The Elegant Universe

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

Part 3: Welcome to the 11th Dimension

1. From our perspective, space-time is seen as the three standard spatial dimensions (left-right, back-forth, and up-down) plus the added dimension of time. We tend to view space as a fixed entity. When Einstein viewed space, what did he think space can do?

2. What is a 'wormhole'? What would you have to do to create a wormhole?

3. According to Einstein why is it **NOT** possible to create a wormhole?

4. How does String Theory allow for the creation of wormholes?

5. According to String Theory, how might parallel universes exist?

6. What is the name given to where these parallel universes might exist?

7. By 1985, five different versions of String Theory had emerged. This fact was a major obstacle until Ed Witten reconstructed String Theory into a new perspective that renewed the hope for a theory of everything. How did Witten explain the existence of these 5 different versions?

8. What was his new version of String Theory called?

9. How many dimensions did his theory require?

10. Dimensions can be described as "degrees of freedom". What does "degrees of freedom" mean?

11. According to M-Theory, what exactly is the 11^{th} dimension and what is it called?

12. How big can the 11^{th} dimension be?

13. Explain the "Loaf of Bread" analogy as a model of the Universe.

14. The Standard Model explains electromagnetism, the strong and weak forces but it doesn't address gravity at the quantum level. Gravity can be overcome very easily because it is very, very weak. Gravity is 1,000 billion billion billion billion times weaker than electromagnetism. A new way of thinking about gravity was that perhaps the force of gravity is equal to the force of electromagnetism but we just can't feel it. According to M-Theory, why might gravity appear weaker than it really is?

15. If we could travel back to the Big Bang, all matter in our Universe would be located at a single point. This singularity would have been incredibly dense and hot and the laws of physics as we know would break down and not make any sense. What caused the Big Bang?

16. According to M-Theory, the Big Bang was not the beginning of our Universe. What caused the Big Bang?

17. What is Fermilab and what are scientists looking for there?

18. The Large Hadron Collider is at CERN. Scientists there are searching for 'super symmetry'. Super symmetry (SUSY), if it exists, would be evident if scientists are able to detect 'sparticles'. What are sparticles?

19. Will the discovery of sparticles prove String Theory?

20. Could String Theory be wrong?