Study investigates kinematics and origin of gas in the galaxy NGC 2655

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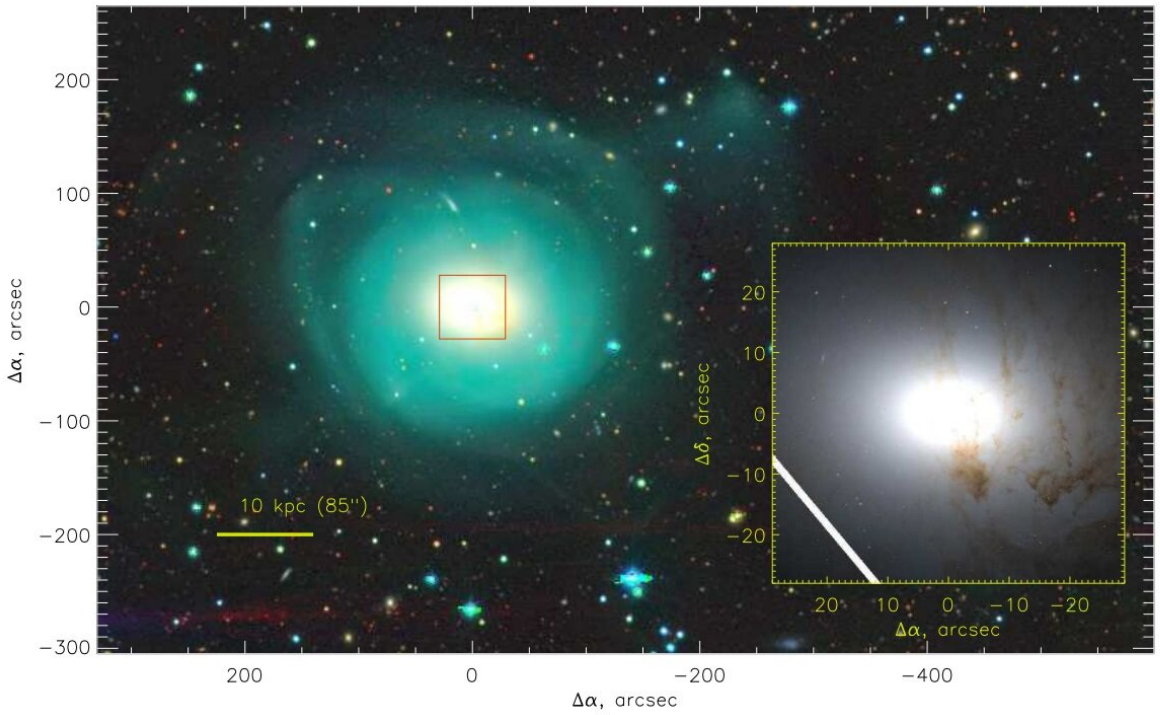

The images of NGC 2655 in composite colors: the left plot – the deep broad-band image of the galaxy taken from the DESI Legacy Imaging Surveys resource (Dey et al. 2019), the right plot – the image of the central part of the galaxy obtained in broad-band filters by the Hubble Space Telescope. At the the right plot one can see asymmetric dust rings produces by the projection of the circumnuclear polar disk. Credit: Sil'chenko et al, 2023

Using the 6-meter telescope of the Special Astrophysical Observatory (SAO) and the 2.5-meter telescope of the Caucasian Mountain Observatory (CMO), Russian astronomers have observed a giant galaxy known as NGC 2655. Results of the observational campaign, presented January 12 on the *arXiv* preprint server, shed more light on the kinematics and origin of ionized gas in this galaxy.

At a distance of about 79.5 million light years, NGC 2655 is a giant disk galaxy in the constellation Camelopardalis. The diameter of the disk of NGC 2655 is approximately 195,000 light years, while the mass of the galaxy's stellar population is estimated to be 200 billion solar masses.

NGC 2655 is the brightest member of the NGC 2655 group, which includes seven galaxies brighter than −15 mag, and all of them are of the late type. This suggests that the whole gas content of NGC 2655 could result from accumulating the surrounding dwarfs by the central galaxy.

The gas content of NGC 2655 drew the attention of a team of astronomers led by Olga Silchenko of the Lomonosov Moscow State University in Russia. They inspected this galaxy using SAO and CMO.

"NGC 2655 is a testbed case of highly inclined rotation of gas in the absence of any star formation in a gas-rich S0, which is of particular interest for us.... We have undertaken some additional observations and are now ready to look into the details of how and when the gas has come to NGC 2655," the researchers wrote in the paper.

The observations found that NGC 2655 has two exponential disks. These disks have different scale lengths and also different orientations of the isophote major axis. In general, the results suggest that the internal and external rotation axes of the stellar disk of NGC 2655 are inclined to each other. Therefore, the astronomers concluded that NGC 2655 is a multi-spin galaxy.

Furthermore, the study found that the orientations of the huge disk of neutral hydrogen and the outer stellar disk in NGC 2655 coincide with each other both spatially and kinematically. The astronomers added that the outer gaseous disk lies within the outer stellar disk, and that even current star formation is taking place somewhere in it.

According to the paper, the obtained data confirm that a minor merger took place in NGC 2655, which was suggested by previous studies. The researchers suppose that a small satellite galaxy struck the central part of NGC 2655 almost vertically about 10 million years ago.

"Apparently, a companion fell onto the galaxy almost vertically, and now, within two kiloparsecs from the center, we observe the remnants of the destroyed companion as a circumpolar loop—the picture is very similar to Sagittarius dwarf torn apart by the Milky Way," the authors of the paper explained.

However, they noted that in the case of NGC 2655, there was much more gas in the merged companion. Trying to explain the origin of ionized gas in NGC 2655, the scientists therefore concluded that the gas of the vertically infalling companion hit the galaxy's gaseous disk experiencing regular rotation. This collision created a shock wave that excited the gas in the polar loop and ran outward across the large galactic gaseous disk.

More information: Olga K. Sil'chenko et al, Kinematics and Origin of Gas in the Disk Galaxy NGC 2655, *arXiv* (2023). DOI: 10.48550/arxiv.2301.05326