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[Erasing Dark Energy](#)

Wide Angle / by Veronique Greenwood / September 24, 2009

Why do we need dark energy to explain the observable universe? Two mathematicians propose an alternate solution that, while beautiful, may raise even **more questions than it answers.**

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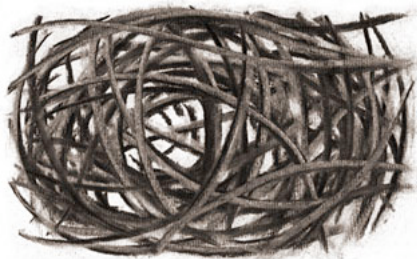


Illustration by Mike Pick

Against all reason, the universe is accelerating its expansion. When two prominent research teams dropped this bombshell in 1998, cosmologists had to revise their models of the universe to include an enormous and deeply mysterious placeholder they called “dark energy.” For dark energy to explain the accelerating expansion, it had to constitute more than 70 percent of the universe. It joined another placeholder, “dark matter,” constituting 20 percent, in overshadowing the meager 4 percent that make up everything else—things like stars, planets, and people.

That a huge fraction of the universe could be composed of this enigmatic stuff was unnerving, to say the least. But what was most disturbing to cosmologists was that the discovery required adding a term to Einstein's equations of general relativity. These equations were derived from pure mathematics and had already beautifully predicted the expansion of the universe, discovered by Edwin Hubble in 1929. To many, even those who accepted its usefulness in explaining the data, dark energy was an inelegant addition. Over the last decade, some researchers have been working to describe what dark energy might be, but others have gone back to see if the equations of general relativity can be tweaked to avoid having to use such a troublesome piece of math.

Building from the Einstein equations, mathematicians Blake Temple and Joel Smoller have now found a way to explain the observations that led researchers to propose dark energy. If their solution, published in the *Proceedings of the National Academies of Science*, fits the data, it could provide a way out of the unpalatable notion of a dark-energy-dominated universe.

The concept of dark energy — which is simply that a phenomenal amount of energy exists in the vacuum of space — emerged from a discrepancy between how far away supernovae were supposed to be and how bright they appeared. In the 1990s, two teams, one led by cosmologists at the Lawrence Berkeley National Labs (LBNL) and the other by Australia's Mount Stromlo Observatory, were in the midst of a massive survey of Type Ia supernovae. Measuring the brightness of these huge stellar explosions lets scientists deduce how much the universe has expanded since the light began its journey.

The two teams were hoping to observe that the brightness of the supernovae, which grows increasingly dim the farther they are from Earth, would plateau at the farthest edge of the observable universe. This would reflect the theory that the universe's expansion was slowing down due to the gravitational pull of matter. But what they observed was the exact opposite. In fact, the supernovae were receding at a rate that would only be possible in a universe with no matter at all.

After considering and ultimately rejecting alternative explanations for the dimming, both teams came to the same conclusion: The supernovae were dim because they were being pushed away by a wave of universal, accelerating expansion. And that could only happen if a huge amount of energy was counteracting the force of gravity. Thus, dark energy was conceived.

To Temple and Smoller, mathematicians at the University of Michigan and the University of California–Davis, respectively, dark energy seemed an ad hoc addition to cosmology. While performing mathematical research on shockwaves, Temple and Smoller realized that an expanding wave with its epicenter near the Earth could produce the dimming effects the two teams had observed. The two started talking to astrophysicists and other mathematicians to flesh out the idea. What they discovered was as utterly unexpected to them as dark energy was to cosmologists: An accelerating wave of expansion following the Big Bang could push what later became matter out across the universe, spreading galaxies farther apart the more distant they got from the wave's center. If this did happen, it would account for the fact that supernovae were dim—they were in fact shoved far away at the very beginning of the universe. But this would've been an isolated event, not a constant accelerating force. Their explanation of the 1998 observations does away with the need for dark energy.

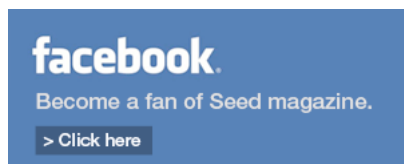
The theory is attractive because it describes the effect astronomers observed using only general relativity. It also provides a mechanism for a scenario that's been discussed in cosmology for some time, the "bubble of underdensity"—the idea that the Earth might be in an area with a low mass density compared to the rest of the universe, which would account for the distance of the supernovae. And Smoller and Temple say that once they have worked out a further version of their solutions, they should have a testable prediction that they can use to see if the theory fits observations.

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REPORT
BAD MEMORIES
How does memory work? A new study suggests it's not as simple as you think. How can we learn about the brain?

By [Name] | [Date]

It's a common belief that memory is a simple process of recording and retrieving information. But a new study from the University of California, San Diego, suggests that memory is a much more complex process. The researchers found that the brain's memory system is not just a passive recorder of information, but an active participant in the process. They discovered that the brain's memory system is constantly updating and reorganizing information as it is stored. This means that our memories are not just a record of what happened, but a reconstruction of what we think happened. The researchers also found that the brain's memory system is highly susceptible to suggestion and bias. This means that our memories can be easily influenced by what we hear or see. The study has important implications for our understanding of memory and for the development of memory-enhancing technologies.





THE SCIENCE

THE EXTINCTION OSCILLATOR

Earthquakes and other natural events may be common, but they kill nearly all life on the planet. The same natural processes, but they're in the background of the story

It's a common misconception that the Earth is a stable planet. In fact, it's a dynamic one, with a core that's constantly moving and a crust that's constantly shifting. The result is a planet that's constantly changing, and that's what makes it so interesting. The Earth's crust is made up of tectonic plates that are constantly moving and colliding. This creates earthquakes, volcanoes, and other natural events that can be devastating to life on the planet. But these events are also what make the Earth a habitable planet. Without them, the Earth would be a dead planet. The same natural processes that create these events also create the conditions that make life possible. The Earth's crust is made up of tectonic plates that are constantly moving and colliding. This creates earthquakes, volcanoes, and other natural events that can be devastating to life on the planet. But these events are also what make the Earth a habitable planet. Without them, the Earth would be a dead planet. The same natural processes that create these events also create the conditions that make life possible.

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Ocean Fertilization



CO2 Levels

The graph shows a sharp upward trend in CO2 levels, which is consistent with the data from the Mauna Loa observatory. The concentration of CO2 in the atmosphere has increased significantly since the late 1950s, and this increase is accelerating. The graph shows a sharp upward trend in CO2 levels, which is consistent with the data from the Mauna Loa observatory. The concentration of CO2 in the atmosphere has increased significantly since the late 1950s, and this increase is accelerating.







The

THE Political Scientist

Red White by John R. Heilbrunn
The American political system is in a state of
collapse. The only way to save it is to
abolish the Constitution and replace it
with a new one. This is the only way
to ensure the survival of the Republic.
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Text describing the magazine cover, mentioning 'The Ego' and 'Erasing Dark Energy'.



Erasing Dark Energy

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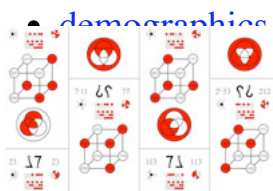
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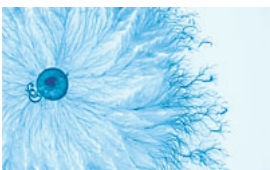
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