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Milky Way Was Heavily Influenced By Environment In Which It Formed

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Science
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M31, the Andromeda Galaxy, in a series of exposures to test stacking images with HDR techniques. I ... [+] UNIVERSAL IMAGES GROUP VIA GETTY IMAGES

We live in one of the most prominent spiral galaxies in our Local Group of galaxies. Yet astronomers have long wondered how our local galactic neighborhood actually formed. But for the first time, a team of astronomers has conducted detailed computer simulations of local group analogs to answer just that.

In a paper appearing in the journal *Monthly Notices of the Royal Astronomical*

Society (MNRAS), lead author Edoardo Carlesi and colleagues note how the large-scale environment surrounding the Milky Way and Andromeda (M31) —- the two most prominent characters in the Local Group of Galaxies —- affects the way they form.

The team concluded that galaxies forming in an environment such as the one we are located tend to have a more quiescent mass assembly history, compared to similar galaxies located elsewhere in the Universe.

“A quiescent merging history means they did not collide with other large galaxies in the last few billion years, and most of their mass was accreted through mergers in the first half of the Universe's life,” Carlesi, a postdoctoral fellow at Germany’s Leibniz Institute for Astrophysics (AIP) Potsdam, told me.

The theoretical importance of this result lies in the fact that so far most of the studies of simulated Milky Way and Andromeda galaxies did not pay attention to the environment around them, he says. here we show that environment does play some role in shaping the Local Group's properties, and should be taken into account, says Carlesi.

The Local Group encompasses two main galaxies, Andromeda and the Milky Way, their satellite galaxies and other tens of dwarf galaxies that are gravitationally bound to this system.

In a way, Carlesi says, it is like looking at a home (whose typical size is of the order of tens of meters) and asking how much its whole neighborhood (a few kilometers in size) affects the way it was built.

Carlesi and colleagues used a numerical technique that they have developed in the last 10 years (the Constrained Simulation technique) that allows for the simulation of the Local Group of galaxies (our cosmic home) within a large-scale environment (its neighborhood).

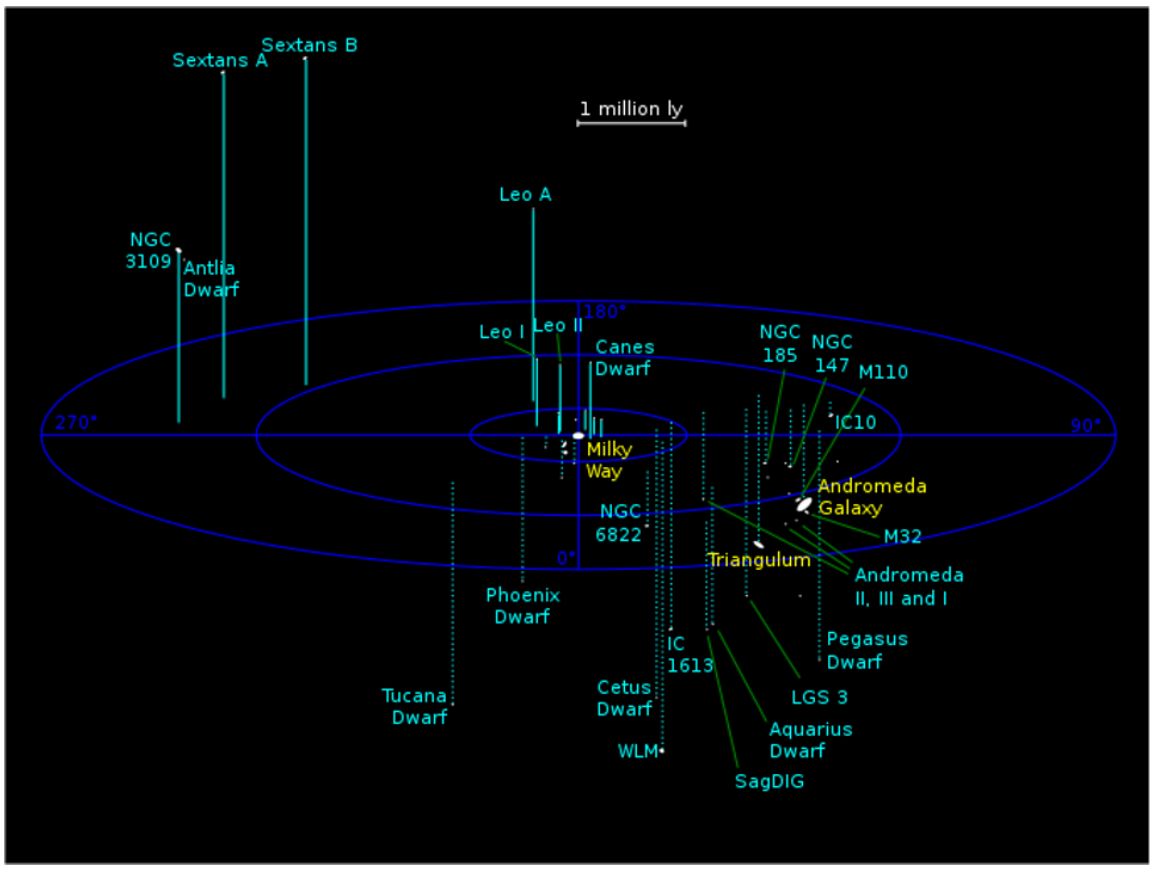
“Using hundreds of simulations, and not a few as other groups including ourselves have done in the past, has allowed us to put our results on firm statistical grounds,” said Carlesi.

We believe that both the Andromeda Galaxy and our Milky Way Galaxy accreted most of their mass in the first half of the age of the Universe, merging with other smaller galaxies, says Carlesi. From around 7 billion years ago until today, these mergers were rarer than one would expect for similar galaxies located elsewhere in the Universe, he says.

“This is why we think that the particular cosmic neighborhood we live

influences the way the Local Group assembled its mass, making it more quiescent that the average," said Carlesi.

The Local Group is in turn also part of the huge Laniakea superstructure, thought to be made up of some 100,000 galaxies and stretch over 250 million light years.



Local Group of Galaxies WIKIPEDIA

You can think of the Local Group as an apartment complex (the Milky Way being one of them) inside a neighborhood (our local environment) in the outskirts of a city (the Virgo supercluster), he says. In this case Laniakea would be our country, a place that contains millions of galaxies such as the Milky Way and tens of clusters such as Virgo, Carlesi says.

As for remaining conundrums?

What we found here is mainly a correlation between the large-scale environment and the formation of the local group, says Carlesi. But he says that the exact physical mechanism behind this link is still not clear, and we need more and higher resolution simulations to have a more complete picture.

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