

A Model of the Expanding Universe

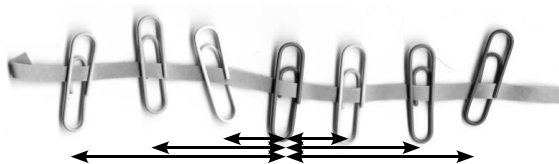
Overview: In this activity, you will make measurements of a model of the expanding Universe. You will see how we are able to tell that the Universe is expanding by looking at distances and speeds of relatively nearby galaxies.

Equipment needed: An elastic band (cut), 7 or 8 paperclips, a ruler with cm markings, a copy of the data table form, a copy of the blank graph, a partner.

1. Cut your elastic band, and place 7 paperclips along it. They should be spaced out across the whole elastic band, but they don't have to be spaced perfectly evenly.



2. In the “From Center to Which Paperclip?” column of the data table, make an entry for each paperclip. If all of your paperclips are different colors, you can use that to identify them. If they are the same color, you can identify paperclips by number, starting from the left; in that case, the center paperclip in the picture above would be #4.
3. The first partner should hold up the elastic band so that it's not stretched, but it doesn't sag. Hold it still!
4. The second partner should measure the distance, in cm, between the *center* paperclip and *each* of the others (see picture below). Record all of these distances on the data column in the “Distance at Beginning” column. The picture below shows the distances that you should measure.



5. Now the first partner should stretch the Universe. For a brief time, your model Universe is expanding just like our Universe! Stretch the Universe, then stop. (Our Universe keeps expanding, but we stop your so that you will be able to make measurements.) **Hold your Universe still until the second partner finishes the next step!**
6. The second partner should again measure the distance, in cm, between the *center* paperclip and *each* of the others. Record these distances in the data table in the “Distance after Expansion” column.
7. You can put down your model Universe now.
8. For each row of the table, subtract the final distance from the beginning distance, and record the difference in the “Difference” column of the table.
9. For each row of the table, plot a point on the graph. The x position of the point is the distance at the beginning. The y position of the point is the Difference.