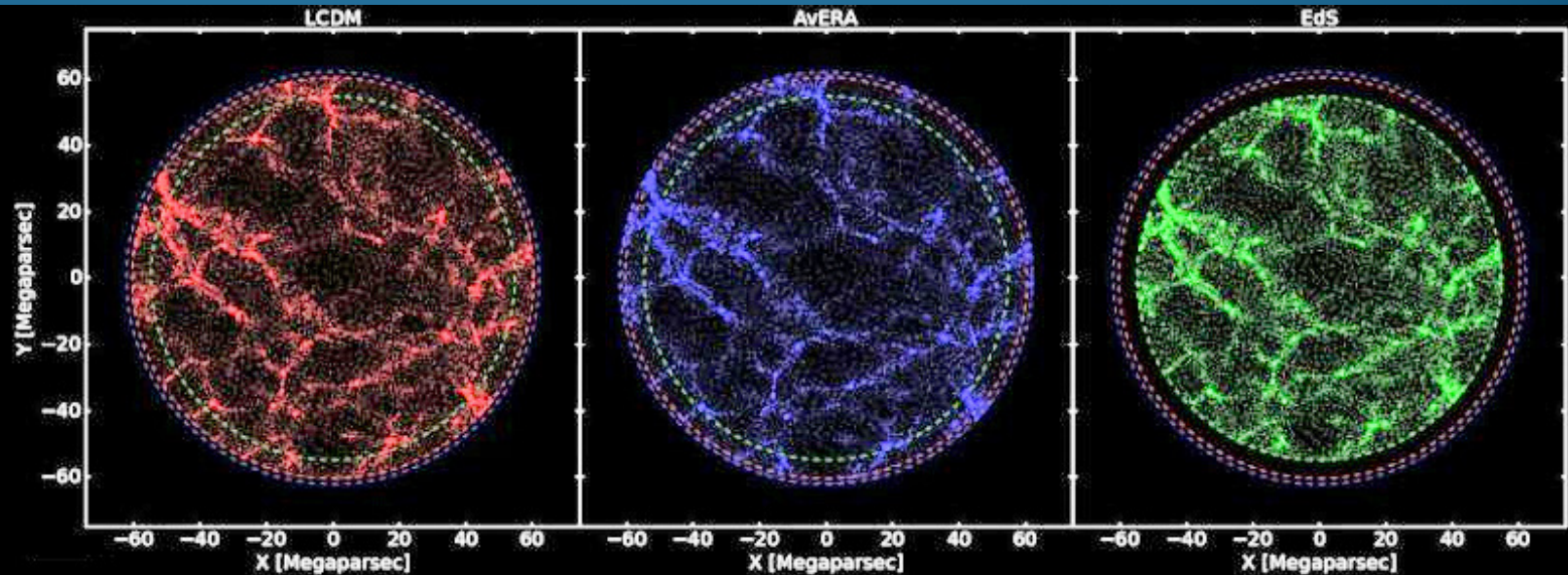




# Abergavenny Astronomy Society

## What's in the news this month?

### Do we need Dark Energy to explain the acceleration of the Universe

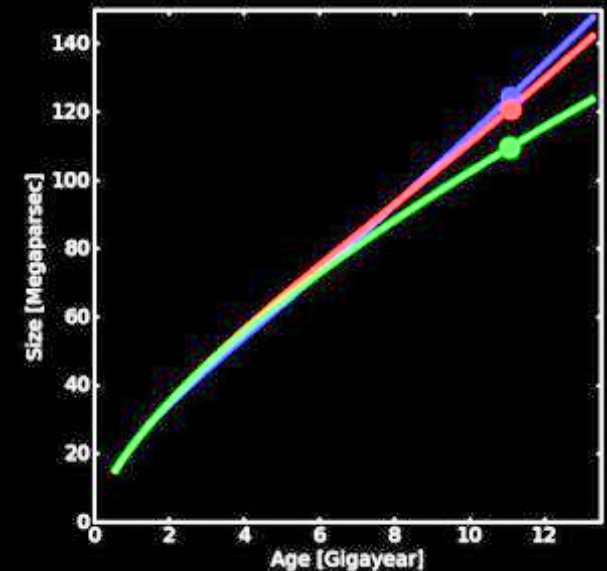


A frame from an animation that shows the expansion of the universe:-

- 1) using the standard 'Lambda Cold Dark Matter' cosmology, which includes dark energy,
- 2) using the new Avera model, that considers the structure of the universe and eliminates the need for dark energy, and
- 3) the Einstein-de Sitter cosmology, the original model without dark energy.
- 4) The panel at the bottom shows the increase of the 'scale factor' (an indication of the size) as a function of time, where 1 Gya is 1 billion years. The growth of structure can also be seen in the top panels.

