

STRING THEORY EXPLAINED

WHAT IS THE TRUE NATURE OF REALITY?

What is the true nature of the universe? Over the centuries we have come up with more and more complicated ideas to answer this question. Like String Theory: a controversial and often misunderstood theory about the nature of everything. What is it, and why should we care?



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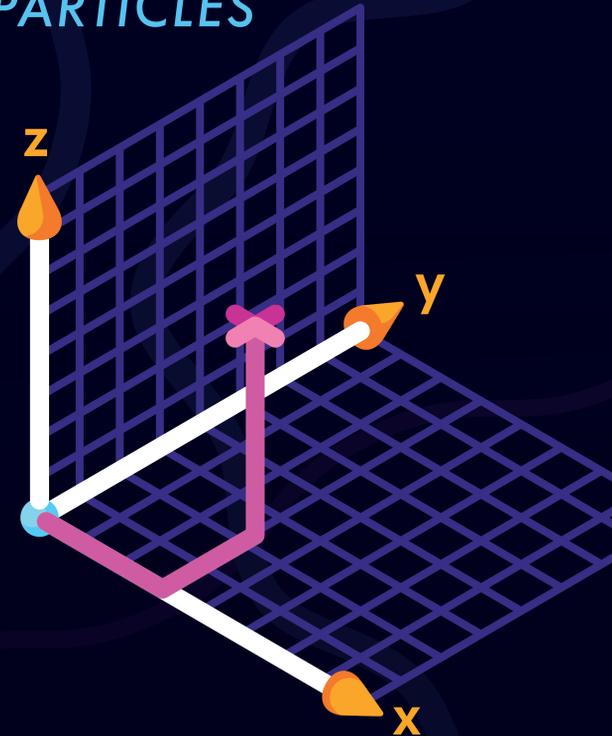


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ELEMENTARY PARTICLES

Scientists always tried to find the fundamental building blocks of reality. Molecules, atoms, protons and eventually elementary particles—objects so small that they cannot be divided. We describe them as points with a given mass, electric charge and so on. Different particles come from different quantum fields; this is Quantum Field Theory.



THE HOLY GRAIL OF PHYSICS

In Quantum Field Theory we have one particle for each physical force. But there is a problem: gravity is not a force like the others. According to Einstein's General Relativity, if particles are actors in a play,

gravity is the stage itself. So far, we could not describe gravity as a particle, and we could not marry the Standard Model of elementary particles to General Relativity. Doing this would be finding the Holy Grail of Physics.



Weak Force



Electromagnetic Force



Strong Force

STRING THEORY

1. THE IDEA

String Theory replaces particles with a one-dimensional string. Different elementary particles are different modes of vibration of the same string. Most importantly, this includes gravity. Because of this string theory quickly graduated to a possible theory of everything.



2. THE PROBLEM



Our universe has three spatial and one temporal dimension. Much of the math describing String Theory requires ten dimensions to work out. Physicists are now trying to get rid of the six extra dimensions, but so far, nobody has succeeded and no prediction of string theory has been proven in an experiment. And since science is all about experiments, what to do with strings?

3. WHY THIS STILL MATTERS

Even if strings may not describe our universe, they make sense in their own right. Unlike previous attempt to marry gravity and quantum physics, their maths does not break down. And solid maths is a good way to make progress in theoretical physics, so that string theory is a good place to test new ideas and see if they may apply to our world.



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THE PROJECT BEHIND THIS POSTER
This poster is part of the project "A voyage to the boundary of theoretical physics" realised within the Agora scheme of the Swiss National Science Foundation and coordinated by Dr. Alessandro Sfondrini of ETH Zurich. Our goal is to give student a taste of what current research in theoretical physics is about and how it is actually performed, dispelling some of the prejudices surrounding this field of science. You can learn more on the project at www.physdocu.ethz.ch