Astrophysicists discover mechanism for spiral-arm formation in disk galaxies

August 11 2016

Astrophysicists at the University of Arkansas have discovered a mechanism for the formation of the spiral arms in disk galaxies.

The finding was published in the *Astrophysical Journal Letters*, the journal of the American Astronomical Society.

The discovery provides a better understanding for the formation of spiral arms in a kind of disk galaxy known as a spiral galaxy, said Hamed Pour-Imani, a physics doctoral student at the U of A and lead author of the study.

Spiral arms are the elongated and curved spiral sections that are connected to the center of a spiral galaxy, such as our own Milky Way.

"Spiral galaxies are fascinating structures in astronomy, and the exact mechanism of the formation of spiral arms is still a mystery in astrophysics," Pour-Imani said. "Our work provides strong evidence for the density wave theory of spiral galaxies, which is one of two popular theories to explain the spiral structures."

Density wave theory was proposed in the 1960s to explain the spiral arm structure of spiral galaxies. The theory posited that spiral arms are not material in nature, but instead made up of areas of greater density, similar to a traffic jam on the highway. Stars move in and out of the spiral arms as they orbit the galaxy. The density wave theory predicts that the pitch angle of spiral arms should vary with the wavelength of the

galaxy's image.

Previous research either failed to find any significant variation in pitch angle or only limited evidence for it, Pour-Imani said. In this study, U of A astrophysicists used an optical wavelength image for disk galaxies and images from the NASA Spitzer Space Telescope at two infrared wavelengths. The pitch angles agreed with the density wave theory.

More information: Hamed Pour-Imani et al. Strong evidence for the density-wave theory of spiral structure in disk galaxies, *The Astrophysical Journal* (2016). DOI: 10.3847/2041-8205/827/1/L2

Provided by University of Arkansas