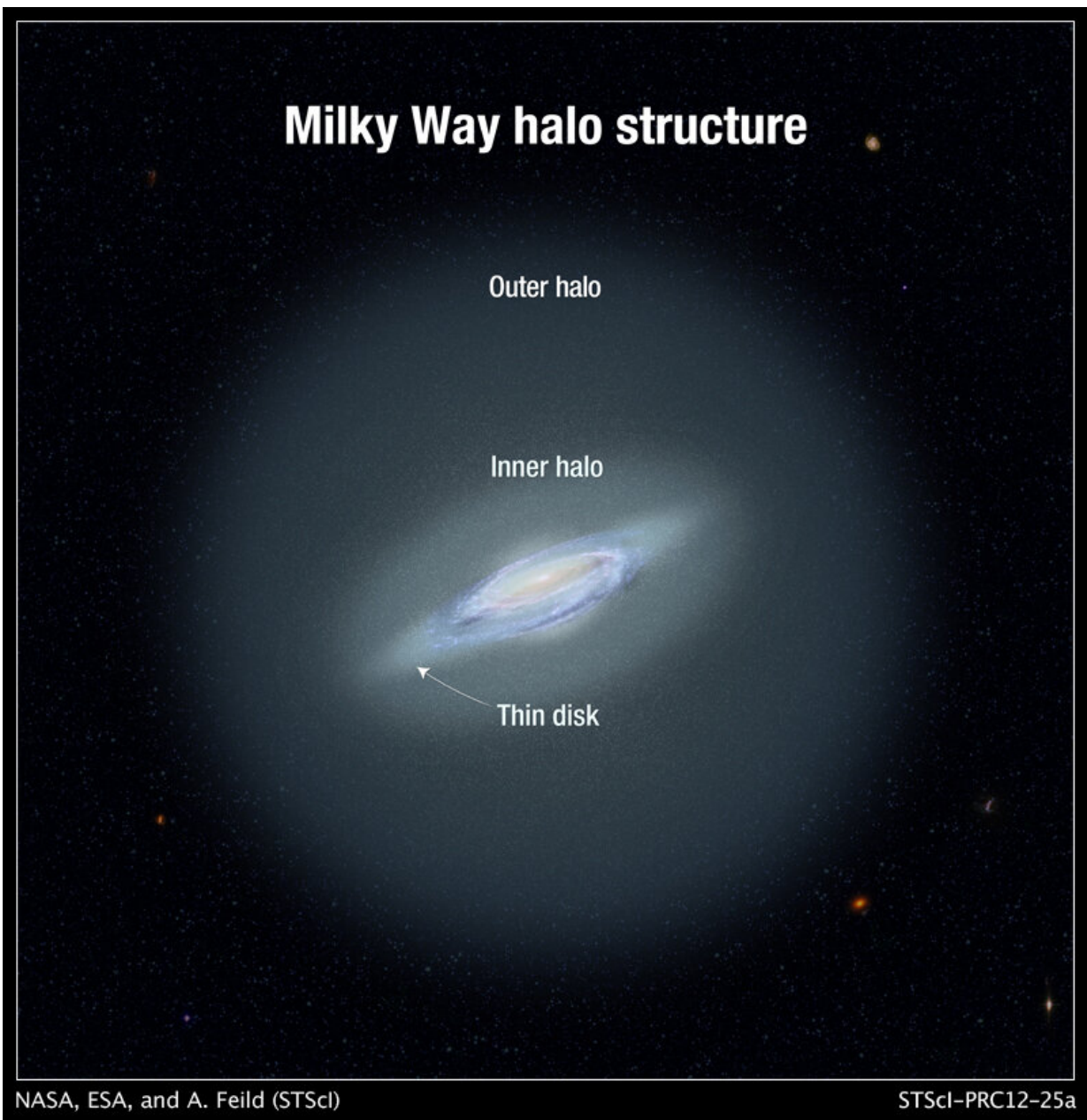


Astronomers find the most distant stars in our galaxy halfway to Andromeda

January 9 2023



This illustration shows the Milky Way galaxy's inner and outer halos. A halo is a spherical cloud of stars surrounding a galaxy. Credit: NASA, ESA, and A. Feild (STScI)

Astronomers have discovered more than 200 distant variable stars known as RR Lyrae stars in the Milky Way's stellar halo. The most distant of these stars is more than a million light years from Earth, almost half the distance to our neighboring galaxy, Andromeda, which is about 2.5 million light years away.

