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# Andromeda Galaxy takes up much more space

**Halo of stars stretches out farther than astronomers previously thought**

By Ker Than



updated 1:16 a.m. PT, Mon., Jan. 8, 2007

SEATTLE - The discovery of several large, metal-poor stars located far from the center of the Andromeda galaxy suggests our nearest galactic neighbor might be up to five times larger than previously thought.

The newfound stars are massive, bloated stars known as **red giants**. Although found far beyond the most visible portion of **Andromeda** — its **swirling disk** — the stars are still gravitationally bound to the galaxy and make up part of its extended "halo."

"We're typically used to thinking of Andromeda as this tiny speck of light, but the actual size of the halo ... extends to a very large radius and it actually fills a substantial portion of the night sky," said study team member Jason Kalirai of the University of California at Santa Cruz.

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Scientists say the Andromeda galaxy, shown here, has a halo of stars that is five times bigger than previously thought.

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**Andromeda**

Also known as M31, Andromeda is located only about 2.5 million light-years from Earth, making it our nearest galactic neighbor.

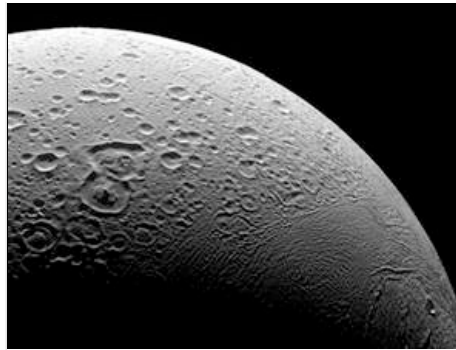
Like our own Milky Way, Andromeda is a **classic spiral galaxy**, which typically consists of three main parts: a flattened disk, a bright

central bulge of densely packed **stars** and an extended spherical halo where stars are more sparsely distributed.

Using the Mayall Telescope at Kitt Peak and the DEIMOS spectrograph on the the Keck II Telescope in Hawaii, the researchers found previously unseen red giant stars out to a distance of at least 500,000 light-years from Andromeda's center.

The researchers picked out Andromeda's faint halo stars using a technique developed by Karoline Gilbert, a UCSC graduate student, which distinguishes the halo stars from the more numerous foreground stars in our Milky Way.

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A dim foreground star and a bright star located much farther away — whose light can be diminished by interstellar gas — can be hard to tell apart because they appear to have similar luminosities as stars in our own galaxy. The researchers liken the effect to distinguishing between the light of a firefly 10 feet away and that of a powerful beacon in the distance.

"In this case, the fireflies are dwarf stars in our own galaxy and the beacons are the red giant stars in Andromeda," said study team member Puraga Guhathakurta, also from UCSC.

#### **Metal-poor halos**

According to current galactic formation theories, the halo is the first part of a galaxy that forms. Stars in the halo are predicted to be metal-poor because they formed during a time when the universe had much less heavy metal content than it does now. Heavy metals are created as stars evolve and then spewed out into interstellar space when ancient stars either explode as supernovas or shed their outer layers to become white dwarfs.

"The first stars are expected to be chemically deficient, and as these other components such as the disk of the galaxy form later, it is contaminated by the products of those first stars, so those stars are more metal rich," Kalirai said.

However, instead of being metal-poor, previous studies have found that Andromeda's halo stars were actually 10 times richer in metals than halo stars in our galaxy. This finding puzzled astronomers because both Andromeda and the Milky Way should have similar formation histories.

The new findings could solve this discrepancy because the red giant stars are anemic, as is expected from galaxy formation theories and what is known about the Milky Way.

"If you plot the metallicity as a function of radius, you see a very nice trend where the inner parts of the galaxy are metal rich, and the outer parts of the galaxy are dominated by stars that are metal-poor," Kalirai said.

"We now believe that previous groups have been mistakenly identifying the outer parts of the Andromeda bulge as its halo," Guhathakurta said.

Paul Hodge, an expert on the Andromeda galaxy from Washington University who was not involved in the study, said the new finding paints a very different picture of our galactic neighbor than was available only a few years ago.

"It's a new galaxy," Hodge said. "The outer parts of this galaxy are finally being revealed and its turning out to be much more interesting and beautiful than when could have imagined."

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