany, believe they have captured five candidate MACHOs on camera.

By comparing two Hubble Space Telescope images that probe the distant universe, Ibata's team found the five objects moving very slightly in the foreground. The team believes the objects may be old white dwarf stars—dim, burned-out stars—in the halo. If the numbers can be extrapolated to the entire halo, "it would be a fair statement to say that at least part of the dark matter mystery has been solved," says team member Harvey Richer of the University of British Columbia in Vancouver, Canada. But other astronomers caution that vast numbers of white dwarfs would create their own problems for theorists. And Ken Freeman of Mount Stromlo Observatory in Canberra, Australia, cautions: "It is not clear at this stage exactly what the MACHO objects are, so I am not sure if this is the first time that MACHOs have been imaged directly."

Thus far, the standard technique for MACHO searching has been gravitational microlensing. Astronomers monitor stars in the Large Magellanic Cloud, a companion galaxy to the Milky Way, watching for the flicker that might indicate that the gravity of an unseen object passing between a star and Earth has slightly focused the star's light. These efforts have detected almost 20 candidate MACHOs, and many astronomers believe MACHOs may account for a sizable chunk of the galaxy's dark matter. But others say the lensing objects could lie outside our galaxy, in the Large Magellanic Cloud itself (*Science*, 17 July 1998, p. 332). And no one knew what MACHOs were—extremely dim stars, stray giant planets, or even small black holes.



Motion picture. Five candidate MACHOs and their movement between 1995 and 1997 (bottom two rows).

CREDIT: NASA

Ibata, Richer, and Douglas Scott, also at the University of British Columbia, decided to see if they could spot MACHOs directly in a Hubble image called Deep Field North. This image, an exposure made over several days in December 1995, shows the faintest objects ever recorded by astronomers, including galaxies in the far reaches of the universe. A single image could not reveal whether any of the objects were MACHOs, but in a second image, any object orbiting in the halo of the galaxy would probably betray itself by moving across the sky.

In 1997, the group learned that Ron Gilliland of the Space Telescope Science Institute in Baltimore, Maryland, planned a second deep image of the same spot to search for extremely distant supernova explosions. Gilliland agreed to share data from the image, made in December 1997. "I did find two supernovae," he says, "but in the end, the search for moving objects turned out to be the more important project." In a paper to appear later this year in *Astrophysical Journal Letters*, Ibata and his colleagues list five faint, bluish objects that changed position between December 1995 and December 1997. Two of them display a substantial proper motion (about 1/20th of an arc second in 2 years), while the other three are "right on the detection limit," says Richer.

He and his colleagues suspect the objects are old, dim white dwarfs at a few thousand light-years' distance. Although it is hard to extrapolate accurately from such a small population, if this number of white dwarfs were scaled up to the whole of the galaxy, the total would be on the order of a few trillion—in good agreement with the microlensing studies. Assuming that the moving objects are white dwarfs, "the whole picture is self-consistent," says Richer.

ESO's Peter Quinn notes, however, that swarms of white dwarfs surrounding galaxies like our own would create astrophysical problems. If they formed in the usual way, from sunlike stars that grew old, shed their atmospheres, and then cooled, the process would have enriched the universe with far larger amounts of elements heavier than hydrogen and helium than are seen. Ibata and his colleagues hope to confirm their proper motion measurements once Hubble has taken a third Deep Field North image next December. Other researchers have spotted what they think may be white dwarfs in a southern Deep Field image, and Ibata's team hopes to make a second image of the same spot to see if they are halo objects.

Definitive confirmation may come from wide-angle surveys with large ground-based telescopes, says Gilliland. "If much closer members of this population are found, they could be studied spectroscopically to determine their true nature," he says. Richer and his colleagues have their fingers crossed: "If the ground-based surveys don't find them, our scenario is not correct," he says.

–GOVERT SCHILLING

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