Corrected: Author correction

LARGE-SCALE STRUCTURE

Saraswati the wide-reaching

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Superclusters of galaxies can contain baryonic masses of up to millions of billions of solar masses and stretch over tens to hundreds of Mpc. Comprising tens to hundreds of galaxy clusters — the biggest gravitationally bound cosmic structures — they trace the largest-scale structure in the Universe. Joydeep Bagchi and collaborators report the discovery of a supercluster that extends over 200 Mpc and contains a minimum of 2×10^{16} solar masses. If confirmed, this is one of the most massive structures ever observed.

The discovery was enabled by extensive optical spectroscopic observations over a large swath of the sky called Stripe 82. Bagchi et al. utilized a statistical method to spatially associate galaxies, eventually revealing the Saraswati supercluster, named after an ancient Indian goddess. This superstructure contains more than 40 confirmed galaxy clusters and is surrounded by vast galactic voids. The most massive clusters within Saraswati form a wall-like configuration with strong filamentary features that imply a dynamically evolving structure.

A supercluster of this size and mass is a prime laboratory for tests of general relativity, gravity, and structure formation and evolution within the ΛCDM paradigm. Cosmological simulations tell us that finding such an extensive and massive structure is very unlikely. Moreover, the redshift of Saraswati ($z \sim 0.3$) places it near the cosmic transition from a matter-dominated to a dark-energy-dominated Universe. Identifying more such superstructures can tightly constrain different cosmological models and the power spectrum of primordial density fluctuations. Follow-up spectroscopic and X-ray observations of Saraswati are now necessary to confirm the boundaries of the supercluster and refine its total mass content.

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