One dot roughly represents an entire galaxy cluster. Units of scale are in Megaparsecs (Mpc), where 1 Mpc is around 3 million million km.

*Credit: István Csabai et al.*



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# Abergavenny Astronomy Society

## *What's in the news this month?*

### Do we need Dark Energy to explain the acceleration of the Universe

#### Explaining the accelerating expansion of the universe without dark energy

March 30, 2017

Royal Astronomical Society

Enigmatic dark energy, thought to make up 68% of the universe, may not exist at all, according to a Hungarian-American team. The researchers believe that standard models of the universe fail to take account of its changing structure, but that once this is done the need for dark energy disappears. The team publish their results in a paper in *Monthly Notices of the Royal Astronomical Society*.

We know from very precise supernova observations that the universe is accelerating, but at the same time we rely on coarse approximations to Einstein's equations which may introduce serious side effects, such as the need for dark energy.

Unlike conventional simulations with a smoothly expanding universe, taking the structure into account led to a model where different regions of the cosmos expand at different rate.

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# Abergavenny Astronomy Society

## *What's in the news this month?*

### The Event Horizon Telescope is switched on

Observations for the EHT project began on April 4th and will continue until April 14th.

The data acquired by each site will then be transported to labs at the Max Planck Institute in Germany and MIT's Haystack Observatory in the US.

There are *two* (radio) sources scheduled for this year Sagittarius A\* and M87.

M87's black hole is very different from Sagittarius A\*.

Although around 2,000 times farther away from Earth than Sagittarius A\*, it's more than 2,000 times more massive, so it appears to the EHT as approximately the same angular size.

M87 is known to be extremely active, blasting out gases into space at almost the speed of light. How these jets are formed are a mystery – black holes are more well-known for consuming matter, not spitting it back out into space!

