



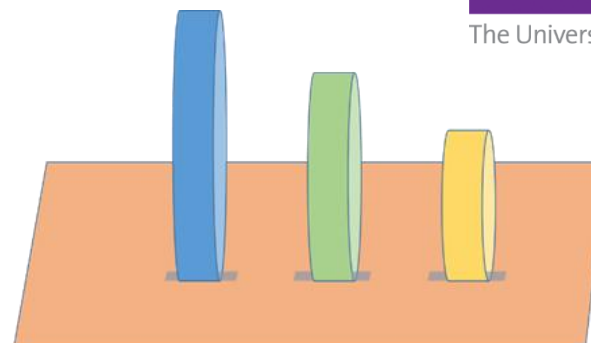
Resonant Rings

MANCHESTER
1824

The University of Manchester

You will need:

- 3 strips of paper, 2.5 cm wide and between 20 and 50 cm long
- a piece of cardboard
- sticky tape



What to do

1. Make 3 rings of different sizes with the paper strips and tape them in a row onto the cardboard.
2. Hold the board level and shake it slowly from side to side.
3. Gradually increase the speed. All the rings will move a little, but at certain speeds one ring will move much more than the others.
4. Experiment with different speeds. Can you activate each ring in turn? Which ring is activated at the slowest speed and which the fastest?

What is going on?

The speed at which you shake the board is called the *frequency*. Frequency means the number of back and forth movements per second

All objects have natural, or *resonant* frequencies at which they tend to vibrate. An object's resonant frequency depends on several things including its stiffness. If an object is shaken at its natural frequency it will begin to vibrate strongly, or *resonate*.

The resonant frequency of the smallest, stiffest ring is highest, and the largest, floppiest ring has the lowest resonant frequency.

The large ring resonates at the slowest shaking speed, and the small ring is activated at the highest speed.

Find out more about resonance here:

www.mwmresearchgroup.org/resonance-and-standing-waves

What we do

We are a research group at the University of Manchester. We use mathematics to model and test the properties of materials and waves. Examples of our research include understanding and reducing noise; modelling the behaviour of ligaments and tendons; and the design of *metamaterials*: special materials with extraordinary properties.



Mathematics
of Waves
and Materials

Work Responsibly

- **Ask an adult** for help with cutting out if needed.
- Be sure to recycle the paper and cardboard afterwards.