The Razor's Edge

Wednesday, August 19, 2009

'Big Wave' Theory Offers Alternative to Dark Energy By Clara Moskowitz

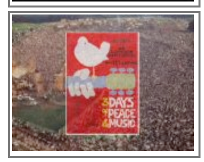
By Clara Moskowitz at Space.com

Mathematicians have proposed an alternative explanation for the accelerating expansion of the universe that does not rely on the mystifying idea of dark energy.

According to the new proposition, the universe is not accelerating, as observations suggest. Instead, an expanding wave flowing through space-time has caused distant galaxies to appear to be accelerating away from us. This

Featured Ar



powered by YouTube

Blog Archive

big wave, initiated after the Big Bang that is thought to have sparked the universe, could explain why objects today appear to be farther away from us than they should be according to the Standard Model of cosmology.

"We're saying that maybe the resulting expanding wave is actually causing the anomalous acceleration," said Blake Temple of the University of California, Davis. "We're saying that dark energy may not really be the correct explanation."

The researchers derived a set of equations describing expanding waves that fit Einstein's theory of general relativity, and which could also account for the apparent acceleration. Temple outlines the new idea with Joel Smoller of the University of Michigan in the Aug. 17 issue of the journal Proceedings of the National Academy of

My Short Stories

My Novel, Percival

Sciences.

While more research will be needed to see if the idea holds up, "the research could change the way astronomers view the composition of our universe," according to a summary from the journal.

To convince other cosmologists, the new model will have to pass muster with further inquiry.

"There are many observational tests of the standard cosmological model that the proposed model must pass, aside from the late phase of accelerated expansion," said Avi Loeb, director of the Institute for Theory and Computation at the Harvard-Smithsonian Center for Astrophysics. "These include big bang nucleosynthesis, the quantitative details of the microwave background

My Novel, The Truth Seeker

My Other Blog

My UConn Blog

anisotropies, the Lyman-alpha forest, and galaxy surveys. The authors do not discuss how their model compares to these tests, and whether the number of free parameters they require in order to fit these observational constraints is smaller than in the standard model. Until they do so, it is not clear why this alternative model should be regarded as advantageous."

Johns Hopkins University astrophysicist Mario Livio agreed that to be seriously considered, the model must be able to predict properties of the universe that astronomers can measure.

He said the real test "is in whether they are able to reproduce all the observed cosmological parameters (as determined, e.g. by a combination of the Hubble Constant and the parameters determined by the CMB observations). To only produce an apparent acceleration is in itself interesting, but not particularly meaningful."

Inconvenient truths

Dark energy is itself a hasty fix to an inconvenient truth discovered by astronomers in the late 1990s: that the universe is expanding, and the rate of this expansion seems to be constantly picking up speed.

To explain this startling finding, cosmologists invoked dark energy, a hypothetical form of energy that is pulling the universe apart in all directions (note that dark energy is wholly separate from the equally mysterious concept of dark matter - a hypothetical form of matter that populates the universe, interacting gravitationally with normal matter, but which cannot be seen with light). In this interpretation, the whole universe is blowing up like a balloon, and from any given point within it, all distant objects appear to be speeding away from you.

But not everyone is happy with the dark energy explanation.

"It just seems like an unnatural correction to the equations - it's like a fudge factor," Temple told SPACE.com. "The equations don't make quite as much physical sense when you put it in. You just put it in to fit the data."

Temple and Smoller think the idea of an expanding wave makes more sense.

"At this stage we think this a very plausible theory," Temple said. "We're saying there isn't any acceleration. The galaxies are displaced from where they're supposed to be because we're in the aftermath of a wave that put those galaxies in a slightly different position."

Ripples in a pond

Temple compared the wave to what happens when you throw a rock into a pond. In this case, the rock would be the Big Bang, and the concentric ripples that result are like a series of waves throughout the universe. Later on, when the first galaxies start to form, they are forming inside space-time that has already been displaced from where it would have been without the wave. So when we observe these galaxies with telescopes, they don't appear to be where we would expect if there had never been a big wave.

One potential issue with this idea is that it might require a big coincidence.

For the universe to appear to be accelerating at the same rate in all directions, we in the Milky Way would have to be near a local center, at the spot where an expansion wave was initiated early in the Big Bang when the universe was filled with radiation.

Temple concedes that this is a coincidence, but said it's possible that we are merely in the center of a smaller wave that affects the galaxies we can see from our vantage point - we need not be in the center of the entire universe for the idea to work.

Posted by David Gillett at Wednesday, August 19, 2009 0 comments

---

Friday, August 14, 2009

Molecules Wrestle for Supremacy in Creation of Superstructures

From the University of Liverpool

Research at the University of Liverpool has found how mirror-image molecules gain control over each other and dictate the physical state of superstructures.

The research team studied ‘chiral’ or ‘different-handed’ molecules which are distinguishable by their inability to be superimposed onto their mirror image. Such molecules are common – proteins use just one mirror form of amino acids and DNA, one form of sugars. Chirality leads to profound differences in the way a molecule functions – for example, drugs such as thalidomide can have positive effects on a patient but can prove harmful in their mirror image form.

Molecules can also assemble in large numbers and form ‘superstructures’ such as snowflakes which are created from large numbers of water molecules. When chiral molecules assemble they can create ‘handed’ superstructures; for example left-handed molecules can assemble together to make a left-handed superstructure. The Liverpool team studied this process in detail by assembling molecules at flat surfaces and using imaging techniques to map the formation of superstructures at nanoscale level.

Before now, scientists have not known whether, in systems containing both left-handed and right-handed molecules, one mirror-form of a molecule could take supremacy over its opposite number in the creation of superstructures, dictating their physical state and chemical and biological properties.

The research found that when equal numbers of mirror-molecules are present at the surface, they organise into separate left and right-handed superstructures, each with distinctly different properties. Crucially, a small imbalance in the population leads to a dramatic difference and only the molecules in the majority assemble into its superstructure, while the minority is left disordered at the surface and unable to create advanced molecular matter.

Professor Rasmita Raval from the University's Surface Science Research Centre said: "We were surprised at these results. All perceived wisdom was that the left and right-handed molecules would simply create their respective superstructures in quantities that reflected the molecular ratio – that is, we would observe proportional representation. Instead, what we obtained was a kind of 'molecular democracy' that worked on a 'first-past-the-post' system where the majority population wrested chiral control of the superstructures and the minority was left disorganised.”

Theoretical modelling carried out by the University of Eindhoven in the Netherlands found that this behaviour arises from the effects of entropy, or disorder, which leads the chiral molecules in the majority to preferentially organise into their superstructure.

The work has important implications in the pharmaceuticals industry and could lead to the development of surface processes to enable separation of drugs and products that are currently difficult to purify. The research also introduces the possibility that assembly processes at surfaces may naturally have led to the evolution of proteins and DNA – the molecules of life – containing just one mirror form of amino acids and sugars.

The research, in collaboration with the University of Eindhoven, is published in *Nature Chemistry*.

Posted by David Gillett at Friday, August 14, 2009 0 comments

Home July 2009

Subscribe to: Posts (Atom)