Physicist explores possibility of parallel universes; Researching gravity offers weight to theories of unknown dimensions; [Final Edition]

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Full Text (783 words)

Parallel universes. Other-worldly dimensions.

That's weird stuff of Star Trek and other science fiction shows.

But while trying to answer puzzling questions about gravity, the force that keeps us on the ground, Lisa Randall, a Harvard theoretical physicist, has also journeyed into the possibilities of parallel universes.

And her theories could be tested.

Randall, who spoke in Waterloo during last night's public lecture put on by the Perimeter Institute for Theoretical Physics, does not believe we can travel to these other universes.

They would be radically different to our own. Any life there would be unlike anything we can perceive, she adds.

But she has good reasons to believe other dimensions and universes exist.

Better still, she thinks there may be solid scientific evidence coming when the Large Hadron Collider near Geneva is switched on in 2007.

"There really could be extra dimensions and that has big implications," she says. "Cosmologically, we could be living in a much bigger universe."

Randall is considered one of today's most promising theoretical physicists. Her work is frequently cited in scientific journals.

Ever since her popular book, Warped Passages: Unraveling the Mysteries of the Universe's Hidden Dimensions, was published, she has been on a hectic public lecture tour.

Everyone is familiar with the three "dimensions" of our space. We can move left or right, backward and forward, up and down.

But there could be other universes that have with fewer or more "degrees of freedom," Randall says.

It is nearly impossible to imagine this. But Randall says 19th- century author Edwin A. Abbott provided a good analogy in his book, Flatland.

Abbott imagined a creature that could only exist on a flat surface. He wondered what that creature would see if a big ball from our universe passed through his two-dimensional world. The creature wouldn't be able to see a ball. He would see a series of flat disks on his horizon,

changing in size as the ball passed through.

Likewise, we could not see something from another dimension, but we might be able to see its effects in our world, Randall says.

The standard model of physics explains electrons, protons, neutrons and other particles, as well as forces of nature like electromagnetism. And physicist Albert Einstein demonstrated how big objects like the earth can warp the fabric of spacetime to produce the force that we know of as gravity.

Yet "big puzzles" remain, she says.

Scientists would like a "grand unified theory" to explain all particles and forces in our universe, including gravity, in one package.

But to make the mathematics work out, they need to insert a big "fudge factor" into their equations. This "fudge" is 16 digits in size, Randall says. "So the question is, 'What's going on?' "

In her work, Randall builds "models" of spacetime with other dimensions that provide intriguing answers. One of the questions she is trying to answer is why gravity is so weak compared with other forces. Although people think gravity is strong, a tiny magnet can pick up a paperclip, she says.

Randall says gravity might be weak in our universe, but strong elsewhere.

One concept Randall has explored is the idea of a "brane," which comes from the word "membrane." In this concept, our three- dimensional universe could be imagined as floating in a "higher- dimensional" space. And this larger "space" could contain other universes, other branes, as well.

Imagine an Oreo cookie -- two flat surfaces with cream in between. The two flat surfaces are branes. The cream is the "bulk" of higher dimensional space we can't see. These two branes may only be separated by a fraction of a centimetre, but we are stuck on our own surface, so we can't see the other brane, Randall says.

The particles of our world are restricted to our brane, she adds. "You can imagine it like a shower curtain that has water droplets stuck on it."

But gravity is a force affected by the entire geometry of the larger space.

In the giant particle-smashing machine that opens in Geneva next year, scientists hope to create particles that might have properties that could be predicted to exist if they were affected by gravity from another dimension.

"That would be strong evidence that these extra dimensions exist," she says. Her work doesn't have practical applications right now.

Einstein's theory of gravity didn't have practical applications at the time, but today, it is used to make the global positioning system (GPS) of satellites function, she says.

So as scientists learn about the bigger picture, "you never know what will happen."

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[Illustration]
Photo: RECORD STAFF / Physicist Lisa Randall says parallel universes may really exist.

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