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Big Wave Theory Offers Alternative to Dark Energy

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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 throughout space-time causes distant galaxies to appear to be accelerating away from us. This big wave, initiated by the Big Bang that is thought to have sparked the universe, could explain why objects appear to be farther away from us than they should be according to the Standard Model of cosmology.

"We're saying that maybe these expanding waves are actually causing the anomalous acceleration," said Blake Temple of the University of California, Davis. "We're saying dark energy is not really 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 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 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."

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 thinks the idea of an expanding wave makes more sense.

"At this stage we think this a very plausible theory," he 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 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.

By **Clara Moskowitz** , Space.com staff writer

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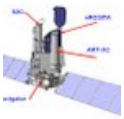

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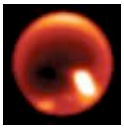

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