Today

- **Announcements:**
  - HW#11 (Last one!) is due April 18 at 8:00 am. There are two short paragraphs to write.
  - Voting for the Spring Break Story is due April 18 at 8:00am.
  - Intellegent Design Extra Credit is due April 25 at 8:00 am.
- **On the nature of science – Byron Jennings**
- **String Theory (if there is time)**
Lecture on Thursday

• Dr. Byron Jennings senior scientist at TRIUMF in Vancouver B.C. – He has published over 100 scientific papers and has worked on calculations related to interactions of fundamental particles, atomic nuclei, and nuclear reactions in stars

• Read his paper on the nature of science at LINK

• Presentation

• Discussion
What comes next?

- There are attempts to extend the standard model to include gravity; these are called supersymmetric theories.
- These say that all fermions (which make up matter) and bosons (that transmit forces) have a corresponding partner boson (to go with our standard fermions) and fermion (to go with our standard bosons).
- Supersymmetric theories predict a whole set of new particles called s-particles, e.g. selectron, sneutrino, photino, Wino, and so on.
- A new accelerator (Large Hadron Collider at CERN-Europe) may be able to produce some of these particles in the next two years.
Superstring Theory

• One of the most promising new theories is string theory. It says that the fundamental building blocks of nature are tiny (10^{-35} m) strings.

• The particles we observe in nature are different ways for strings to vibrate.

• String theories require at least 11 dimensions.

• Gravity is weak because the graviton exists mostly in another dimension, but there is a slight overlap with us.

• String theory may be a theory of everything where all phenomena can be described by one equation.
String Theory Pictures

Extra dimensions

What one of the dimensions might look like. Calabi-Yau space

Interaction of strings:
The finite size ($10^{-35}$ m) overcome many of the problems with the interaction of point particles.
Problems with String Theory

• So far it has no predictions that can be tested by experiments. Is it even science?
• There is no explanation that is “better” than some other model.
• The landscape problem – String theory seems to predict a large number of universes with different fundamental constants. This may explain the anthropic principle (Weinberg) as to why our universe is finely tuned to allow life as we know it. Is this science?