

Activity: Resonance Rings

Introduction: All objects have a natural frequency at which they vibrate. When the frequency of the shaking matches the frequency of one of the rings in this activity, it begins to vibrate more than the rest. In other words, some of the energy in the shaking is absorbed by that ring. This effect is called *resonance*. Resonance takes place when energy of the right frequency (or multiples of the right frequency) is added to an object causing it to vibrate. When electromagnetic energy enters the Earth's atmosphere, certain wavelengths match the natural frequencies of atoms and molecules of various atmospheric gases such as nitrogen and ozone. When this happens the energy in those wavelengths is absorbed by those atoms or molecules, intercepting this energy before it reaches the Earth's surface. Wavelengths that do not match the natural frequencies of these atmospheric constituents pass through.

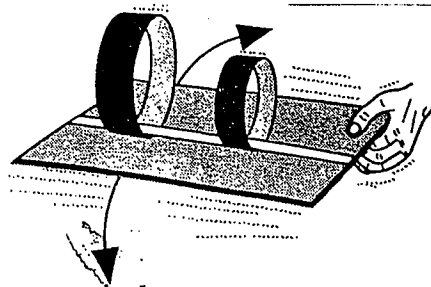
Resonance is important to astronomy for another reason. All starlight begins in the center of the star as a product of nuclear fusion. As the radiation emerges from the photosphere, or surface of the star, some wavelengths of radiation may be missing. The missing components produce dark lines, called, *absorption lines* in the star's spectra. The lines are created as the radiation passes through the outer gaseous layers of the star. Some of that radiation will be absorbed as various gas atoms present there resonant. Absorption lines tell what elements are present in the outer gaseous layer of a star.

Objective: To show how atoms and molecules in the Earth's atmosphere absorb energy through resonance.

Materials: Used lightweight file folders, cardboard sheet about 20 - by 30 cm, masking tape, scissors;

Procedure:

1. Cut two strips of paper from the used file folder. each strip should be about 3 cm wide. Make the strips approximately 30 and 35 cm long.
2. Curl each strip into a cylinder and tape the ends together.
3. Tape the cylinder to the cardboard as shown in the diagram. If the ring has a crease from the file folder, the crease should be at the bottom.



4. Holding the cardboard, slowly shake it back and forth and observe what happens when you gradually increase the frequency of the shaking.

For Further Research:

- Investigate the frequencies of various objects, such as bells, wine goblets or tuning forks. If you have access to an oscilloscope, use it to convert the sounds to wave forms.
- What gas in the upper atmosphere blocks ultraviolet radiation? Why is it important?