The Elegant Universe

Superstrings, Hidden Dimensions, and the Quest for the Ultimate Theory

Part 2: String's the Thing

1. Traditionally, matter has been viewed as point particles - similar to tiny billiard balls. Some physicists believe that these tiny particles may, in fact, be made of strings. Strings are believed to be tiny vibrating strands of energy that may allow for the combining of the very large with the very small. What is the problem with String Theory?

2. One way physicists can study microscopic particles by smashing them together at high speeds and studying those collisions. As a result of these experiments, scientists said that the forces of nature can also be explained by particles. What are these particles of force called?

3. How is what we feel as force created by these particles?

4. Scientists have discovered the messenger particles for electromagnetism, the strong force, and the weak force. If we could rewind the cosmic film to the moment just after the Big Bang, what do physicists believe would happen to the messenger particles for electromagnetism and the weak force?

5. What is this new force called?

6. If we could go back even closer to the moment of the Big Bang, what would happen to this new force and the strong force?

7. What does the Standard Model explain?

8. What did the Standard Model not include?

9. How big is a string compared to an atom?

10. After careful reconsideration, the mysterious mass-less particle that John Schwartz had been trying to get rid of in String Theory was thought to be the gravitron. What does a gravitron do at the quantum level?

11. What is an anomaly?

12. In 1984, what did Schwartz and Michael Green do to prove that String Theory had the mathematical depth to encompass all four forces?

13. What do strings do to the jittery surface of the quantum world? How do they do this?

14. String Theory predicts extra dimensions in addition to the traditional three spatial dimensions and time. Where are these extra, unseen dimensions found?

15. How do these 6 extra dimensions differ from one another?

16. Why are these extra dimensions needed?

17. By 1985, how many versions of String Theory had been developed?

18. Why did this hamper the search for a "Theory of Everything"?