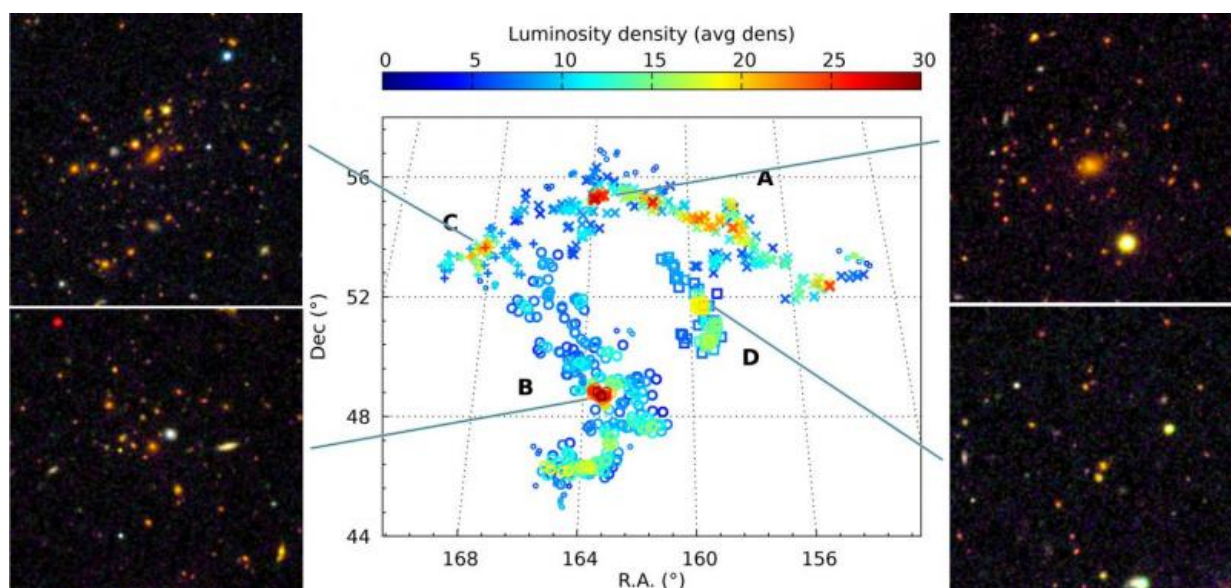


Distant, massive 'hypercluster' of galaxies discovered

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The central map shows the distribution on the sky of the Boss Great Wall. The area subtended by this structure is the equivalent of 400 times the angular size of the Moon, and it is situated at more than 4 thousand million light years away from us. On the map, each point represents a galaxy, while the colours represent the density of the surroundings. So the red areas correspond to the regions with the maximum concentration of galaxies. In the four RGB images from the SDSS (Sloan Digital Sky Survey), each red dot is a galaxy chosen for study, (surrounded by other galaxies at different distances). To show comparison, the combined angular size of these four detailed images is hardly one hundredth of the angular size of the Moon, very tiny compared to the angular size of the complete map. Credit: Alina Streblyanska (IAC).

A group of researchers, among them scientists from the IAC, has discovered one of the most distant and massive "hyperclusters" of galaxies found thus far: the BOSS Great Wall (BGW). According to Heidi Lietzen, the principal investigator of this research, there is probably no other similar system so clearly isolated and with a comparable size.

As this astrophysicist explains "superclusters of galaxies are the largest structures in the universe, formed by groups of galaxies bound together by their [gravitational interactions](#). These huge structures, with sizes between 10 and 50 megaparsecs, (30 to 150 million light years) can host thousands of galaxies.

Galaxies started to form in the [early universe](#), in those regions where the density of matter was somewhat higher than average. Slowly, all the matter began joining and moving toward the denser zones, where the superclusters formed after a long process. They are young structures compared with other systems such as normal galaxy clusters, because it took millions of years for them to group together into a single system. In this way, the structure of the universe as a whole can be seen as the "cosmic web" predicted by Yakov Zeldovich, in which the material of the universe is organized within interconnected filaments around voids which have a much lower density.

The results of the study, published today in the journal *Astronomy & Astrophysics* have shown the presence of the BGW system, with a diameter of some 900 million light years. It is formed by two superclusters and two "walls" of galaxies, probably bigger in volume and diameter than any other known hypercluster. The structure as a whole contains some 830 galaxies, which make it one of the most massive hyperclusters known. The Sloan Great Wall, the most similar known hypercluster of galaxies, which is 160 Mpc long, has about half the mass of the BGW.

"To detect the BOSS Great Wall hypercluster measurements were made of 500,000 galaxies to reconstruct the space distribution of the luminous density. The BGW is clearly the biggest isolated [structure](#) in volume which has been studied in space," commented José Alberto Rubiño, one of the other authors of the study. The sample was taken from the Sloan Digital Sky Survey (SDSS), a project which has mapped and catalogued the universe to study it in depth.

These enormous structures give us valuable information to compare with cosmological models. They can even challenge the numerical simulations that describe the formation and evolution of structures in the [universe](#), because these simulations ought to be able to predict structures as big as this. The superclusters and hyperclusters are very useful for understanding how [galaxies](#) have evolved, because this evolution should be quicker in high density environments.

"Studying hyperclusters can give us clues about how to predict just when and how matter groups together, and offers new challenges to existing cosmological models," says Alina Streblynska, an astrophysicist at the IAC.

More information: H. Lietzen et al. Discovery of a massive supercluster system at ~ 0.47 , *Astronomy & Astrophysics* (2016). [DOI: 10.1051/0004-6361/201628261](https://doi.org/10.1051/0004-6361/201628261)

Provided by IAC

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