String theory in 3 minutes

Soft skill seminar 06/02/10

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Why do we need another theory?

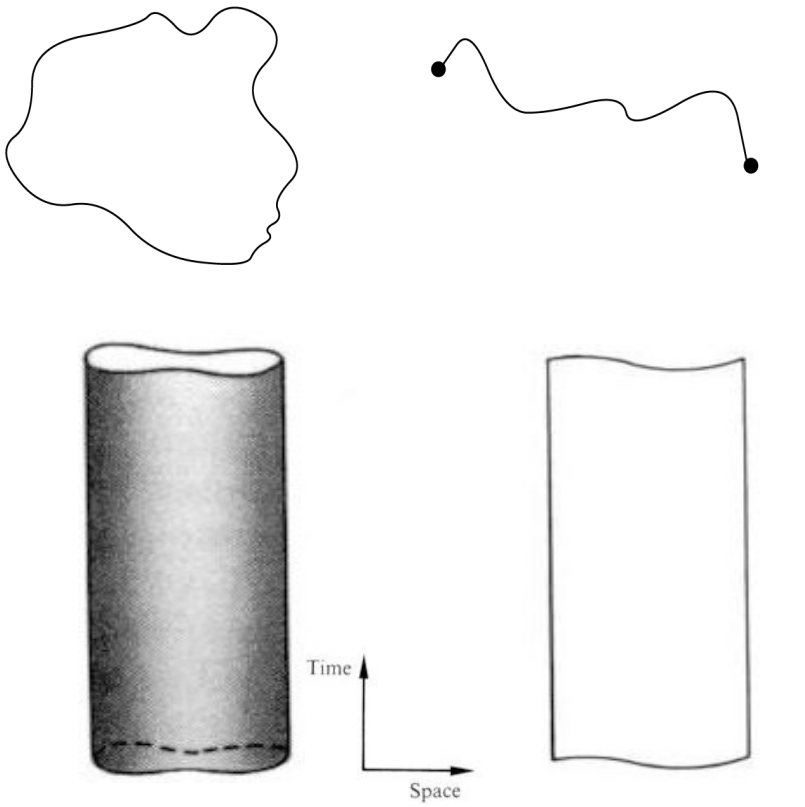
- Search for a single fundamental theory describing all interactions

- Standard model (SM) of particle physics and general theory of relativity (GR) valid in complementary energy regimes

- String theory simultaneously incorporates standard model interactions and gravity

Some necessary ingredients

I. Strings

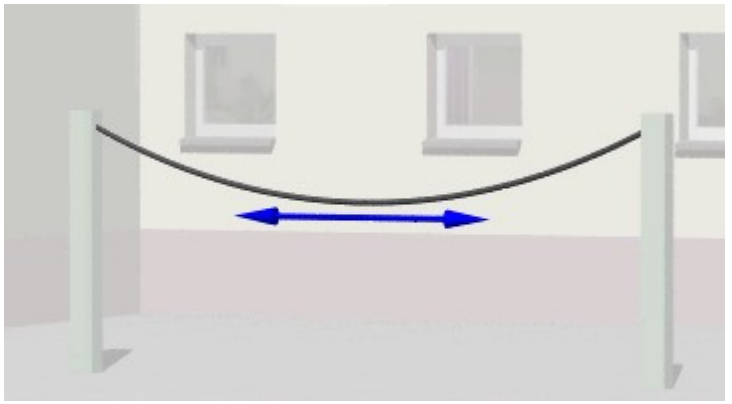


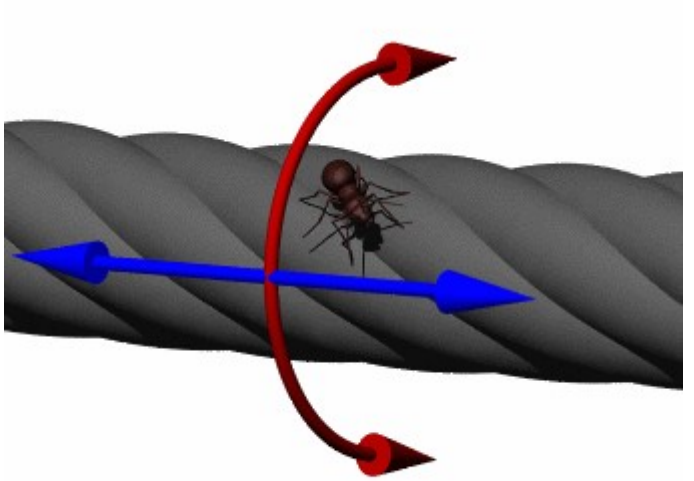
- Particles represented by vibrational modes of a 1-dimensional string
- Strings can be open or closed
- Time evolution of a string sweeps out a 2-dimensional world-sheet
- Physics only makes sense on distances larger than the string length
  → gravity can be quantized

II. Extra Dimensions

- String theory is only consistently defined in 10 spacetime dimensions

- At first sight, this seems to contradict our experimental experience, but can actually be in accordance with it





Some important achievements of string theory:

- Naturally incorporates gravity
- Contains supersymmetry
- Entropy of black holes can be determined in terms of microscopic states

Some open problems:

- String theory is far from being completely understood which makes experimentally verifyable predictions difficult