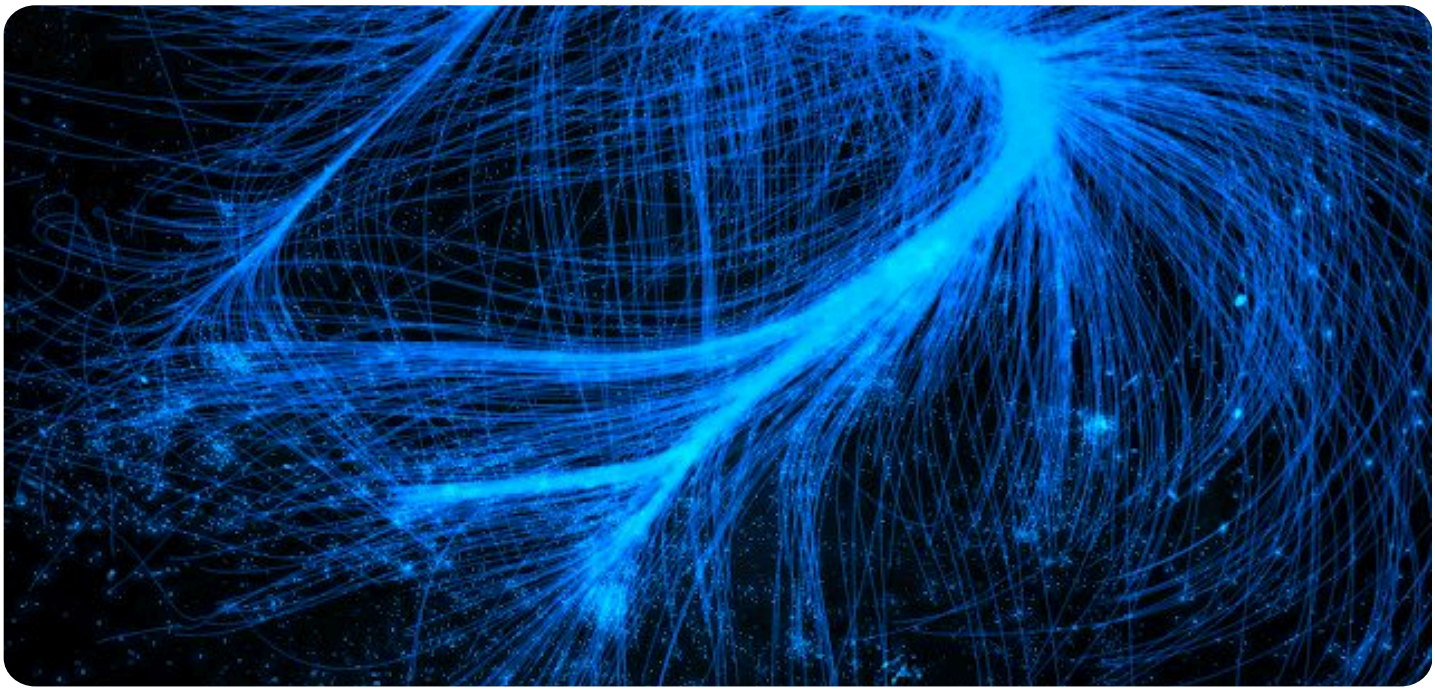
The Laniakea Supercluster and The Great Attractor



The Laniakea Supercluster: Our Home in the Heavenly Skies Credits: Relevancy22

The **Laniakea Supercluster** is the vast cosmic structure that contains our home galaxy, the Milky Way, along with approximately 100,000 to 150,000 other galaxies. The Earth orbits the Sun at a speed of about 30 km/s, while the Sun travels around the center of the Milky Way at nearly 220 km/s. Our galaxy itself moves through space at roughly 600 km/s. The Milky Way belongs to a collection of galaxies known as the Local Group, which forms part of larger cosmic structures such as the **Virgo Cluster** and the **Hydra-Centaurus region**. These structures are all connected within the Laniakea Supercluster, a gravitationally linked region spanning hundreds of millions of light-years. Understanding the motion of galaxies within this enormous structure has led astronomers to one of the greatest mysteries of modern astronomy: **the Great Attractor**.

