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# Commentary: Universe may exist in a 'white hole'



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NEW YORK, Sept. 16 (UPI) -- Instead of containing all of creation, the universe itself may exist inside sort of a giant black hole that is reversed, like a movie running backward, so instead of sucking everything into oblivion, the "white hole" is ejecting everything outward.

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The new theory, derived from Einstein's equations for relativity, suggests beyond our universe "is a universe we are expanding into, a much bigger place," mathematical physicist Blake Temple of the University of California, Davis, told United Press International.

The leading idea of how the universe began remains the Big Bang theory, which explains our cosmos was born, not so much from a giant explosion, but a giant expansion, ejecting everything -- even time and space -- from an infinitesimal spot nearly 14-billion years ago.

In 1925, famed astronomer Edwin Hubble -- after whom the orbiting Hubble Space Telescope is named -- discovered all observable galaxies are flying apart from one another. By tracing the history of the universe back in time, scientists have been able to estimate the present cosmos grew from a single point of incredible heat and pressure. Echoes of the Big Bang still pervade all of space as a dim background of microwave radiation.

In the so-called standard model, the universe is assumed to go on expanding infinitely in every direction and eventually to reach infinite mass. This is a sticking point, with which Blake Temple and collaborator Joel Smoller have problems.

"A basic principle of physics is that nothing is infinite," Temple said. "Is there



anything else in physics you can think of that is infinite?"

Temple and Smoller wanted to create a new model of the Big Bang where the total mass was not infinite. Both are experts in the mathematical theory of shock waves, the steep, high-pressure fronts of explosions. Shock wave science attempts to explain such phenomena as the sonic boom created by the wings of aircraft, the way gridlock propagates in vehicular traffic and tidal waves.

"Every explosion I've ever seen has a shock wave," Temple said. "We said, 'My God, the expanding universe is the only explosion we've ever seen without a shock wave. Can we incorporate one into it?'"

Their model, which Temple and Smoller reveal in the latest issue of the Proceedings of the National Academy of Sciences, took a decade to develop. Because their model squeezed all of the universe's mass into a tight space that proceeded to explode outward, that meant the cosmos had to have begun from a black hole.

Black holes are pits in space and time predicted by Einstein's equations that are so dense, nothing can escape their gravitational pulls, not even light. At the heart of a black hole is a singularity, a point of infinite density where space and time as we know it end.

"What is nice about Einstein's equations is that they are time-reversible," Temple said. A black hole's dynamics played backwards are equally as plausible as the normal version. Although singularities contained in normal black holes end space and time, the new model of a white hole begins space and time.

At first, Smoller and Temple assumed our universe had already escaped the confines of the white hole. However, if we had, we should be able to see the shock wave from the Big Bang explosion, Temple explained. "Since we don't see a shock wave, it's farther out. This means we are inside a time-reversed black hole," Temple explained.

Though the model seems like idle speculation at first, Temple said "a big surprise" is its mathematics predict accurately the correct values of pressure and density at the earliest stages of the Big Bang.

"I like the idea. I think it's very appealing," mathematician James Glimm of the State University of New York at Stonybrook told UPI. "It's an extremely exciting development. It's one of the boldest new ideas that has been offered in cosmology in a while. I'm sure it will capture the attention of a lot of people."

One major implication of this model, Temple explained, is "there is something outside. Our universe is in a much larger space-time. The universe we know could be much bigger than the region of expanding galaxies," he said.

"There could be other universes. All could exist within this outer space beyond these things," Glimm said.

Temple said future papers could help reveal when our expanding universe will contact with its shock wave and emerge from the edges of the white hole. "If you were off the center of the universe, you would see (the shock wave) as a disturbance in the sky," he said.

Of course, "what set the explosion in motion, that's a complete mystery," Temple said. "What's the mechanism, where it came from, we don't know, but this is exactly the same question there is for the Big Bang in the standard model."

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