www.cnrs.fr

UNIVERSITÉ DE STRASBOURG

PRESS RELEASE I PARIS I 21 JULY 2014

Satellite galaxies put astronomers in a spin

An international team of researchers, led by astronomers at the Observatoire Astronomique de Strasbourg (CNRS/Université de Strasbourg), has studied 380 galaxies and shown that their small satellite galaxies almost always move in rotating discs. However, such satellite galaxy discs are not predicted by current models of the formation of structures in the Universe. This discovery could cause modelers serious headaches in the years ahead. The results of the study are published in the 31 July 2014 issue of the journal *Nature*.

The existence of numerous dwarf galaxies around large galaxies such as our own Milky Way has long been known. In the past few years, the orbits of these dwarf galaxies around the Milky Way and our neighboring galaxy Andromeda have raised a number of questions of interpretation. This is because the orbits are arranged in large, flat rotating structures[1], whereas our best current models of galaxy formation, derived from the standard model of cosmology, predict that they should move in all directions. It therefore seemed that the Milky Way and its neighbor were statistical anomalies among the billions of galaxies that make up the Universe, as an international study recently confirmed[2].

Now, however, a study carried out in Strasbourg and Sydney based on the Sloan Digital Sky Survey, a survey covering a third of the sky that makes it possible to explore the properties of distant galaxies, has shown that, in 380 galaxies observed, located between 30 and 700 million light years away and having at least two visible satellite galaxies, the small satellite galaxies also appear to orbit around their hosts. The researchers estimate that approximately half the satellite galaxies in the Local Universe must be located in rotating discs in order to agree with their observations.

These findings call into question the predictions of the standard model at galactic scales. This is because, if this phenomenon were linked to the accretion of satellite galaxies along filaments of dark matter in the Universe, it would be necessary to explain why these rotating structures are much thinner than the filaments that gave rise to them, and also why the two brightest satellite galaxies, which are the two that can be seen, systematically always come from the same filament. Alternatively, the discovery may mean that our current models need to be completely revised. Today, everything appears to indicate that the standard model provides a faithful representation of observations at the largest scales of the Universe[3], but that, for the moment, we are overlooking something fundamental at smaller scales.

---

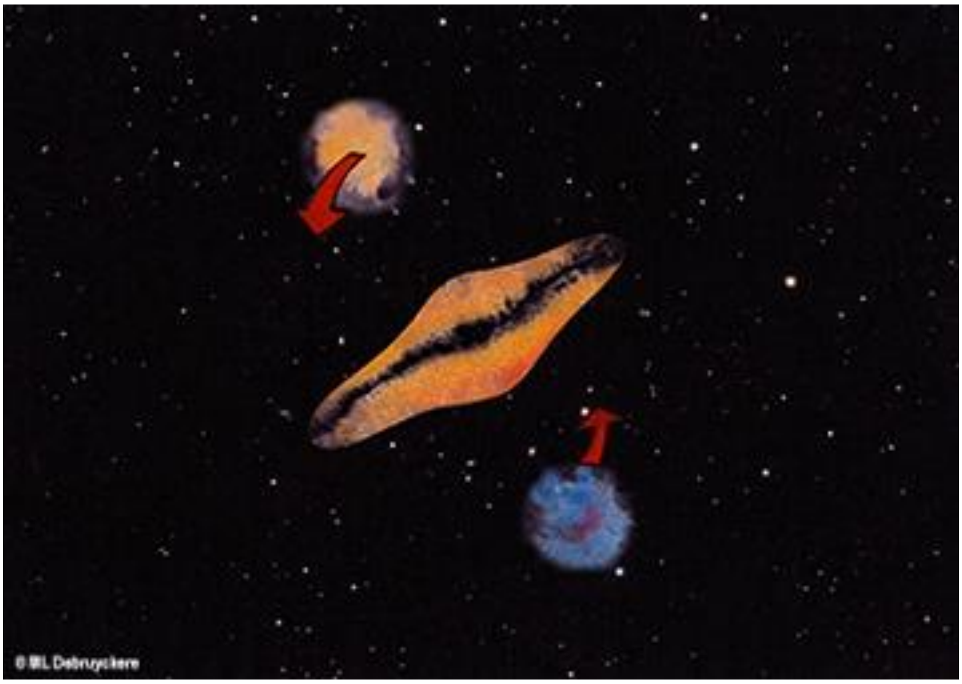
[1] Ibata et al., *A vast, thin plane of corotating dwarf galaxies orbiting the Andromeda galaxy*, Nature 493, January 2013, doi:10.1038/nature11717

[2] Pawlowski et al., *Co-orbiting satellite galaxy structures are still in conflict with the distribution of primordial dwarf galaxies,* MNRAS Vol. 442, June 2014, 10.1093/mnras/stu1005

[3] Shan et al., *Weak lensing mass map and peak statistics in Canada-France-Hawaii Telescope Stripe 82 survey* , MNRAS Vol. 442, June 2014, doi:10.1093/mnras/stu1040

www.cnrs.fr

UNIVERSITÉ DE STRASBOURG



The host galaxy and its two satellite galaxies (artist rendering) are observed in the plane of the sky, and the measured speed is the relative speed of the satellites' motion towards and away from the host and the observer (the overall speed is away from us due to the expansion of the Universe). There is a consistent rotational motion of the satellites around their hosts that is not predicted by models.
© Marie-Laure Debruyckere

Reference

Velocity anti-correlation of diametrically opposed galaxy satellites in the low z universe, N. G. Ibata, R. A. Ibata, B. Famaey, G. F. Lewis, *Nature*, Vol. 513, July 2014.

Contact information

CNRS researcher I Benoit Famaey I **T 0033 3 68 85 24 13** I benoit.famaey@astro.unistra.fr
CNRS Press Office I Loïc Bommersbach I **T 0033 1 44 96 51 51** I presse@cnrs-dir.fr