Physics Wars

String theory was supposed to reconcile the subatomic world with the vast reaches of spacetime. Now Lee Smolin wants to unravel it.

By Adam Rogers

The universe has a problem. The math that describes gravity and the structure of spacetime – general relativity – conflicts with the math that describes the interactions of subatomic particles – quantum mechanics. For the past two decades, the dominant approach to unifying the two has been string theory, which basically says that the universe is made of infinitesimally small, vibrating filaments of energy moving through multiple dimensions. It's wacky stuff, but no weirder than a lot of other science. Yet in his new book, The Trouble With Physics, theoretician Lee Smolin argues that string theory is not only weird, it might be wrong. A founding scientist at the Perimeter Institute for Theoretical Physics in Waterloo, Ontario, Smolin says that string theory is unconvincing – maybe even nonscientific – and that physicists have embraced it at the expense of other promising research. At home in Toronto, Smolin talked about physicist cliques and the true nature of the universe.

So you're calling bullshit on a big chunk of modern physics.
I wouldn't put it that way, but that's fair. The field of fundamental theoretical physics is in trouble, and this book is about why. But I have enormous respect for everybody whose work I'm criticizing. If string theory is a mistake, it's not a trivial mistake. It's a deep mistake and therefore kind of worthy.

Yet you essentially accuse string theorists of being the jocks of theoretical physics.
A lot of people are frustrated that this community that styles itself as dominant – and is dominant in many places in the US – is uninterested in other good work. Look, when we have quantum gravity meetings, we try to invite a representative from each of the major opposing theories, including string theory. It's not that we're so very moral; it's just what you do. But at the annual international string theory meeting, they've never done this.

Why are they so antisocial? Territoriality?
One metaphor that I like comes from complexity theory. Let's say you have a landscape with a bunch of hills, and you want to find the highest mountain. String theory is a hill, and loop quantum gravity is a hill, and so are spin foam models and twistor theory and causal sets and brane worlds.

So some scientists are good hill climbers. You set them on a slope, and they incrementally advance the science upward. Other scientists are good explorers – valley crossers – who find new slopes. The problem we have now is that science is dominated by hill climbers. They've found the tops of the hills, and they're just …

… defending the hill.
Right. And meanwhile, the truth is somewhere over there.

You've said that string theory doesn't make any testable predictions. What do you mean by that?
Well, the hypothesis was that the geometry that describes our universe has four "flat" dimensions and six more curled up so tiny that they can't be seen. The problem is, once you start to curl up some of the dimensions, you get an infinite number of geometries that allow strings to propagate.

That does seem like a problem.
Yeah, and we're not even there yet. We know that the expansion of our universe is accelerating, which means a number called the cosmological constant must be positive. At first everyone thought string theory was completely inconsistent with that. In 2003, some evidence was found for string theories where the cosmological constant is positive, too. But if those theories exist, then there are at least 10^500 of them.

So there's a string theory to cover any observation.
Well, every string theory that's been written down says the speed of light is universal. But other ideas about quantum gravity predict the speed of light has actually increased. And an experiment on the Gamma Ray Large Area Space Telescope, launching next year, will check this. So I've said, look, if the speed of light isn't universal, that disconfirms string theory. But the string theorists say they could probably invent versions of the theory that work either way. We'd have to change our notion of what science is to accommodate this proposition. You just can't do science on that basis.

**Let me predict the response to your book: This is sour grapes from a researcher on the wrong side of history.**
First of all, over the past 20 years, I've published 18 technical papers in string theory. The last one was about a year ago. But even if I accepted your premise, this is what the literature is for. Science moves fastest when there's plenty of debate and controversy. So this book is addressed to our colleagues as well as the public.

**Then how do you think the stringy folks will respond?**
They could say, "String theory is gonna work; it's just taking a long time. It gets so much right that it has to be worth pursuing." But the disagreement is not about whether string theory is worth pursuing. It's about whether it should be the only thing pursued.

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