

Nova: The Elegant Universe Video Questions



Part I: Einstein's Dream

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1. What was Einstein's dream?

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2. What word describes what scientists are trying to do with theories about the forces of nature?

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3. Einstein discovered that the fastest speed in the universe was the speed of _____. How did this conflict with Isaac Newton's theory of gravity?

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4. Draw or describe Einstein's theory of gravity & space-time (General Relativity).

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5. What two forces were unified (explained by one theory) in the past?

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6. What is similar about gravity and electromagnetism (E&M)? What difference kept Einstein from unifying the theories of gravity and electromagnetism (E&M)?

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7. Give examples of how Quantum Mechanics (theory explaining the structure & behavior of atoms) seems strange to our everyday lives.

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8. List the 4 forces of nature.

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9. What can't scientists understand until they unify General Relativity (gravity) with Quantum Mechanics (E&M, strong nuclear force, and weak nuclear force)?

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Part II: String's the Thing

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1. Einstein's General Relativity describes the universe on a _____ scale while Quantum Mechanics describes the universe on a _____ scale. Give one example of how the two theories disagree or conflict with each other.

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2. What theory could unite the above two theories and also unite the four forces of nature under one explanation? Give at least two problems with this theory.

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3. Leonard Suskind first viewed particles as _____ while other physicists viewed particles as _____, but experiments show that even forces could be explained with _____. This became known as the _____ Model, but this model still could not explain _____.

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4. Experiments show protons and neutrons are made of quarks, but quarks and everything else might be made of _____. These are described as vibrating strands of energy. Draw an example of one below.

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5. String theory requires _____ dimensions. What could these look like?

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6. What could the different vibrations of strings in different dimensions explain?

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Part III: Welcome to the 11th Dimension

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1. If Einstein was correct, space could _____, but could not _____. If string theory is correct, space could _____ and using wormholes is possible.

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2. In the 1980's, while searching for one "theory of everything", _____ string theories were actually

developed. Ed Witten was able to unify the different theories with _____ theory, but it requires the existence of _____ dimensions.

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3. Where can we go to help us imagine a different number of dimensions?

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4. The extra dimensions allows strings to become _____ and they could be as large as a _____. If that is true, there might be _____ universes.

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5. Gravity is so much weaker than E&M. How can this now be explained and why does this only happen to gravity?

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6. What are some problems with the big bang theory? What are possible solutions?

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7. How are scientists trying to find experimental evidence for extra dimensions and super-symmetry to support String Theory's predictions?