

PRACTICAL EXERCISES AND QUESTIONS FOR THE STUDENTS

Materials Required (for each pair of students):

student handout	1 large balloon
4 strips of paper cut 2cm x 30 cm	2 bendy metric rulers
1 marker	science journal
scissors	pen/pencil
large paper clips	

PRACTICAL EXERCISE 2: Model of the expanding Universe

This activity aims to illustrate the expansion of the Universe. You are going to create a model of the expanding Universe.

- 2.1 You will need one balloon, a flexible metric ruler and a paper strip for conducting measurements, a copy of this page, and a marker.
- 2.2. Use the markers to make 10 - 15 dots on the balloon and number 10 of them after the balloon is partially inflated.
- 2.3. Inflate balloon with 4 medium breaths to about the size of your fist; do not over inflate the balloon!
- 2.4. Bend the end of the balloon down and paper clip it so that no air escapes.
- 2.5. Record below what happens to the dots. Be very specific - use complete sentences.
- 2.6. Measure and record the distance between dot number *one* (your "home" dot) and neighboring dots with the METRIC RULERS. Be careful not to indent the balloon by pressing on it.
- 2.7. Now measure and record the distance between dot number *one* (your "home" dot) and the other 10 dots with the paper strip. Note any differences in the two measuring techniques.
- 2.8. Double the size of the balloon by inflating it slowly; do not over inflate the balloon! Measure and record the data from the enlarged balloon using both tools.
- 2.9. Answer the summary questions below.
 - a. If the dots represent galaxies, do they get larger as the balloon expands? Why do you think this is or is not so?
 - b. What relationship exists between the speed of the galaxies moving apart and their initial distance from one another? Name this Law.
 - c. Which measuring tool was more accurate? Why?

d. What is harder for the astronomer to measure: A galaxy's redshift (indicating recessional velocity) or its distance from Earth? Why? Explain your answer.

Partially Expanded				Totally Expanded				
Dot	Initial Distance from Dot #1 using the ruler	Initial Distance from Dot #1 using the paper strip	Difference	Dot	Final Distance from Dot #1 using the ruler	Final Distance from Dot #1 using the paper strip	Difference	Change from Before to After
2				2				
3				3				
4				4				
5				5				
6				6				
7				7				
8				8				
9				9				
10				10				
11				11				