Lisa Randall

Physicist

As one of the world’s leading theoretical physicists, you’ve hypothesized that there are extra dimensions to the universe—ones that are hidden by the limits to human senses. Do such rarefied theories really have much bearing in the real world? These dimensions would have important implications for cosmology and many questions about the basic nature of matter. But the real impact, for a while at least, will just be an expanded understanding of the makeup of the universe. It makes us better people when we’re thinking about big ideas, about what’s really there in nature. When Fermi National Accelerator Laboratory was being developed, the physicist Robert Wilson was asked, “Would it be good for the defense of the country?” His reply was something to the effect of “No, but it would make the country worth defending.”

What drew you into this work?

I was originally drawn into string theory and cosmology by the idea of having some sort of long-term truths. If you’re going to work on something, you want it to be something that lasts forever—you’re aiming to have ideas that will survive the test of time.

Have you found some?

What is called the Standard Model, describing most of the forces of the universe, has been tested to a high degree of accuracy. Now we’re trying to find what lies beyond it, and those clues are staying remarkably hidden. The primary puzzle is why gravity is so weak. The theory we’re exploring is that gravity may be concentrated somewhere else, in an extra dimension. The region where it is concentrated may be a sort of parallel universe, with completely different chemistry and forces.

So there’s a prospect of another Einstein-style moment that will extend our entire understanding of the universe.

Yes, in the sense that we could find some big things that underlie what we currently see. When we unpick things in physics these days, it’s not necessarily that the old things were wrong. It’s just that underlying it is a more complete theory. Quantum mechanics tells us that a ball is made up of atoms, but Newton’s laws still work just fine. You can predict the ball’s trajectory without knowing that it’s made up of atoms. It sounds kind of technical, but problems like why gravity is so weak point to something dramatic. It could be an extra-dimensional space, it could be a change in the nature of what we think are the symmetries of space and time. We clearly are missing something big. That isn’t necessarily something to be proud of, but it tells us that there is something sitting there.

Are you excited that you’re missing something?

That is one of the great things in physics—it recognizes that what you see isn’t all that is there. It’s what you see at the human scale that is easy for you to observe. Once you go to smaller scales or higher energies, it turns out the universe could be an

etirely different-looking place.

Gravity may be concentrated in an extra dimension—a parallel universe with completely different chemistry.

By Andrew C. Revkin

Don’t talk of dimensions beyond our senses

Do you see problems with the way science and society interact?

There are problems with the way truth and society intersect these days. For one thing, science is difficult. Things like string theory and climate change are complex. People need a little more patience with uncertainty. We live in the era of the sound bite, and, on the whole, science doesn’t lend itself to sound bites. Why are people afraid of science? It’s based on fear—they’re losing control of their universe.

Are we at a pivotal point in the history of the human species? Or does every era seem pivotal to those who are living in it?

I actually do think it’s a critical time for our country. Our interaction with the planet, in terms of how we’ve changed it, has dramatically accelerated over the past 100 years. We’ve started going in a lot of bad directions, and we need to turn those around.

What directions?

How decisions have been made—our foreign policy, our energy policy, our economic policy. TV advertising has really changed the way money influences politics. These are incredibly dangerous trends, and they are threatening to democracy. We just don’t have the separation of powers we’ve had in the past. People have always had bad ideas, but usually there is someone around to check it.

When I was growing up, there was a sense of optimism. There were pushes for minority rights, pushes for women’s rights. There was a sense of trying to equalize the playing field. Now it seems like there’s a retrenchment. And that’s very dangerous.

What has led to things going that way?

People not thinking.

Can physics help solve global warming and other dangers facing the world in the coming decades?

There are physics-related ideas floating around for how to engineer the climate, but that’s quite a daring leap to make. Physics can have practical implications, but what we are doing is pure science. We’re doing it for the sake of knowledge.

Are you optimistic or pessimistic about the future?

I’m a worrier. I have some inner optimism, but when you look at things in their full complexity, it’s very hard to just say things are going to go well. There are always too many things that can go wrong.

I guess the reason I probably still am an optimist is that I continue to work on difficult things, and you have to be somewhat of an optimist to think that those things are worth doing. Believing we can understand the laws of nature—you have to be pretty optimistic to believe that.