The Event Horizon Telescope Array

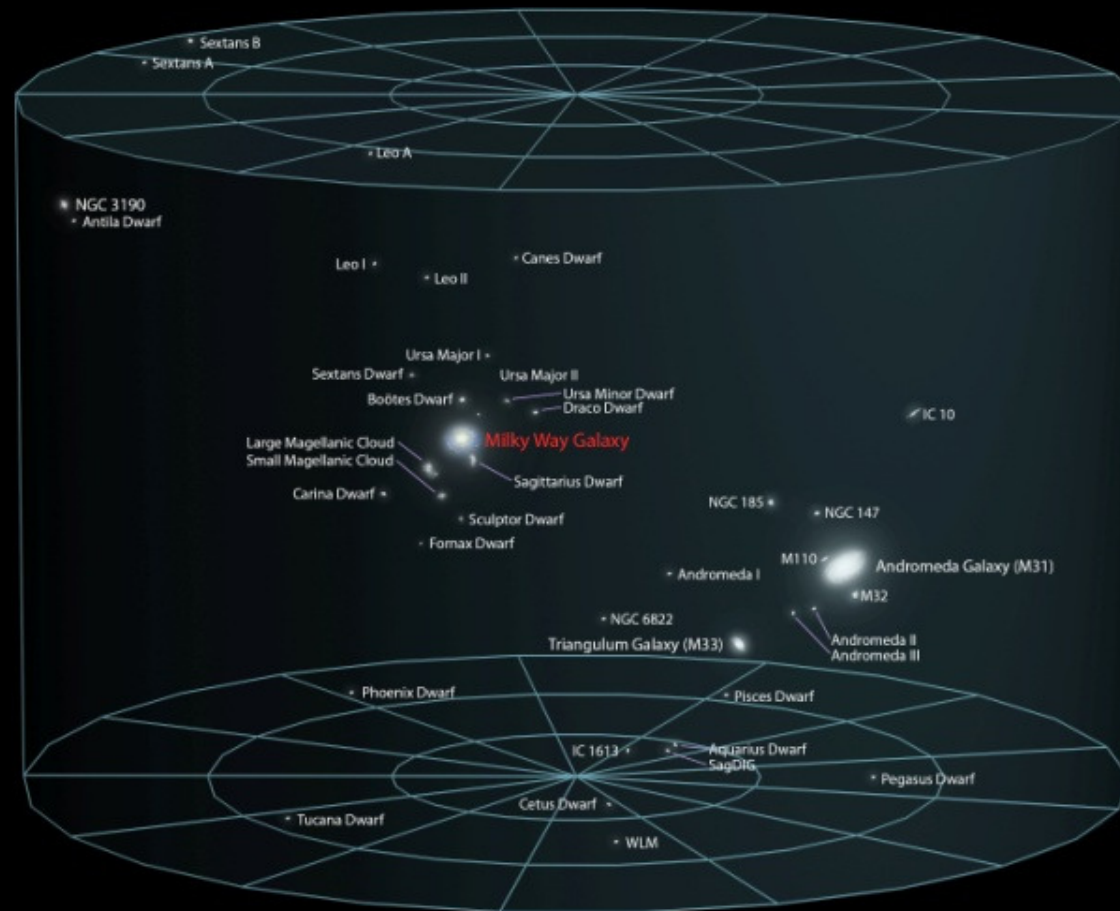


# Abergavenny Astronomy Society

**What's in the news this month?**

**Challenge to Standard Model seen off**

## Local Galactic Group



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# Abergavenny Astronomy Society

## *What's in the news this month?*

### Challenge to Standard Model seen off

Satellite galaxies at edge of Milky Way coexist with dark matter  
March 30, 2017                      Rochester Institute of Technology

Research conducted by scientists at RIT rules out a challenge to the accepted standard model of the universe and theory of how galaxies form by shedding new light on a problematic structure.

The vast polar structure - a plane of satellite galaxies at the poles of the Milky Way - is at the centre of a tug-of-war between scientists who disagree about the existence of mysterious dark matter, the invisible substance that comprises 85 % of the mass of the universe.

A paper accepted for publication in the *Monthly Notices for the Royal Astronomical Society* bolsters the standard cosmological model, the Cold Dark Matter paradigm, by showing that the vast polar structure formed well after the Milky Way and is an unstable structure.

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# Abergavenny Astronomy Society

## *What's in the news this month?*

### Largest, purest Brown Dwarf

Astronomers identify purest, most massive brown dwarf  
March 24, 2017  
Royal Astronomical Society



*John Pinfield*

An artist's impression of the new pure and massive brown dwarf.

Credit: John Pinfield

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# Abergavenny Astronomy Society

## *What's in the news this month?*

### Largest, purest Brown Dwarf

The object, known as SDSS J0104+1535, is a member of the so called halo, the outermost reaches of our galaxy, made up of the most ancient stars.

Brown dwarfs are intermediate between planets and fully fledged stars. Their mass is too small for full nuclear fusion of hydrogen to helium to take place, but they are usually significantly more massive than planets.

Located 750 light years away in the constellation of Pisces, this object is made of gas that is around 250 times purer than the Sun, so consists of more than 99.99% hydrogen and helium.

Estimated to have formed about 10 billion years ago, measurements also suggest it has a mass equivalent to 90 times that of Jupiter, making it the most massive brown dwarf found to date, approx 97% of the size necessary for fusion to start according to our current models.

It was previously not known if brown dwarfs could form from such primordial gas, and the discovery points the way to a larger undiscovered population of extremely pure brown dwarfs from our Galaxy's ancient past.

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# Abergavenny Astronomy Society

## *What's in the news this month?*

### Gravitational waves kick huge Black Hole out of Galaxy

This image, taken by the HST, reveals a runaway quasar fleeing from its galaxy's central hub.

A quasar is the visible, energetic signature of a black hole. Black holes are the energy source at the heart of quasars intense, compact gushers of radiation that can outshine an entire galaxy.