The Anomaly of the Movement

In 1929 Edwin Hubble discovered that the universe is ever-expanding; as you, the reader, are reading this, the universe keeps expanding at a mind-boggling rate. At the mercy of this, our universe continuously creates space between astronomically big objects, but also at the mercy of gravity, the galaxies form an intricate thread-like structure and the combination of this thread-like structure is what we call the cosmic web, and each thread is called a galactic filament. These clusters and superclusters create such astronomical amounts of gravity that they interfere even with galaxies millions of light-years away. Due to this gravity, the galaxies create clusters and superclusters. In 2014 at the university of Hawaii, we discovered

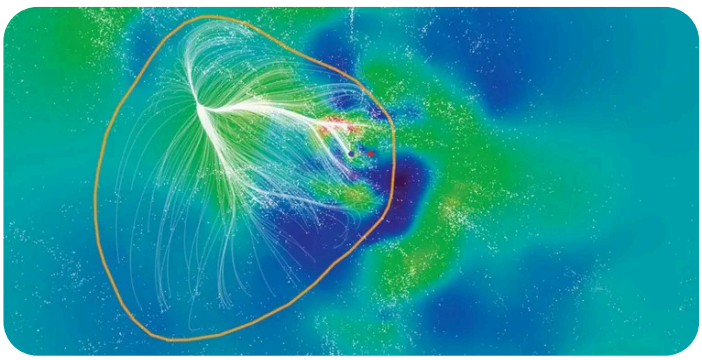
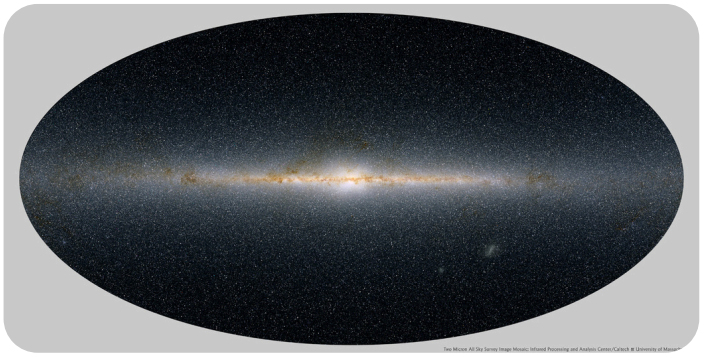


Photo of the Laniakea Supercluster (Laniakea Supercluster, Wikipedia)

that the four neighbouring superclusters form yet another big galactic supercluster, which we call the Laniakea Supercluster, and through Hubble's

discovery, we were expecting the galaxies to move in account of the expansion of the universe, but we were partly wrong. The galaxies showed an anomaly in their movement; they were being attracted to a region in space that is not visible to us humans, shoutout to our solar system alignment in the Milky Way galaxy. The bright core and the dust clouds extinguish the light coming from the plane of our galaxy, which creates a blind spot for us earthlings, which is known as the **zone of Avoidance** (1/5th of our field of view is ZoA),



Zone of Avoidance (Caltech and University of Massachusetts, wikiwand)

which only adds more fuel to the fire of our curiosity. This region where the galaxies are being attracted lies about 150,000,000-220,000,000 light-years far away from us and is what we call **"The Great Attractor"**. The effects of the Great Attractor were first observed in 1986, and scientists continue to study it today. In about 100 million years, our solar system may reach a better position to finally uncover its mystery. The significance of the Great Attractor extends beyond the motion of our own galaxy. By studying the velocities of galaxies, astronomers can map the distribution of matter that is otherwise difficult to detect. The Great Attractor demonstrates that gravity can influence objects across enormous cosmic distances and provides evidence that visible galaxies account for only a fraction of the mass present in the universe. Investigating this region has therefore become an important tool for understanding the large-scale structure of the cosmos and the role of dark matter in shaping it.

THE BIG QUESTION: What is the Great Attractor?

One of the most important effects of the Great Attractor is its gravitational pull on nearby galaxies. The gravity generated by this massive region draws galaxies toward it, affecting their speed and direction.

The Milky Way, along with the entire Local Group of galaxies, is moving toward the Great Attractor at a speed of nearly 600 km/s. This movement occurs in addition to the normal expansion of the universe. The unusual motion caused by gravity is known as “peculiar velocity”.

