

Devouring stars

According to a survey, the Milky Way cannibalized eleven neighboring galaxies

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Illustration that depicts stellar streams circling the galaxy

Approximately 200 million years after the Big Bang, which refers to the initial explosion that gave rise to the universe 13.8 billion years ago, the first stars of what would become the Milky Way began to coalesce. Since then, the galaxy has not stopped growing. Approximately 9 billion years ago, for example, its characteristic spiral arms took form. A new study indicates that by expanding and attracting other matter in its vicinity, the Milky Way cannibalized stars from eleven smaller, neighboring galaxies. Its gravitational force, especially that of the (invisible) dark matter halo that seems to envelop the galaxy, pulled vast numbers of stars away from these little systems and drew them into its orbit, thereby forming eleven chains, or streams, of stars of external origin that revolve around the Milky Way without being incorporated into its spiral arms or the bulge at its center. "These streams tell us about the formation and structure of the Milky Way," says Nora Shipp, who is a doctoral student at the University of Michigan, in the United States, and lead

author of the study, which is available in the arXiv repository.

These stellar streams were identified by the Dark Energy Survey (DES), an international collaboration in which Brazil is a participant. The survey's goal is to study the mysterious nature of dark energy, which makes up 71% of the universe (dark matter accounts for 24% and normal, or baryonic, matter—visible stars and other celestial bodies—makes up only 5%). Dark energy causes the expansion of the universe to accelerate. In an attempt to understand this predominant but enigmatic component of the universe, the DES looks for patterns that may explain the formation of cosmic structures. To do this, the survey produces periodic, high-resolution images of an area that corresponds to one-eighth of the observable sky. Employing a powerful 570-megapixel camera that is installed in the Blanco telescope in Chile, the DES mapped 400 million astronomical objects, such as galaxies and supernovae, during its first three years of operation (from 2014 to 2016).

One of the studied objects was the Milky Way, in which remnants of the eleven galaxies were identified. "Like comets that leave visible tails when they pass near the Sun, these stellar streams are the vestiges of galaxies that have been swallowed up by the Milky Way," observes astrophysicist Márcio Maia of the Inter-Institutional e-Astronomy Laboratory (LINEA), which provides support for Brazilian participation in the DES and other surveys. A coauthor of the study on the Milky Way, Maia says that the colors of these streams of newly discovered stars are different from those of most other stars in the galaxy. Using this variation in tone, astrophysicists were able to deduce their chemical composition and determine that the streams originated outside the Milky Way. To date, approximately 30 stellar streams that originated outside the galaxy have been discovered. ■ **Marcos Pivetta**

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SHIPP, N. *et al.* Stellar streams discovered in the dark energy survey. *arXiv*. Online, Jan 9, 2018.