Record: 1

Title: The universe gives up its dark secrets.

Authors: Battersby, Stephen

Source: New Scientist; 12/20/2003, Vol. 180 Issue 2426-2428, p16-16, 1p, 2 color

Document Type: Article

Subject Terms: COSMOLOGY
ANTIGRAVITY
CATACLYSMIC variable stars
SUPERNOVAE
ARTIFICIAL satellites
ASTRONOMY

Abstract: Cosmologists have dreamed up some wild ideas about our universe, filling it with oceans of invisible matter, invoking a kind of cosmic antigravity and describing an ancient cataclysm called inflation that stretched out space. Using a satellite positioned millions of kilometres from Earth called Wilkinson Microwave Anisotropy Probe, scientists built up a mottled map of the sky showing the temperature variations in microwave radiation from the young universe. From this pattern of hot and cold spots, they extracted information about the cosmos including its age and expansion rate and even a definitive list of its main ingredients. That is far more precise than anything we have had before. In the 1990s, observations of supernova explosions showed the universe's expansion was speeding up and cosmologists blamed a new kind of dark stuff called repulsive dark energy. Meanwhile dark energy changes the curvature of space, distorting the pattern.

Lexile: 980

Full Text Word Count: 720

ISSN: 02624079

Accession Number: 11953853

Database: MAS Ultra - School Edition

Section: News review 2003: International news and exclusive

The universe gives up its dark secrets

THOSE crazy cosmologists. They have dreamed up some wild ideas about our universe — filling it with oceans of invisible matter, invoking a kind of cosmic antigravity, and describing an ancient cataclysm called inflation that stretched out space. It sounded like the product of an overactive imagination. Until, earlier this year, we found that they were, quite startlingly, right.

Using a satellite positioned millions of kilometres from Earth called the Wilkinson Microwave Anisotropy Probe (WMAP), scientists built up a mottled map of the sky showing the temperature variations in microwave radiation from the young universe (see picture, right). From this pattern of hot and cold spots, they extracted information about the cosmos including its age and expansion rate, and even a definitive list of its main ingredients — that is far more precise than anything we have had before. Cosmology, people said, had come of age.

Just 20 years ago, for example, the universe was thought to be "somewhere between 10 and 20 billion years old". By this January, the range had been whittled down to 12 to 15 billion. A few days later we got the real answer at last. The universe is 13.7 billion years old.

Other important numbers were pinned down too (see "Our universe according to WMAP"), but more importantly the probe passed judgement on some big ideas. Dark matter, the substance thought to glue galaxies together, has been a controversial idea for the best part of a century and has never been detected directly. Then In the 1990s, observations of supernova explosions showed the universe's expansion was speeding up, and cosmologists blamed a new kind of dark stuff called repulsive dark energy.

Now, one invisible escape clause seems forgivable. But two? All the things astronomers have ever seen in the universe with their fabulous array of instruments are made of ordinary stuff: planets,

nebulae and stars of all kinds are built from protons, neutrons and electrons. Yet astrophysicists were claiming that all this amounts to just a few per cent of the universe's content.

Despite the evidence for dark matter, I'd always had a suspicion that it might be a big mistake. So I was eager to see the WMAP results.

The pattern of spots in the background radiation reflects the slight humps and bumps in the density of the early universe, and the size of those variations depends on the kind of matter, dark or otherwise, that filled space. Meanwhile dark energy changes the curvature of space, distorting the pattern.

When the WMAP cosmologists compared the data with a huge range of cosmological possibilities, the model that matched contained 23 per cent dark matter, 73 percent dark energy, and just 4 per cent ordinary matter.

None of this is yet proved beyond doubt, and earlier this month astronomers found that distant galaxy clusters are rarer than dark-energy models predict. But for now the evidence for seems to outweigh the evidence against. We are probably stuck with the dark stuff.

The new map supported the crazy idea of inflation, too. When the universe was less than 1O[sup-30] seconds old, the theory says, it suddenly expanded at a colossal rate, stretching space flat. This would solve some puzzles about the universe — why it is so uniform on very large scales, for example. But it was a controversial and daring hypothesis, until WMAP saw a pattern of polarisation in the microwave background that no existing rival theory could account for.

It is true that there was a lot of evidence for dark matter, dark energy and inflation before WMAP. But it was based on less compelling data, as if it were a charcoal sketch of the universe with small patches inked in by various hands. By giving us a single detailed plan, the probe has converted most remaining sceptics. It's time to stop teasing cosmologists for building great towers of speculation on slight foundations.

OUR UNIVERSE ACCORDING TO WMAP

- Age: 13.7 billion years
- Shape: flat
- Age when first light appeared: 200 million years
- Contents:
- 4% ordinary matter
- 23% dark matter, nature unknown
- 73% dark energy, nature unknown
- Hubble constant (expansion rate): 71 km/sec/megaparsec

PHOTO (COLOR): We can't see dark matter, but we know it's there

PHOTO (COLOR)

~~~~~~~~

By Stephen Battersby

~~~~~~~~