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Intergalactic Voids: The Great Nothingnesses of the Universe

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Special points of interest:

- Large-scale astronomy
- Triton Fun stuff
- Superfluous questions

We are always looking for contributors to the Science Newsletter. If you would like to write an article about a science subject you are excited about, or contribute a superfluous question, or if you would like to be on our mailing list for future newsletters, please e-mail us at:

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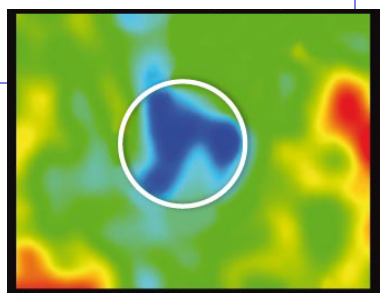
Macroastronomy is a unique specialized astronomical field of study that analyzes and accumulates data on the large-scale levels, structures, and quantities of matter, dark matter, non-matter, and objects in the Universe. It is the study of the macrocosm and the study of astronomical topics from a larger perspective. Its first astronomical worker can be acknowledged to be Edwin Hubble.

The sheer immense vastness of space has been extended almost beyond imagination since Hubble's discovery of island galaxies (like our neighbor, the Andromeda Galaxy, M31) beyond our own Milky Way Galaxy in 1922-1923. The announcement of such a discovery on 1925 January 01 surprised the world and created friction with astronomers' beliefs, most notably Harlow Shapley. Hubble's discovery was detailed later in his historical work *The Realm of the Nebulae* in 1936. The current known time-distance of the observed Universe is 13.7 billion light years.

Macroastronomy's largest subfield by size, i.e. voids, quite literally shows that most of the Universe is filled with non-filling - - literally nothing! The next largest would be considered the relatively recent study of non-baryonic matter, i.e. dark matter and dark energy. Baryonic matter (the observable matter that you are aware of) forms 4% of the visible Universe. Dark matter forms 22% and dark energy 74%.

In the observable matter realm, voids are devoid of galaxies and stars with few exceptions. Cosmic intergalactic voids have been studied since their discovery in 1978 and on a large scale since 1994 with efforts by the Estonian astronomers Maret Einasto and Erik Tago, amongst others. This knowledge has greatly been enhanced in recent years. The imaging part of the Sloan Digital Sky Survey has now been completed as of August, 2008 after having reached its mapping limit of 1/4 of the Earth's entire visible sky - - the heavens as seen from its location in New Mexico.

Voids have been popularized historically - - one such "endless void" was noted in an initial episode of the 1970's television science fiction series *Battlestar Galactica*; or fictionally as the great "Nothing" in the fantasy novel *The Neverending Story* by Michael Ende. The boundaries of all voids are defined by immense strings of galaxy clouds, galaxy walls, galaxy filaments, and galaxy superclusters. It also appears recently that dark energy, dark matter, and dark matter filaments can also outline voids.



The big Empty

WMAP data showing a chilly spot in the universe: it's a supervoid !

All voids appear to be gravitationally formed and some of them are almost spherical, but are generally elongated to some degree. They range in size up to around 30 megaparsecs across (100 million light years) to supervoids of 100 megaparsecs (325 million light years). Data indicates that the largest one, almost a billion light years across [!!], as announced 2007 August 03, is the *Eridanus Supervoid*. It is situated 6-10 billion light years away from us and is commonly referred to as the Cosmic Microwave Background Cold Spot.

On this large scale, our own position locally is within the Virgo Supercluster (also known as the Local Supercluster) of galaxies. There are 7 supervoids relatively nearby with centers going out to a distance of about 500 million light years from us.

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Intergalactic Voids:

Photos/Info: University of Hawaii Institute of Astronomy/Sloan Digital Sky Survey/WMAP/I. Szapudi/B. Granett/M. Neyrinck

Two of those are the *Northern Local Supervoid* whose center is 199 million light years away at 339 million light years across; and the *Southern Local Supervoid* whose center is 313 million light years away at 365 million light years across.

Remember, "nothing" is *something* in the cosmos!

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References:

1. *The Realm of the Nebulae*, Edwin Hubble, 1936.
2."Void statistics in large galaxy redshift surveys: Does halo occupation of field galaxies depend on environment?", J. L. Tinker, et al., *The Astrophysical Journal*, **686**, 53-71, 2008
3. "The NGC 672 and NGC 784 galaxy groups: Evidence for galaxy formation and growth along a nearby dark matter filament", A. Zitrin & N. Brosch, *Monthly Notices of the Royal Astronomical Society*, 2008 August 13 preprint.
4. "The structure of the Universe traced by rich clusters of galaxies", M. Einasto, et al., *Monthly Notices of the Royal Astronomical Society*, **269**, 301-322, 1994.
5. "Extragalactic radio sources and the WMAP Cold Spot", L. Rudnick, et al., *The Astrophysical Journal*, **671**, 40-44, 2007; Erratum, *The Astrophysical Journal*, **678**, 1531, 2008.

