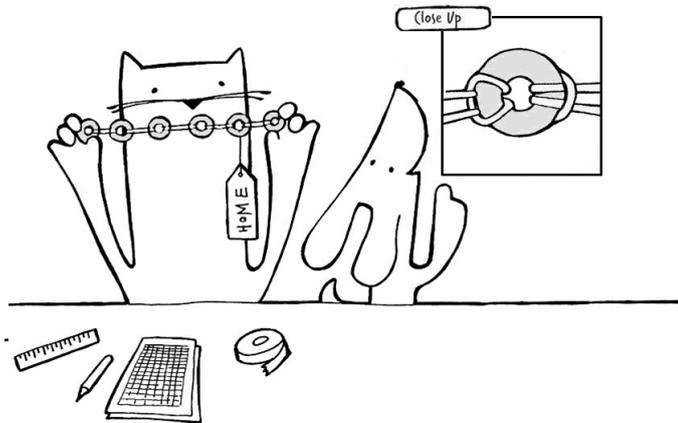


Do Try This at Home

From the Institute of Physics

Elastic band universe



What you need:

- 6 assorted washers (or paper clips)
- 5 elastic bands of the same thickness (and ideally of different lengths)
- Small stickers
- Ruler or tape measure
- Graph paper (or laptop with Microsoft Excel or similar)
- Sticky tape

What you need to do:

1. Make a model universe from rubber bands and washers, as shown above. Each washer represents a different galaxy.
2. Choose one washer to be the home galaxy, label it with a sticker. Label the other galaxies with letters A to E.
3. Copy the table below.

Galaxy	Distance from home/ cm		Change in distance/ cm
	Initial	Final	
A			
B			
C			
D			
E			

4. Measure the distance from the home galaxy to galaxy A. Repeat for the other galaxies and write the distance in the 'initial' column of the table
5. Expand the universe until it is twice its original length and then tape down the ends to a table or the floor to hold it in place.
6. Measure the new distance from the home to the other galaxies. Fill in the 'final' column of the table.
7. Subtract values in the second column from those in third column to calculate the change in distance.
8. Plot a graph of "change in distance" against "initial distance" and draw a line of best fit.
9. Repeat steps 4 to 8 but with a different galaxy as home galaxy. Compare the gradients of your two graphs. What effect does changing your home galaxy have?

Now do this:

The table below shows the speeds with which 5 galaxies are moving away from us, and their distances from us.

Galaxy	Distance/ 10^{20} km	Speed/ km/s
NGC 3627	3.1	750
NGC 4775	8.2	1900
NGC 3147	13.6	2500
NGC 6745	19.7	4250
NGC 554	22.1	5200

Plot a graph of distance against speed and write an explanation of why the graph supports the idea that the universe is expanding but it doesn't mean that we are at the centre of the expansion. Include diagrams if it helps.

Something else to try:

The elastic band universe is a one dimensional model. Make a two dimensional model using stickers on a balloon.