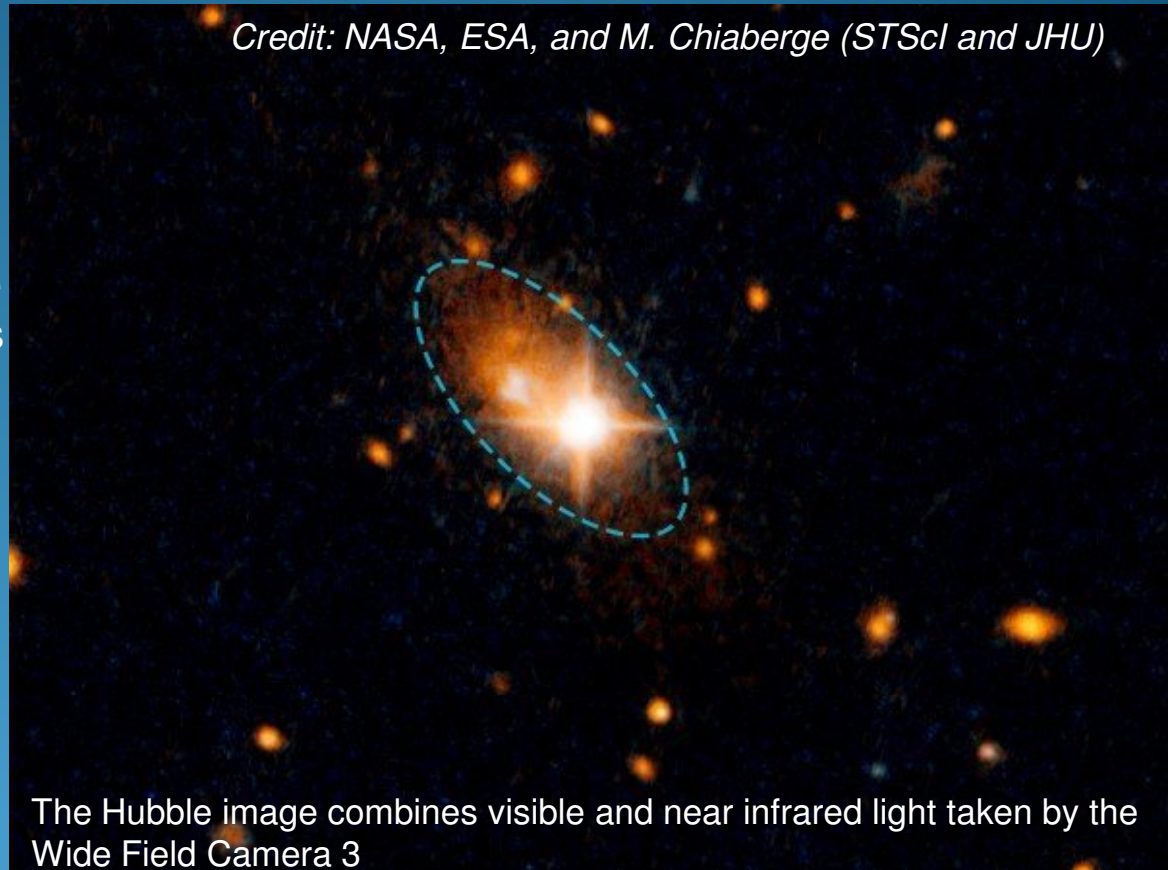
The green dotted line marks the visible periphery of the galaxy. The quasar, named 3C186, appears as a bright star just off centre.

The quasar and its host galaxy reside 8 billion light years from Earth.

Researchers estimate that it took the equivalent energy of 100 million supernovas exploding simultaneously to jettison the black hole.

The most plausible explanation for this propulsive energy is that the monster object was given a kick by gravitational waves unleashed by the merger of two hefty black holes at the centre of the host galaxy.

*Credit: NASA, ESA, and M. Chiaberge (STScI and JHU)*



The Hubble image combines visible and near infrared light taken by the Wide Field Camera 3

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# Abergavenny Astronomy Society

## *What's in the news this month?*

Last month - How many moons has the earth got?

This month – How many Planets in the Solar System?

The Current Official Answer : 8  
Neptune.

Mercury, Venus, Earth, Mars, Jupiter, Saturn, Uranus,

Plus the Dwarf Planets : 5 official dwarf planets: Ceres, Pluto, Haumea, Makemake, Eris.

The number of planets pre 2006 : 9

Pluto reclassified as dwarf planet in 2006

The number of planets pre 1930 : 8

Pluto was discovered in 1930

The number of planets pre 1854 : 8 - 23

Discovery of Neptune (1846) and many asteroids

The number of planets pre 1801 : 7

Mercury, Venus, Earth, Mars, Jupiter, Saturn, Uranus

The number of planets pre 1781 : 6 or 8?  
confused as 2 planets, morning and evening.

Uranus (1781), plus Mercury & Venus sometimes

Classical Period :

7

As defined by astrology

Sun, Moon, Mercury, Venus, Mars, Jupiter & Saturn.

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# Abergavenny Astronomy Society

## *What's in the news this month?*

Last month - How many moons has the earth got?

This month – How many Planets in the Solar System?

At the annual Lunar & Planetary Science Conference last month Kirby Runyon, a planetary scientist at John Hopkins University, is presenting a fundamentally different definition of a planet.

The existing definition, formulated in 2006, used gravitational dominance as the main principle:-

- 1) It is in orbit around the sun
- 2) Has sufficient mass to assume hydrostatic equilibrium (ie it's round)
- 3) Has cleared the neighbourhood around it's orbit.

Runyon has proposed that the definition be based on a geophysical basis. That is hydrostatic equilibrium but too small to start nuclear fusion.

This would, according to Runyon, recognise what scientists are already doing, use the term when comparing geological features.

Runyon said he found dozens of examples in the scientific literature of researchers referring to “the planets Pluto, Earth and Mars” to talk about glacial processes on their surfaces, or “a planet wide haze layer” when discussing the moon Titan's atmosphere.

By his count, 102 new planets could be added to our solar system under the new criteria.

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