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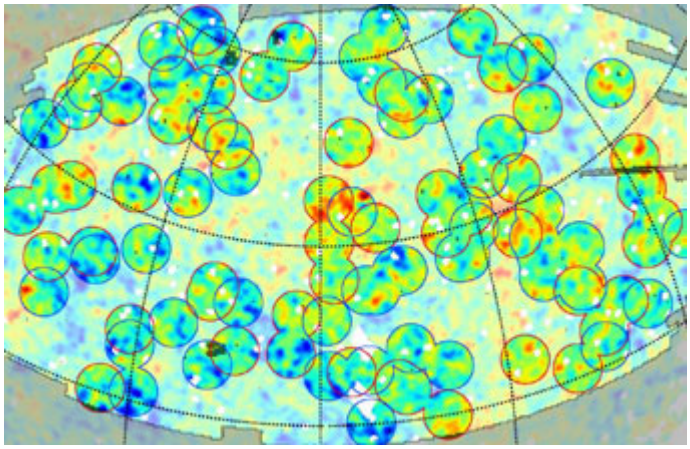
Recommended Reading:

6. The Sloan Digital Sky Survey II: *Los Angeles Times*, 2008 October 15.
7. "The CMB Cold Spot: Texture, cluster or void?", M. Cruz [Santander, Spain], et al., *Monthly Notices of the Royal Astronomical Society*, 2008 October 02 preprint.



Superstructures in the Universe

Areas of high and low density exist across space. There are massive superclusters of galaxies and extremely large areas where there is almost no mass of any type, no normal matter or dark matter. These are the *supervoids*. The Wilkinson Microwave Anisotropy Probe (WMAP) satellite recorded the temperature of the Cosmic Microwave Background radiation in the universe. The supervoids have colder temperatures (because there is no mass there to have temperature). The locations of known supervoids and superclusters is overlaid on the WMAP data in studies by the University of Hawaii Institute of Astronomy. The blue circles are supervoids, the red ones are superclusters.

Galaxy Clusters

To the left is the Galaxy cluster named *Abell 1689*. Massive structures containing millions of galaxies clustered together exist in the universe. These are the largest objects known. The clusters contain visible and dark matter detectable by its effect on the Cosmic Microwave Background Radiation (CMB).

TRITON FUN PRODUCTS

2009 has been declared the "International Year of Astronomy". Events and activities to further the excitement of astronomy are being planned by IYA committees in over 100 countries. The logo for the IYA2009 is shown below. For more info on upcoming IYA2009 events, go to: http://www.astronomy2009.org

Triton Fun is an authorized distributor of T-shirts, sweatshirts and long-sleeve tees sporting this new logo. Part of the proceeds from the sale of these shirts will go to support astronomy clubs and astronomy activities connected with IYA2009 in California.

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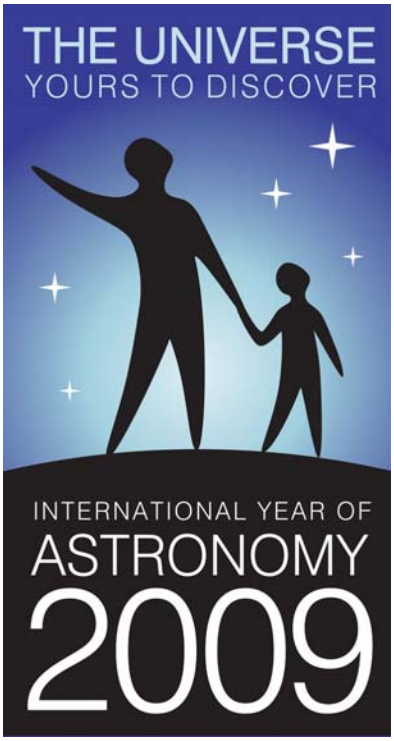

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Superfluous Questions:

1) Argentum is the latin name for *what* element ?

a) Lead b) Palladium c) Silver d) Gold

2) In the TV show *Space:1999*, what happened when Koenig and Bergman went through the Black Hole ?

a) they fainted b) time speeded up c) they spoke to an alien d) they took measurements

3) In the movie *It's a Wonderful Life*, what book was Clarence reading when he met George ?

a) A Christmas Carol b) Little Women c) Tom Sawyer d) Tale of Two Cities

4) When will the New Horizons spacecraft arrive at Pluto ?

a) 2011 b) 2015 c) 2018 d) 2009

—> ANSWERS in next months issue of the Science Newsletter ! <——-

** ANSWERS to October's Superfluous Questions: 1. b) 34 2. c) 86 3. c) dark matter 4. d) Texas