Astronomers crunch numbers, universe gets bigger

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The Triangulum Galaxy (M33). Credit: Indiana University

That intergalactic road trip to Triangulum is going to take a little longer than you had planned. An Ohio State University astronomer and his colleagues have determined that the Triangulum Galaxy, otherwise known as M33, is actually about 15 percent farther away from our galaxy than previously measured.

This finding implies that the Hubble constant, a number that astronomers rely on to calculate a host of factors -- including the size and age of the universe -- could be significantly off the mark as well.

That means that the universe could be 15 percent bigger and 15 percent older than any previous calculations suggested.

The astronomers came to this conclusion after they invented a new method for calculating intergalactic distances, one that is more precise and much simpler than standard methods. Kris Stanek, associate professor of astronomy at Ohio State, and his coauthors describe the method in a paper to appear in the *Astrophysical Journal* (astro-ph/0606279).

In 1929, Edwin Hubble formulated the cosmological distance law that determines the Hubble constant. Scientists have disagreed about the exact value of the constant over the years, but the current value has been accepted since the 1950s. Astronomers have discovered other cosmological parameters since then, but the Hubble constant and its associated methods for calculating distance haven't changed.

"The Hubble constant used to be the one parameter that we knew pretty well, and now it's lagging behind. Now we know some things quite a bit better than we know the Hubble constant," Stanek said. "Ten years ago, we didn't even know that dark energy existed. Now we know how much dark energy there is -- better than we know the Hubble constant, which has been around for almost 80 years."

Still, Stanek said he and his colleagues didn't start this work in order to change the value of the Hubble constant. They just wanted to find a simpler way to calculate distances.

To calculate the distance to a faraway galaxy using the Hubble constant, astronomers have to work through several complex steps of related equations, and incorporate distances to closer objects, such as the Large Magellanic Cloud.

"In every step you accumulate errors," Stanek said. "We wanted an independent measure of distance -- a single step that will one day help with measuring dark energy and other things."

The new method took 10 years to develop. They studied M33 in optical and infrared wavelengths, checking and re-checking measurements that are normally taken for granted. They used telescopes of all sizes, from fairly small 1-meter telescopes to the largest in the world -- the 10-meter telescopes at the Keck Observatory in Hawaii .

"Technologically, we had to be on the cutting edge to make this work, but the basic idea is very simple," he said.

They studied two of the brightest stars in M33, which are part of a binary system, meaning that the stars orbit each other. As seen from Earth, one star eclipses the other every five days.

They measured the mass of the stars, which told them how bright those stars would appear if they were nearby. But the stars actually appear dimmer because they are far away. The difference between the intrinsic brightness and the apparent brightness told them how far away the stars were -- in a single calculation.

To their surprise, the distance was 15 percent farther than they expected: about 3 million light-years away, instead of 2.6 million light-years as determined by the Hubble constant.

If this new distance measurement is correct, then the true value of the Hubble constant may be 15 percent smaller -- and the universe may be 15 percent bigger and older -- than previously thought.

"Our margin of error is now 6 percent, which is actually pretty good," Stanek said. Next, they may do the same calculation for another star

system in M33, to reduce their error further, or they may look at the nearby Andromeda galaxy. The kind of binary systems they are looking for are relatively rare, he said, and getting all the necessary measurements to repeat the calculation would probably take at least another two years.

Source: Ohio State University