

Theoretical Quantum Physics....FOR KIDS

Materials needed:

For each student:

Two sheets, half sheets, or quarter sheets of paper

A pencil or pen

For the instructor

A string, rubber band, and/or (best) guitar

A piece of foam or thick rubber

Long needle and thread

- 1) Ask: Does anyone here know what a dimension is?

The ultimate result should be basic understanding of dimensions 1-3

- 2) Ask: What about...the *fourth* dimension?

Explain dimension 4 is time.

Time:

Have students

- 1) Make a single dot on one sheet of paper/Stand in one place (dimension 1)
- 2) Draw a line/Walk around (2)
- 3) Draw a square/Run around and jump (3)

Then....

- 4) Ask them to move in time (dimension 4)

Explain this can be done just by sitting still

- 5) Ask them to move *back* in time

Explain that regardless of what happens in any other dimension, we are always 'stuck' moving forward in time

Space (string theory/what is matter)

- 1) Ask what an atom is

Explain what an atom is. Focus on the existence of atomic particles (i.e. protons, neutrons, electrons)

- 2) “We know that atoms are inside everything, and (ex) neutrons are inside atoms, but what’s inside a neutron?”

- 3) Ask everyone to take a non-marked sheet of paper. Explain that to a physicist, this is a plane. Right now, it doesn’t take up space. So, how do we make it take up space in the third dimension?

Roll up the paper—so now we have some empty space with a plane wrapped around it. This is the smallest thing that takes up space.

- 4) Now instructor takes up the string, students watch instructor. So, to form some of these tiny, tiny particles, we take a little tube like we just made...and we make a circle (the ends of the string are tied together.)

- 5) Even though we have this loop, why don’t we just see the empty space?

- 6) Physicists think that this is because the loops vibrate (demonstrate vibration with string, rubber band, or guitar), very quickly so it seems like the whole space is full. And that’s what matter is made of.

Space-time

- 1) So, if time is always there, how do we fit it in with the other dimensions?

- 2) (take up the sheet of foam) This sheet has three dimensions, right? But we can’t change it to add the fourth. So, we just say that time is all through the other three dimensions. This gives us something called space-time. This foam, is space-time. Now we know that space-time is curved. So, how could we get around in time without going in a straight line?

- 3) Like in the books, some people think we could time travel if we found a way to put a line through the foam (puts needle through foam) and into another part of the curve (do so with the needle, pulling the thread through.)