

February 5, 2009

General Relativity

Agenda

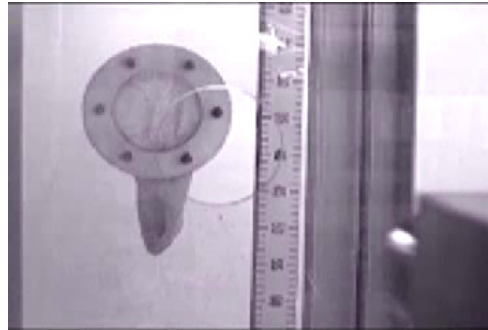
- Test in 2 weeks
- Will discuss projects on Tuesday
- Review Relativity
- Relativity exercise

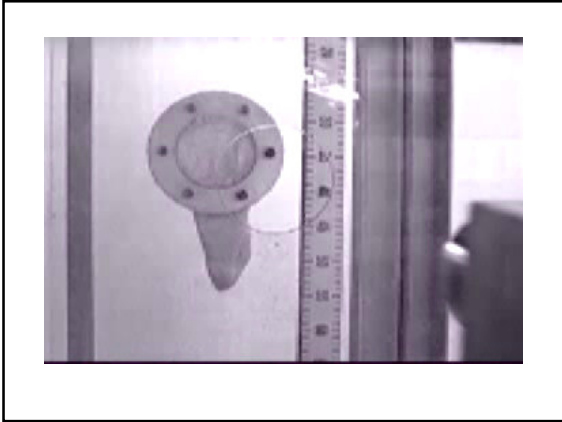
Elegant Universe Part I

- Four Forces of Nature:
 - Gravity—weakest, but important because always adds
 - Electromagnetism—strong, but tends to cancel out +/-
 - Weak—radioactivity
 - Strong—holds nucleus together
- Unifications:
 - Electric and Magnetic Forces—Maxwell
 - Motivated Einstein to unify w/ Gravity
 - Drive of physics to reduce to fewest possible laws
 - Motivates study of string theory

Elegant Universe Part I

- Unification hard:
 - Quantum mechanics deals with small stuff
 - Gravity tends to deal with big, massive stuff
 - They don't agree!
- Black Holes
 - Necessarily brings together Quantum w/ Gravity
 - Playground of astrophysicists, string theorists, etc
- String Theory
 - Only things that exist...tiny vibrating strands
 - Various particles "manifest" as different "notes" on string
 - No accepted experimental test established...is it science?





Quiz

- You wake up in a sealed box, and everything in it seems to be weightless. From this you know:
 1. The box is on the surface of a planet.
 2. The box is floating in space far from anything.
 3. The box is accelerating in space.
 4. The box is falling toward the center of a planet.

Quiz

- For gravitational lensing to occur, one needs the following
 1. Three bright objects in a line.
 2. A bright, distant object, a massive intermediate object.
 3. Two large objects.

Quiz

- Einstein's Equivalence Principle relates
 1. The speed of light to the speed of an inertial frame of reference.
 2. The acceleration on the surface of the Earth to that experienced in space.
 3. Acceleration to the effect of gravity.
 4. Gravitational waves to electromagnetic waves.

Quiz

- Gravitational time dilation is the effect in which time runs more slowly
 1. For those moving with respect to us.
 2. For those experiencing stronger gravity.
 3. For those accelerating the slowest.

Quiz

- Which of the following is not a difference between Newton's gravity and Einstein's?
 1. Newton's doesn't involve time whereas Einstein's is dynamical.
 2. Newton's doesn't affect light.
 3. Einstein's predict gravitational waves.
 4. Newton's involves "action at a distance."
 5. None of the above.

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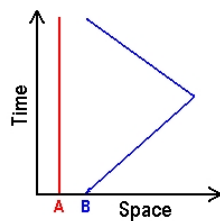
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