XMM-VID1-2075 is a massive, evolved and slow-rotating galaxy, observations suggest

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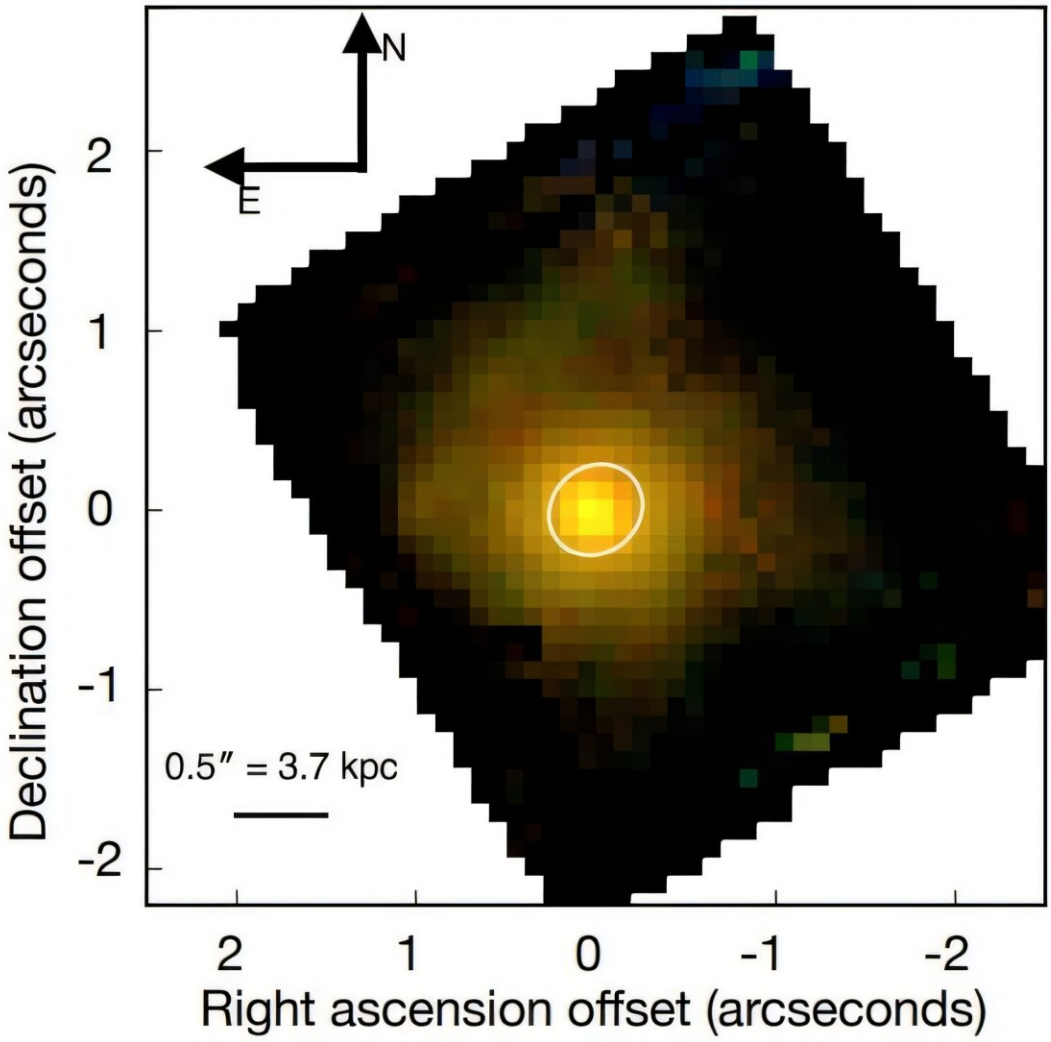

An RGB image of XMM-VID1-2075 generated by collapsing the data cube along the wavelength axis to form a deep image. Credit: *arXiv* (2025). DOI:

10.48550/arxiv.2508.10987

Using the James Webb Space Telescope (JWST), astronomers have conducted spectroscopic observations of a high-redshift galaxy known as XMM-VID1-2075. Results of the observational campaign, presented August 14 on the pre-print server *arXiv*, suggest that XMM-VID1-2075 is a massive and evolved slow-rotator.

The so-called "slow-rotators" represent a small fraction of the most massive galaxies, which stopped forming stars and are dispersion-supported systems. Such galaxies are highly evolved and often exist in dense cluster environments.

To date, no slow-rotators have been confirmed from stellar kinematics beyond the redshift of 2.0. It is generally assumed that at high redshifts, these slow-rotating systems are predicted to be rarely found.

However, recent observations performed by a team of astronomers led by Ben Forrest of the University of California, Davis, have identified such a high-redshift slow-rotator. Using JWST's Near Infrared Spectrograph (NIRSpec) and Near Infrared Camera (NIRCam), they report that the galaxy XMM-VID1-2075, at a redshift of 3.45, showcases properties consistent with the lack of rotation seen in slow rotators in the local universe.

According to the paper, XMM-VID1-2075 was initially selected by Forrest and colleagues from a catalog based on near-infrared observations from the VISTA Deep Extragalactic Observations survey due to its apparent brightness, high photometric redshift, and red spectral energy distribution.

The observations confirmed that XMM-VID1-2075 has a high redshift and a large stellar mass of about 330 billion solar masses. The collected data indicate that the galaxy has a star formation rate of less than one solar mass per year and a large stellar velocity dispersion of some 379 km/s.

Furthermore, the astronomers measured the semi-major axis of XMM-VID1-2075, which turned out to be approximately 7,300 light years. This, together with an ellipticity of 0.11, yields a circularized effective radius of 6,500 light years.

Most importantly, JWST observations show that XMM-VID1-2075 exhibits extended low surface brightness asymmetries and its spin parameter was estimated to be 0.1. These findings point out the slow-rotator nature of XMM-VID1-2075 and suggest a merger activity.

Therefore, the findings indicate that XMM-VID1-2075 is the highest redshift slow-rotator so far identified from stellar kinematics. The authors of the paper add that XMM-VID1-2075 is more similar kinematically to the most massive early-type galaxies in the local universe than other observed high-redshift galaxies, though it is smaller in size than the local slow-rotators.

In concluding remarks, the researchers note that their results suggest that merger activity played a key role in the formation and kinematic transformation of some of the most massive galaxies when the universe was less than two billion years old.

More information: Ben Forrest et al, A massive, evolved slow-rotating galaxy in the early Universe, *arXiv* (2025). DOI: 10.48550/arxiv.2508.10987