

# Expanding Universe of Students

**Purpose:** The purpose of this exercise is to demonstrate WHY the statement "the farther things are, the faster they are moving away" means that the Universe is expanding.

**Activity:**

1. Ask for volunteers from the audience. You will need probably 5 or 7, but the more the merrier.
2. Stand them all in a line, with their shoulders touching.
3. Now, ask them to all take one giant step to the left. This is what the Universe would look like if it were simply moving, like a train. Have the class notice that for the middle person, nothing has changed. She is still the same distance from everybody else. Have the class notice that this is true for everybody in the group.
4. Now, have them spread out, so that their arms are spread, and their fingers just touch. The middle person now looks at the two next to her, and sees they've move 2 arm lengths in 2 seconds (approximately), so they have a speed of 1. The two people outside of them, however, have moved 4 arm lengths in 2 seconds, so they have a speed of 2. And so on. This is exactly what would have happened if they were standing on a big, expanding rubber band. Since this relationship (more distant things are going away faster) is what we observe to happen in space, we see that space must be expanding, like a big rubber band, in every direction.
5. Notice that the result was the same whether you picked the person in the middle, or the person on the end. (Now is an appropriate time to mention that you don't have an infinite, or even very large, number of people, so they'll just have to imagine the line stretching on and on forever.) The Universe is isotropic and homogeneous...
6. Now have the students imagine this happening in every direction. It's easy with such a visual picture in front of them.
7. Ask for questions. One that you often get is "What if they were moving randomly?" Have the students in the front do this. Pick a direction, right or left, and move that way one step. It's obvious immediately that the rule no longer applies.