This gravitational attraction influences not only individual galaxies but also entire galaxy clusters, creating massive flows of matter across the cosmos.

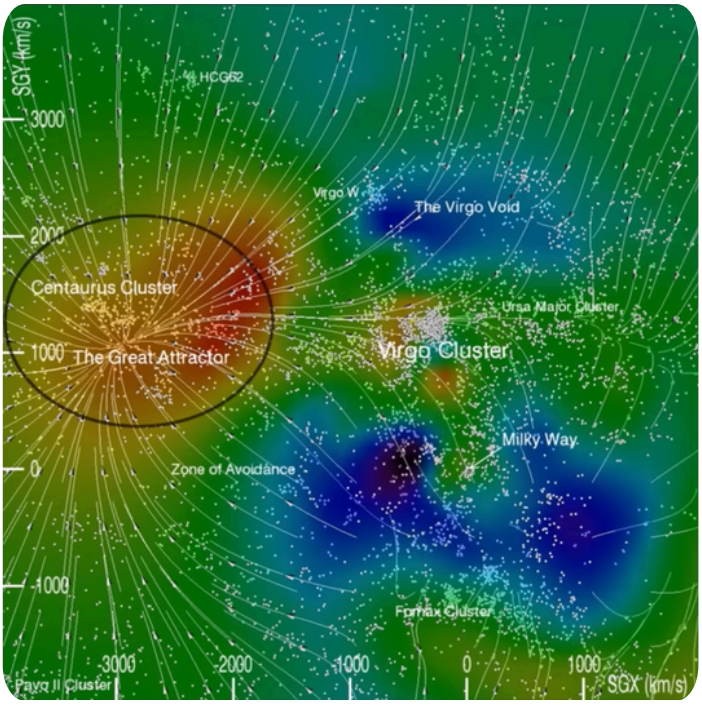
A team of professional scientists led by Professor Donald Lyden-Bell released a paper in 1988. They proposed that about 400 elliptical galaxies were all being attracted to a region in space, which they termed "The Great Attractor". After that, many speculations have been proposed, but mainly three conclusions for what could be behind the blindspot in our cosmic eyes seem valid:

1) The Great Attractor is actually an even denser group of galaxies.

2) The Great Attractor is actually much more ominous, and it is an ultra-massive black hole.

3) The Great Attractor is actually the doing of some mysterious dark force.

Despite many speculations, the Great Attractor being a dense group of galaxies seems to be the most likely case. Though the odds of other cases are not zero.



Cosmic flow and the underlying density field (Credits: Researchgate.net)

“Something out there is tugging on us.”

~ Sandra Faber (Astrophysicist)

Modern Observational Technology

To observe hidden regions of space beyond the Zone of Avoidance, astronomers use **X-ray astronomy**. This method uses powerful space telescopes that detect X-rays emitted by extremely hot cosmic objects such as galaxy clusters and superheated gas. Unlike visible light, X-rays can penetrate regions heavily obscured by dust and gas in the Milky Way. Massive galaxy clusters contain gas heated to millions of degrees, causing them to release strong X-ray radiation. Space observatories such as the Chandra X-ray Observatory and XMM-Newton detect this radiation using highly sensitive instruments placed outside Earth's atmosphere. Scientists then analyze the X-ray emissions to locate hidden galaxy clusters and massive gravitational structures, including regions associated with the Great Attractor. By mapping these X-ray signals, astronomers can study areas of the universe that cannot be clearly observed using ordinary optical telescopes.

Conclusion

The discovery of the Laniakea Supercluster and the Great Attractor has changed humanity's understanding of the universe. Scientists now know that galaxies are not randomly scattered through space, but are connected through enormous gravitational flows across vast cosmic structures. Using modern technologies such as X-ray astronomy, astronomers are able to observe hidden regions beyond the Zone of Avoidance and continue exploring mysteries that were once impossible to study. These discoveries not only reveal the immense scale and complexity of the cosmos but also highlight humanity's growing ability to understand the universe beyond our own galaxy. With advancing technology, we are getting closer to solving the universe's mysteries.

- Written by Arush Sharma