Galaxy study challenges cosmic-age estimate

Talk about a problem of astronomical proportions.

Last month, researchers announced that they had determined the age of the universe to unprecedented accuracy (SN: 5/29/99, p. 340). Now, a report suggests that a cosmic yardstick used to calculate that age may be shorter than assumed. This could shrink the age of the cosmos by 2 billion years.

The most recent study relies on the Very Long Baseline Array, 10 radio telescopes that span North America. Using this network, researchers have directly measured the distance to the galaxy NGC 4258—independent of any yardstick. "It's hard to go wrong when you're just doing high-school algebra to calculate a distance," says James R. Herrnstein of the National Radio Astronomy Observatory in Socorro, N.M.

His team's estimate, 23.5 million light-years, is the most precise ever measured for a remote galaxy, asserts Herrnstein. That distance is accurate to within 7 percent, he reported June 1 at a meeting in Chicago of the American Astronomical Society.

Another team, however, using the yardstick, puts the distance at 26 million to 28 million light-years. For that measurement, Eyal Maoz of NASA's Ames Research Center in Mountain View, Calif., and his colleagues, including Wendy L. Freedman of the Carnegie Observatories in Pasadena, Calif., used the Hubble Space Telescope to observe about 24 of the stars known as Cepheid variables. Each star's intrinsic brightness is proportional to the rate at which it pulsates. To determine distance, astronomers compare a Cepheid's innate brightness with its appearance in the sky.

NGC 4258 is the first galaxy for which the two methods have been compared, and it's too early to say which will prove correct, Freedman says. But if the error lies with the widely used Cepheid method, the universe may be 15 to 20 percent younger than the 12 billion and 13.5 billion years reported May 25 by Freedman. Those estimates, based on Cepheids and three other distance indicators, are accurate within 10 percent, she says.

Calculating the true brightness of a Cepheid depends ultimately on the distance to one of our galaxy's closest neighbors, the Large Magellanic Cloud. Uncertainty in that distance is the largest source of error in the age calculated by Freedman's group. Recent estimates have come up with a distance 15 to 20 percent less than the one that the team used.

In contrast, the radio telescope–derived distance to NGC 4258 depends primarily on geometry. At the core of this galaxy lies a disk of gas, seen edge-on, whirling around a suspected black hole. The gas includes water masers, clouds of water vapor that emit intense radio waves. Herrnstein's team tracked 30 of these brilliant blobs over a 3-year period to measure how far they traveled across the sky, carried by the disk's rotation.

Like a distant airplane that crawls across the sky, the 30 masers barely seem to move, despite a speed of 3.2 million kilometers per hour, calculated from measurements of other masers in the galaxy. Comparing this speed with the observed change in position, the team calculated a distance that they call "the golden meterstick in the glass case."

Whether that gold will turn out to be brass remains to be seen. The analysis assumes that the masers move in sync with the rest of the gas in the disk. This seems likely because each blob appears to be moving at the same rate, Herrnstein says. Even if the masers move in elliptical orbits, rather than in circles, as the team supposed, a discrepancy with the Cepheid distance still holds, he adds.

David A. Neufeld of Johns Hopkins University in Baltimore, who studies water masers, notes that the measurements amount to "a one-trick pony," since few galaxies are known to contain masers and even fewer can also be easily observed from Earth. Nonetheless, he says, astronomers must explain the difference between the radio and Cepheid measurements before they can assume that they have accurately determined the age of the cosmos.

Freedman says the debate may continue until 2005, when the Space Interferometry Mission measures the distance to the Large Magellanic Cloud. —*R. Cowen*

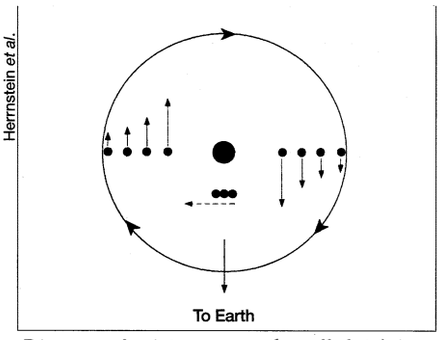

Diagram depicts masers (small dots) in a rotating disk at the core of NGC 4258.

Boosting tomato's SOS gets pests killed

A field test has now shown that making a tomato scream louder brings a horde of bug-hunting parasitic wasps to trash the tomato's attackers.

In the botanical version of "Help! They're eating me," plants release volatile chemicals when caterpillars bite their leaves. Creatures that prey on caterpillars home in on these distress signals. Like ambulance chasers, they rush to the scene.

The recent test demonstrated that spraying a plant hormone on a tomato crop to boost the distress signals pays off, says Jennifer S. Thaler of the University of California, Davis. "This SOS actually results in more herbivores being killed—that's new," she notes.

In a California field infested with beet armyworms, Thaler sprayed jasmonic acid on half the young tomato plants. That hormone, found in plants as diverse as ferns and cotton, triggers the manufacture of insect toxins and SOS signals.

Native parasitic wasps, *Hyposoter exiguae,* cruise the fields and inject eggs into armyworms. When the eggs hatch, larvae eat the armyworm from inside.

Three weeks after treating the field, Thaler looked for wasp larvae that had killed their armyworms and formed protective cases that look like bird droppings. She found such pupae on about half of the sprayed plants. The body armyworm count in sprayed plots was twice that in control areas, she reports in the June 17 NATURE.

Fatal injection: A wasp injects a beet armyworm with an egg. Its larva will kill the caterpillar from inside.

In another experiment, lab-reared caterpillars in cups beside sprayed plants suffered 37 percent more parasitism than those near controls.

Thaler's research "is a very important next step," comments the Department of Agriculture's W. Joe Lewis of Tifton, Ga., who studies ways to incorporate SOS signals into pest control. He says that intriguing as the strategy sounds, he wants to know more about the big picture. For instance, does amplifying the signals crowd wasps into an area with no corresponding profusion of caterpillars, so that it reduces the next wasp generation?

USDA chemist and plant-defense specialist James H. Tumlinson of Gainesville, Fla., notes, "The really interesting part of this is that it was done in the field." Remarking that the strategy holds promise, he says, "This is a really red-hot area." —*S. Milius*