



Quasar Variability Study

Student Name: _____

Period/Subject: _____

The Expanding Universe – Balloon Analogy

Introduction

When Edwin Hubble made the discovery that the Universe was expanding, our total way of thinking about the world changed. With Hubble's work, he noted that galaxies were moving away from us. As a result of his observations, he concluded there was a constant relationship between the speed of a galaxy's movement and the distance it is from Earth. In other words, the more distant the galaxy, the faster it is moving away.

Materials

- 1 large, round balloon
- Metric ruler
- Piece of string for measurements
- Markers: black, red, and blue

Procedure

Take an un-inflated balloon, and blow it up to about the size of your fist. Twist and hold the neck end to keep air from escaping. Do not tie the balloon shut. Using the black marker, make a dot on the round part of the balloon and label it MW (Milky Way). This dot will be your reference point.

Draw 10 more dots everywhere on the balloon. Number the dots randomly 1 through 10. The dots represent galaxies.

Your partner will measure (in centimeters) the distance from the dot labeled MW to each of the 10 galaxy dots. Do this by using the string to measure the distance on the balloon, then measure the length on the string, onto the ruler. Record these 10 measurements on the data table below.

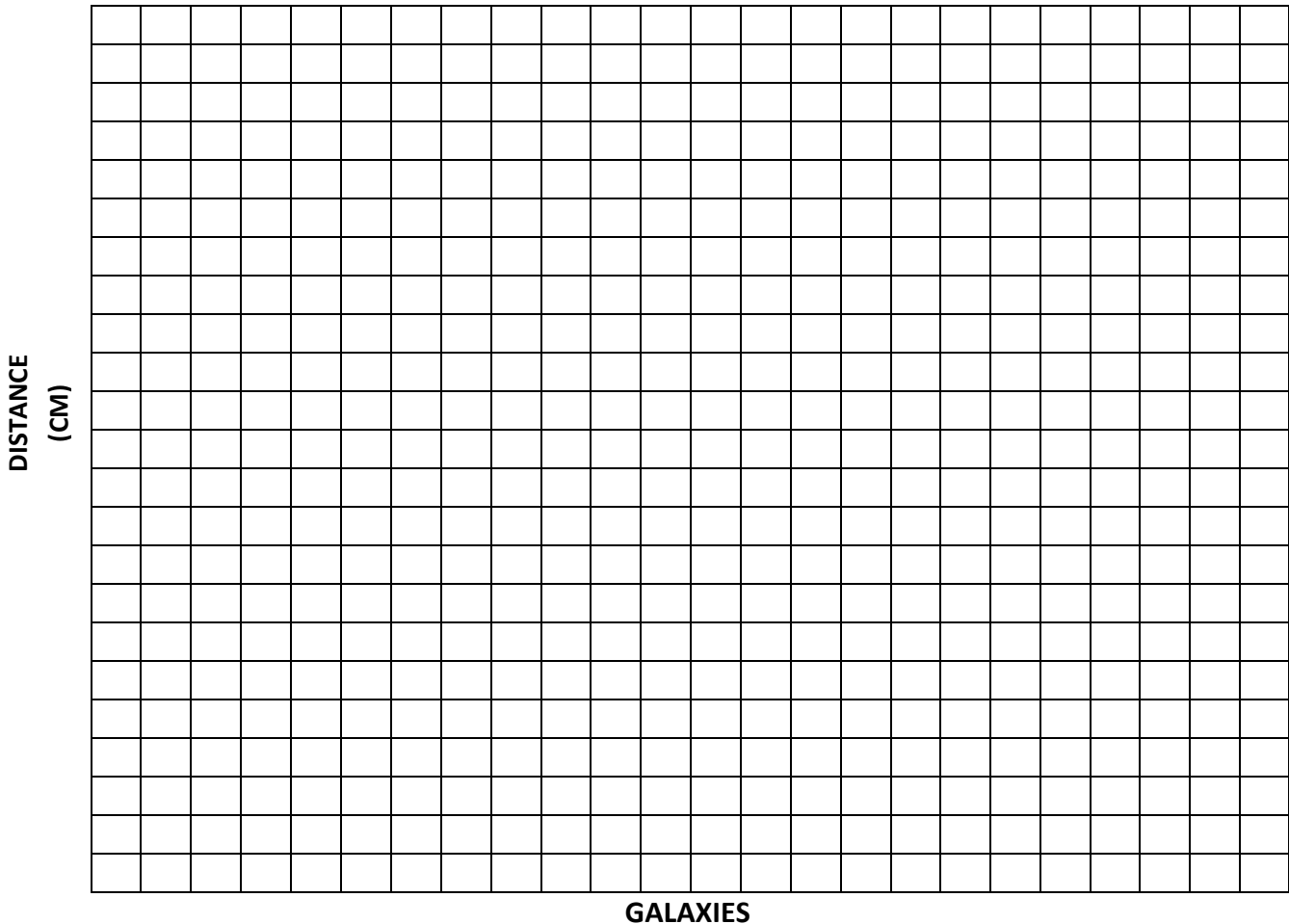
Blow up the balloon to about the size of your head. Tie the balloon shut this time. Repeat the measuring procedure between the MW dot and all 10 galaxy dots. (Hint: you may need to re-mark the dots again – be sure they are the same number). Record the measurements on the data table.

Find the difference between the first and second measurement (subtract the smaller number from the larger number) and record it into the data table.

Data Table

Galaxy (dot) Number	First Measurement	Second Measurement	Difference
MW – 1			
MW – 2			
MW – 3			
MW – 4			
MW – 5			
MW – 6			
MW – 7			
MW – 8			
MW – 9			
MW – 10			

6. Make a double-line graph for the two sets of measurements. Plot the information in the first measurement column for each of the 10 galaxies in the color red. Plot the second measurements for all 10 galaxies in the color blue.



Observations

1. What happened to the dots when you fully expanded the balloon?
2. What conclusions can you make from the first set of measurements and the second set? Use the graph to help you with the results.
3. What conclusions can you make from this balloon model about the expanding Universe?