Satellite galaxies put astronomers in a spin

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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* ("Velocity anti-correlation of diametrically opposed galaxy satellites in the low-redshift universe").

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 ("A vast, thin plane of corotating dwarf galaxies orbiting the Andromeda galaxy"), 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 ("Co-orbiting satellite galaxy structures are still in conflict with the distribution of primordial dwarf galaxies").

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 ("Weak lensing mass map and peak statistics in Canada–France–Hawaii Telescope Stripe 82 survey"), but that, for the moment, we are overlooking something fundamental at smaller scales.

More information: "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. DOI: 10.1038/nature13481

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