

## Dark Energy Exploration Activity

### Materials Required:

- 1 balloon for each student (or pair of students)
- 1 permanent marker for each student (or pair of students)

### Instructions:

1. Hand out materials to students.
2. Have students draw galaxies on their balloons over the entire surface.  
Note: If time is short, the galaxies can simply be dots. If time permits, students can draw galaxies and decorate their balloons more creatively. These “universes” could later be hung around the classroom.
3. Students then blow up their balloons partially.
4. Students observe the movement of their galaxies.
5. Students then inflate the balloon completely and observe how the distribution of the galaxies changed.
6. Students deflate their balloons. Have them experiment with making their Universe expand at different rates.
7. After the activity, you can have students name their Universes and then display them around the classroom.



### Follow-Up Questions

1. Would it be possible to identify a center point away from which all of the galaxies were moving? Explain.
2. If you blew air into the balloon with more force, what would happen to the movement of the galaxies? Explain using Newton’s Second Law.
3. How did this activity simulate the concept of “Dark Energy” as explained in the video we watched at the beginning of class?
4. If your Universe is expanded (in other words, your balloon is inflated), is there a way to simulate the effect of gravity?
5. What do you need to do to have a “static” universe - in other words, how can you make a Universe that does not expand or contract?

### Answers to Follow-Up Questions:

1. There is no single center point. All of the galaxies are moving away from all other galaxies.
2. If there is more force, there is greater acceleration. Therefore, for the Universe to expand more quickly, something must be providing greater force (and thus energy).
3. In the video at the beginning of the class, it was explained that scientists believe the Universe is expanding at an increasing rate. Acceleration requires a force, as simulated by the force of blowing into the balloon. Thus the student applying force to the air in the balloon to expand it simulates the idea that Dark Energy is expanding the Universe.
4. Releasing the air in the balloon would simulate the effects of Gravity, as the galaxies move closer together. This shrinking simulates the attractive force due to gravity.
5. In order to have a “static” Universe, the balloon must be held. This means that the expanding force of “Dark Energy” (the pressurized air in the balloon) is perfectly balanced by the contracting force of gravity (the tendency of the balloon to deflate).