Math theories may hold clues to origin, future of life in universe

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How did we get here and where are we headed? These are some of life's biggest questions. To get the answers, one Kansas State University professor is doing the math.

Louis Crane, K-State professor of mathematics, is studying new theories about why the universe is the way it is. He has a grant from the Foundational Questions Institute to study new approaches to the quantum theory of gravity, his primary research area as both a mathematician and a physicist. Crane hopes to uncover implications of these theories for the origin and the future of life.

He said that the standard model, which is the accepted theory of physics, has a large number of fundamental constants. Examples are the strengths of fundamental forces and the masses of fundamental particles.

What complicates things, Crane said, is that the theory does not explain the values of these constants. Rather, they are known by measurement and put into equations by hand.

"If they had just slightly different values, we would live in a different universe," Crane said. "If they were a little different, we wouldn't be here."

His work has been published in many journals, including *Communications in Mathematical Physics* and in *Classical and Quantum Gravity*. His work on implications for life was accepted for publication

and he was invited to present his research at the Evo Devo Conference in Paris in 2008.

Crane said that his ideas build on the work of Lee Smolin, a theoretical physicist. Instead of a universe fine-tuned to produce stars, as Smolin suggests, Crane proposes that the universe is fine-tuned to produce successful industrial civilizations, possibly including us.

"Life couldn't exist if stars didn't shine for billions of years," Crane said. "Only a fine-tuning in the constants causes them to do so. Another fine-tuning in the constants causes carbon, the foundation of life, to be abundant."

Crane suggests that if he is correct that artificial black holes are possible, then successful industrial civilizations -- maybe ours -- will eventually produce them. That's because at a certain size they would be a perfect energy source for interstellar travel.

"I started doing calculations and found that the right-sized black hole to fuel a starship is just on the edge of what's possible," he said. "If you can build one, it has implications for the future of life because we would eventually spread life throughout the galaxy if we could build starships."

Black holes are believed to produce a new universe on the other end of the singularity, but one that lies in our future and is always out of reach. Yet such universes, Crane said, also would be fine-tuned to produce life, civilizations and, eventually, more black holes.

"If this is possible, then we will fill the universe with life," he said. "I'm suggesting that life forms are part of a grand evolutionary cycle, which includes universes and black holes."

Crane is joined in his research by Shawn Westmoreland, a K-State

doctoral student in mathematics.

Although there's been a lot of interest in the research from academic philosophers, Crane said that doing such abstract and imaginative research in Kansas often is an interesting experience.

"But I take solace in the Kansas state motto, 'ad astra per aspera,' which means 'to the stars through difficulty,'" he said.

Source: Kansas State University (news : web)