One Universe or Many: Scientists Debate the Controversy

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One of the hottest - and most mind-bending - questions in modern physics is whether the universe we inhabit is the only one, or if there are an infinite number of alternative universes in higher dimensions beyond those we know, or perhaps could know.

Once upon a time, people were certain that the earth was at the center of the universe, and that everything revolved around it. Later, astronomers proved that wasn't the case – that the earth revolves around the Sun, which is just another star in the Milky Way galaxy, which, it later turned out, is not unique either; the Milky Way is just one of many galaxies. But at least there is just one universe, right? Well, maybe not.

"Previously we thought that the whole universe is like one expanding balloon," says Stanford University physicist Andrei Linde, who originated the so-called "inflationary" or "multiverse" theory, which plausibly asserts the existence of several universes, each with its own set of laws, "But then we learned that this balloon creates new balloons, these balloons create new balloons. And this process goes on forever…."

Stanford University physicist Andrei Linde originated the multiverse theory

At a recent debate at New York's American Museum of Natural History, Linde said that colleagues who dismiss the inflationary cosmology out of hand remind him of his childhood in the Soviet Union, when both East and West were certain they had the one true ideology.

"In physics," he said, "there is also an ideology. We want to find one unique rule which rules the whole universe, the best

rule, the only possible rule -- and that's the goal of physics. But the goal of physics may be more democratic. It may allow [a] universe of this type and a universe of that type." "And," he added, "until you prove it is absolutely necessary for the entire universe to follow just one rule prescribed to us, the multiverse theory will be alive."

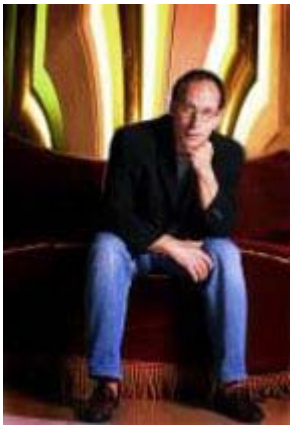
Theoretical physicist and author of 'Parallel Worlds' Michio Kaku

Michio Kaku, a leading theoretical physicist and the author of *Parallel Worlds*, has no problems accepting the theory. In fact, Kaku is a co-founder of a branch of "String Theory" physics which is consistent with the inflationary, multiverse model. To explain his theory to the lay public, Kaku often likens the universe to a musical string, with subatomic particles as its "notes."

"And physics would be the harmonies you could write on these vibrating strings. Then what is chemistry? Chemistry is the melodies you can play on these strings. What is the universe? The universe is the symphony of strings. Then what is the mind of God? The mind of God that Einstein spent thirty years of his life trying to read would be cosmic music resonating through eleven-dimensional hyperspace!"

Kaku went on to assert, that, if that picture is correct, "then our universe is a 'soap bubble' of some sort existing with other soap bubbles. And our multiverse is like a bubble bath with universes popping into existence, budding, sprouting, colliding with other universes."

Cosmologist Lawrence Krauss, an astronomy professor at Case Western Reserve University, and the author of *Hiding in the Mirror: The Mysterious Allure of Extra Dimensions from Plato to String Theory and Beyond,* is a skeptic. He says that multiverse theory may be all-too-human wishful thinking.



Case-Western Reserve astronomy professor, and author Lawrence Krauss

"We don't want to be alone," he says. "It would be nice if our universe weren't the only one. In fact, it would be nice if there were universes that were better than ours!" Krauss says, that as a scientist, he knows that "every time we open up a new window on the universe, we're likely to be surprised. But to say with any kind of supposed certainty that we know that space and time at some scale is full of 'bubbles' is science fiction in the extreme!"

But much of what is called science fiction one day becomes science fact the next day. Lisa Randall is a theoretical physicist at Harvard University, and the author of *Warped Passages: Unraveling the Secrets of the Universe's Hidden Dimensions*. She agrees that it may be impossible to directly observe other universes or

higher dimensions from within this universe or dimension. "… But the only way to know if there are other things to observe is if we think about them in the first place."

Randall points out that there are practical questions that might be answered by those inquiries -- such as why gravity seems to be so weak compared to electromagnetism, and other fundamental nuclear forces.

"It could be that gravity is in fact as strong as those other forces but it's somewhere else in a higher dimensional universe – it's not where we are." And she adds that it is interesting to think about these things. "But it is most interesting to think about how we can access them. Do they have any influence on our world? Is there any way of testing these ideas?"

There may be, when the world's most powerful particle accelerator is switched on next year in Switzerland. The Large Hadron Collider, as the atom-smasher is known, may reveal new information about the forces that hold together this universe… and maybe others.