

Young star-forming complexes detected in the galaxy NGC 4324

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The image of NGC 4324 in combined colors taken from the SDSS survey, DR9. Credit: Ahn et al., 2012.

Using the Caucasus Mountain Observatory, Russian astronomers have investigated a nearby lenticular galaxy known as NGC 4324. They detected young star-forming complexes in the inner ring of this galaxy. The findings, presented October 14 on arXiv.org, could improve our knowledge about the formation and evolution of NGC 4324.

Located some 85 million <u>light years</u> away in the constellation Virgo, NGC 4324 (also known as UGC 07451) is an early-type lenticular galaxy about 66,000 light years in size. It has a <u>stellar mass</u> of some 56 billion <u>solar masses</u>, while its total mass is estimated to be at least 10 times greater.

Previous observations of NGC 4324 have found that it contains a significant amount of gas and have revealed its remarkable structure—a bright blue ring of <u>star formation</u> embedded in a large-scale stellar disk typical for lenticular galaxies.

A team of astronomers from the Lomonosov Moscow State University in Russia, led by Irina Proshina, inspected the pattern of star formation in the ring of NGC 4324. For this purpose, they used the 2.5-m telescope at the Caucasus Mountain Observatory. The study was complemented by archival images from the SDSS, GALEX and WISE surveys.

"We decided to take full images of the galaxy NGC 4324 in narrow photometric bands centered on the H α and [NII] λ 6583 emission lines with the MaNGaL instrument—a mapper with a tunable filter.... The observations were carried out on April 17, 2018, with the 2.5-m telescope at the Caucasus Mountain Observatory," the researchers wrote



in the paper.

All in all, the study detected 18 young star-forming complexes (clumps) with a mean size of about 1,600 light years. The largest clumps turned out to have estimated stellar masses reaching 10 million solar masses.

The results suggest that the starbursts in these clumps have begun quite recently—within 10 million years. The astronomers explained that the stars that could be formed during a previous starburst that took place about 200 million years ago, cannot contribute now to the far-ultraviolet (FUV) luminosity having already exploded, or their luminosity peak has now shifted to the near-ultraviolet (NUV), leading to the observed dip in the FUV of the clumps.

According to the research, there is a regularity in the distribution of starforming complexes in the ring of NGC 4324. This suggests that the physical star formation mechanisms over local scales are the same in spiral and lenticular galaxies.

The researchers concluded that their findings confirm the hypothesis about the possible feeding of the disk in NGC 4324 with gas through the infall of gas-rich satellite <u>galaxies</u> or giant clouds.

"Clumps are formed in the ring due to the gravitational instability, in which star formation ignites. The subsequent star formation triggers in the gaseous ring are probably the <u>shock waves</u> from evolving complexes of massive OB stars—the first formed clusters of young stars in the gaseous clumps. In addition, the infall of a satellite or a giant gas cloud onto the galactic disk can serve as a trigger of another starburst. Thus, the chain of 'gaseous clumps—star complexes' observed by us is a chain of the propagation of star formation both in space (in the ring) and in time," the authors of the paper explained.



More information: I. S. Proshina, A. V. Moiseev, O. K. Sil'chenko, Young Star-Forming Complexes in the Ring of the S0 galaxy NGC 4324. arXiv:2210.07786v1 [astro-ph.GA], <u>arxiv.org/abs/2210.07786</u>

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