Tying string theory together: A new book attempts to explain string theory to the masses

September 17 2010, By Phillip F. Schewe

Credit: quinet / via flickr

Reality comes in layers. Everything we see in the world around us, scientists tell us, is made of atoms and combinations of atoms called molecules. Atoms are themselves made of tiny particles -- electrons, protons, and neutrons. Protons, in turn, are believed to be made of still tinier things called quarks. Is that the end of it? Probably not.

Many physicists now believe that at a still lower level, matter consists of a network of vibrating strings. For several thousand researchers worldwide, using strings to explain complex phenomena is practically a crusade. The book "String Theory for Dummies" by Andrew

Zimmerman Jones tries to capture the excitement of these developments without using any equations.

The reason strings are such a hot topic nowadays, Jones explains, is that the new theory not only helps to solve some long-standing problems in physics, but it also attempts to explain other, not-yet-observed phenomena such as time travel and the possible existence of extra dimensions.

One of the great virtues of string theory is that it tries to be a theory of everything. No, this doesn't mean explaining the meaning of life. For a physicist a "theory of everything" refers to an over-arching framework that explains the four known physical forces: the electromagnetic force, which holds atoms together and is also responsible for things like electricity, magnetism, and light; gravity, which holds stars together and keeps the planets orbiting our sun; the strong nuclear force which holds nuclei together; and the weak nuclear force, which is responsible for tearing nuclei apart through things like radioactivity.

In practice, contriving a theory of everything means reconciling the two great physics theories of the previous century: quantum mechanics and general relativity. Quantum science generally deals with matter at small scales (all those nested layers of particles), while general relativity generally deals with massive things like planets and galaxies. For the past century physicists have failed to bring these two mighty theories together.

String theory, at least on paper, seems to have succeeded. Gravity not only fits in with quantum behavior -- it is actually required by string theory. But here's the problem: string theory is exciting and elegant, but it’s still just a bunch of equations on paper. So far it has failed to offer any testable predictions.

Lee Smolin, who works at the Perimeter Institute of Theoretical Physics in Waterloo, Ontario, is one of the chief string skeptics. His book, "The Trouble With Physics: The Rise of String Theory, the Fall of a Science, and What Comes Next," provides an interesting history of physics theories of the past two centuries. Smolin says that string theory has been around for 35 years. No previous major physics theory in past centuries has needed more than about ten years to be proved. So what’s taking so long?

To underscore the grave lack of experimental support for string theory, Smolin quoted physicist Richard Feynman's dislike of early forms of the theory: "'I don't like that they're not calculating anything,' said Feynman about string theorists. 'I don't like that they don't check their ideas. I don't like that for anything that disagrees with an experiment, they cook up an explanation.'"

Give us a chance, says Edward Witten of the Institute for Advanced Study in Princeton, N.J. Witten, not a founder of string theory but perhaps its most prominent practitioner and defender, argues that the complexity of mathematics used by the theory and the ambitiousness of the task of unifying all the known physical forces into a single framework must necessarily take time.

"String theory has been discovered in bits and pieces -- over a period that has stretched for nearly four decades -- without anyone really understanding what is behind it. As a result, every bit that is unearthed comes as a surprise," Witten wrote in an essay in Nature magazine. "We still don't know where all these ideas are coming from -- or heading to."

Some of the more forefront areas of particle physics are discussed in a clear way, things such as black holes, multiverses, and Higgs bosons. The book is well furnished with vivid illustrations. And as with so many of the other "For Dummies" books, there are plenty of text sidebars to handle sub-topics and other warnings and detour instructions that help the reader maneuver around this vast topic as if she were driving through Manhattan at rush hour. This journey through modern physics at rush hour is so filled with things to learn about that there isn't much room left for biography. Many personalities working in string theory today are mentioned but few are allowed the space to settle into our imagination.

Jones's book faces the issue of string theory's lack of experimental proof head on. He admits that there isn’t much evidence, but generally he takes Witten's view that we need still more time to settle the issue of string theory's validity and usefulness.

Jones runs the physics page on the popular About.com website, so he is used to grappling with down-to-earth explanations of tough subjects.

But does his book make string theory clear? Well, if you're a physicist the book does a nice job of summarizing string theory and its contributions to related subjects like mathematics and cosmology.

What about readers who are non-scientists but interested in learning about abstruse subjects like strings and are willing to do preparatory homework? Here again, Jones's book is worthwhile. It offers a nice exposition of classical theories of force (which explain why a ladder doesn't slide off the wall), quantum mechanics (which shows how atomic and sub-atomic objects get fuzzier the closer we look at them), and general relativity (which explains how massive objects warp the space in their vicinity).

And dummies? Will they like the book? Let's suppose that anyone who buys this book is not a dummy. But for readers who don't know much about science and who might have received something less than a top grade in high school geometry, "String Theory for Dummies" will be too great a challenge. String theory is a mountain of a subject with lots of foothills that need to be climbed before reaching the summit. These foothills, corresponding to all those careful explanations of particles, waves, forces, quanta, uncertainties, and extra dimensions only get us to about 1970. Then the really difficult climbing begins.

Unfortunately, that's the way it is with most of cutting edge science. It's hard to scientists themselves to understand, much less the rest of us.

Provided by Inside Science News Service

Citation: Tying string theory together: A new book attempts to explain string theory to the masses (2010, September 17) retrieved 27 April 2024 from https://phys.org/news/2010-09-tying-theory-masses.html