The student newspaper of Case Western Reserve University.

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Harvard physicist gives talk on string theory

***Alison Dietz**, News Editor*

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On Tuesday, Case welcomed physicist Lisa Randall to a nearly-full Severance Hall as the third speaker in the university's Distinguished Lecture Series.

Randall, currently a professor of theoretical physics at Harvard, recently published a book titled Warped Passages: Unraveling the Mysteries of the Universe's Hidden Dimensions that details her ideas on string theory in a way accessible to the public.

This accessibility drew some students to the lecture.

"I heard that Lisa Randall was good at presenting the topic in an understandable way. It's something that I read and then become thoroughly confused by," said sophomore Ethan Engle.

Others were more interested in the fact that Randall was the first tenured woman in the Princeton physics department and the first tenured female theoretical physicist at MIT and Harvard.

"I'm interested in the topic and observing another female in the physics realm," said sophomore Marinda Mitchell. "I want to see how she carries herself and interacts with others."

Randall was introduced by Case professor Lawrence Krauss, who described her as "one of the most active young particle physicists in the world."

The lecture began with an overview of her ideas about string theory and the existence of extra dimensions. Randall, a particle physicist, also uses cosmology in her study.

"There's an interplay between the fields," said Randall.

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The current particle physics view is that the universe is made up of fundamental particles which are unable to be broken down into smaller parts.

"It's funny that the name for atoms comes from the fact that they are supposed to be indivisible and unchanging," said Randall. "But we detected them because they change and divide."

The current candidate for the most fundamental particle is the quark, which makes up protons and neutrons. However, Randall asserts that the standard model is incomplete, and that string theory can account for the discrepancies.

One problem that Randall noted is the difficulty in reconciling general relativity, used in large-scale problems, and quantum theory, used on much smaller scales. One method of reconciliation is string theory, which states that fundamental particles are simply one-dimensional strings. These strings vibrate in different ways that mark them as the neutrons, protons, and other particles that we see.

Randall also promoted the idea of multiple dimensions as a way to address problems that have baffled physicists for years and to deduce connections that might otherwise be missed. She noted that string theory only makes sense if there are extra dimensions to work with. She remained pragmatic, however.

"Even if there are no extra dimensions, thinking outside of our framework raises other questions," said Randall.

She then discussed how extra dimensions would work in geometry, starting with a zero-dimensional point and working up to a four-dimensional hypercube. She also mentioned the difficulty in rendering a hypercube in three or even two dimensions.

"Just because extra dimensions are hard to picture doesn't mean they don't exist," said Randall.

As an example, she brought up the book Flatland by Edwin A. Abbott, wherein a two-dimensional square encounters a three-dimensional sphere. The only way for the square to experience the sphere is as a series of expanding and shrinking circles. Similarly, a hypercube could only be experienced by three-dimensional humans as a series of expanding and shrinking cubes.

Randall contended that the best way to describe such objects is with words. "With this, a word is worth 1000 pictures."

If all these extra dimensions exist, why can't they be seen? Several theories abound, including the idea that the extra dimensions are rolled up to a tiny size.

"People think, if something's that tiny, it might as well not be there," said Randall.

Randall's theory is that there are "membranes" that act to prevent our universe from existing in more than three dimensions, much as water droplets on a window can only move in two dimensions. There may be many such membranes out there that could allow for the existence of multiple dimensions, though we, being stuck on our membrane, can not experience them.

These membranes could also explain the reason that gravitational force is so much weaker than electromagnetic force in our universe. Randall postulates that there could be a "gravitybrane" on which gravity is concentrated, and that only small amounts of gravity can reach our membrane.

Randall's theories and others are all being studied around the world to determine the makeup and possibilities of the universe.

"We don't know if this is how the universe works, but we can test it," said Randall.

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