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ASTRONOMERS PROBE DARK MATTER AROUND GIANT GALAXY

Astronomers have traced a halo of dark matter around a giant elliptical galaxy far into its periphery, seeing the transition between its halo and that of the cluster it sits in. The results are being presented today by Dr. Aaron J. Romanowsky of the Kapteyn Astronomical Institute, in Groningen, the Netherlands, and Dr. Christopher S. Kochanek of the Harvard-Smithsonian Center for Astrophysics, in Cambridge, MA, to the meeting of the American Astronomical Society in Rochester, NY. Their report sheds light on the poorly-known properties of dark matter around elliptical galaxies, and tests predictions for the formation of galaxies and clusters.

It has long been known from measurements of their gas velocities that spiral galaxies like our own Milky Way typically come embedded in massive, extended "halos" of dark matter. But the situation for elliptical galaxies is less clear — there are no generally available observational tools for determining the mass in their outer parts. A promising avenue involves the study of globular clusters, which reside in swarms of thousands around some galaxies. These bright, compact objects can be found far out from a galaxy's center, and their orbital velocities measured.

The giant elliptical galaxy M87 lies at the center of the nearby Virgo Cluster of galaxies, 50 million light years away. There is now an abundance of data available on it, including velocities of its stars, and of over two hundred of its globular clusters (most of which were observed by Drs. Judith G. Cohen and Anton Ryzhov at the California Insitute of Technology, in Pasadena, CA, using the W.M. Keck Observatory on Mauna Kea, HI).

Drs. Romanowsky and Kochanek have completed an analysis of these data, looking for rigorous confirmation of the existence of a dark matter halo around the galaxy. They found clear evidence of it, as well as signs of the larger dark halo belonging to the Virgo Cluster itself.

"As we looks far enough out in the outer parts of a galaxy, we should see the velocities of its orbiting globular clusters falling off," said Dr. Romanowsky. "This is because the dark matter should eventually peter out, along with its gravitational influence — the density should decrease at least as rapidly as one over the radius-squared. But in the case of M87, we find the mass density decreasing more slowly than this, which we interpret as being due to the presence of the Virgo Cluster halo. This cluster halo appears to have a high-density 'core', similar to what is predicted by some cosmological theories. Future analyses will examine the distribution of this dark matter in more detail, and further observations (e.g., of the velocities of planetary nebulae) will add more information."

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