The characteristic pulsations and brightness of RR Lyrae stars make them excellent "standard candles" for measuring galactic distances. These new observations have allowed the researchers to trace the outer limits of the Milky Way's halo.

"This study is redefining what constitutes the outer limits of our galaxy," said Raja GuhaThakurta, professor and chair of astronomy and astrophysics at UC Santa Cruz. "Our galaxy and Andromeda are both so big, there's hardly any space between the two galaxies."

GuhaThakurta explained that the stellar halo component of our galaxy is much bigger than the disk, which is about 100,000 [light years](#) across. Our solar system resides in one of the spiral arms of the disk. In the middle of the disk is a central bulge, and surrounding it is the halo, which contains the [oldest stars](#) in the galaxy and extends for hundreds of thousands of light years in every direction.

"The halo is the hardest part to study because the outer limits are so far away," GuhaThakurta said. "The stars are very sparse compared to the high stellar densities of the disk and the bulge, but the halo is dominated

by dark matter and actually contains most of the mass of the galaxy."

Yuting Feng, a doctoral student working with GuhaThakurta at UCSC, led the new study and is presenting their findings in two talks at the American Astronomical Society meeting in Seattle on January 9 and 11.

According to Feng, previous modeling studies had calculated that the [stellar halo](#) should extend out to around 300 kiloparsecs or 1 million light years from the galactic center. (Astronomers measure galactic distances in kiloparsecs; one kiloparsec is equal to 3,260 light years.) The 208 RR Lyrae stars detected by Feng and his colleagues ranged in distance from about 20 to 320 kiloparsecs.

"We were able to use these [variable stars](#) as reliable tracers to pin down the distances," Feng said. "Our observations confirm the theoretical estimates of the size of the halo, so that's an important result."

The findings are based on data from the Next Generation Virgo Cluster Survey (NGVS), a program using the Canada-France-Hawaii Telescope (CFHT) to study a cluster of galaxies well beyond the Milky Way. The survey was not designed to detect RR Lyrae stars, so the researchers had to dig them out of the dataset. The Virgo Cluster is a large cluster of galaxies that includes the giant elliptical galaxy M87.

"To get a deep exposure of M87 and the [galaxies](#) around it, the telescope also captured the foreground stars in the same field, so the data we used are sort of a by-product of that survey," Feng explained.

According to GuhaThakurta, the excellent quality of the NGVS data enabled the team to obtain the most reliable and precise characterization of RR Lyrae at these distances. RR Lyrae are old stars with very specific physical properties that cause them to expand and contract in a regularly repeating cycle.

"The way their brightness varies looks like an EKG—they're like the heartbeats of the galaxy—so the brightness goes up quickly and comes down slowly, and the cycle repeats perfectly with this very characteristic shape," GuhaThakurta said. "In addition, if you measure their average brightness, it is the same from star to star. This combination is fantastic for studying the structure of the galaxy."

The sky is full of stars, some brighter than others, but a star may look bright because it is very luminous or because it is very close, and it can be hard to tell the difference. Astronomers can identify an RR Lyrae star from its characteristic pulsations, then use its observed brightness to calculate how far away it is. The procedures are not simple, however. More distant objects, such as quasars, can masquerade as RR Lyrae stars.

"Only [astronomers](#) know how painful it is to get reliable tracers of these distances," Feng said. "This robust sample of distant RR Lyrae stars gives us a very powerful tool for studying the halo and testing our current models of the size and mass of our galaxy."

This study is based on observations obtained with MegaPrime/MegaCam, a joint project of CFHT and CEA/IRFU, at the Canada-France-Hawaii Telescope (CFHT), which is operated by the National Research Council (NRC) of Canada, the Institut National des Sciences de l'Univers of the Centre National de la Recherche Scientifique (CNRS) of France, and the University of Hawaii.

More information: Conference: [American Astronomical Society meeting in Seattle](#)

Provided by University of California - Santa Cruz

Citation: Astronomers find the most distant stars in our galaxy halfway to Andromeda (2023, January 9) retrieved 10 May 2024 from <https://phys.org/news/2023-01-astronomers-distant-stars-galaxy-halfway.html>

This document is subject to copyright. Apart from any fair dealing for the purpose of private study or research, no part may be reproduced without the written permission. The content is provided for information purposes only.