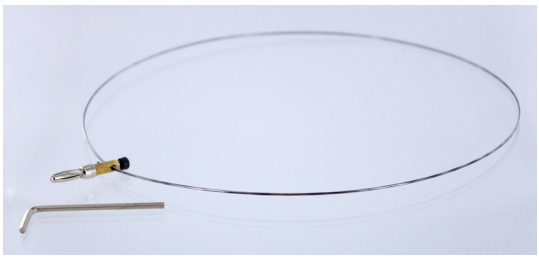
ARBOR SCIENTIFIC

TOOLS THAT TEACH.

Instructional Guide

Resonance Wire Loop

Part# P7-1500-02



Contents:

1 ea. 1 ea. Wire loop (fully assembled with banana plug connector)
1 ea. Allen Key

Required but not included:
Sine Wave Generator
Mechanical Wave Driver

Teacher's Background Knowledge

The Arbor Scientific Wire Loop provides a way of demonstrating standing waves on a circular wire. It can be used to explain the energy levels for electron orbits in an atom. The wavelength of a wave traveling in a medium is determined by the wave speed in the medium and the frequency of the disturbance producing the waves. When a whole number of wavelengths just fit in a medium of fixed length, the waves can add together to produce a standing wave pattern.

Introduction to the Apparatus

In the wire loop, the speed of the waves around the wire is a function of the wire's density and stiffness. If the wire is vibrated, the wavelength the waves will decrease as the frequency increases. When a frequency is reached that produces full waves that just fit around the wire, consecutive waves will add together to produce a standing wave along the wire. Higher frequencies, which are multiples of the lowest standing wave frequency, will produce standing waves of shorter lengths with increased numbers of nodes and antinodes. The wire loop will form a standing wave at specific frequencies: each one corresponding to a unique wavelength. An important application of these standing waves is in understanding the connection to the electron orbits in the Bohr atoms. Each Bohr orbit corresponds to a standing wave configuration for the electron.

Set up the experiment as shown below.

1. Insert the banana plug that is holding the two ends of the wire loop into Mechanical Wave Generator shaft as shown above.
2. Connect the Mechanical Wave Driver to the Sine Wave Generator using the two banana plug cables

Getting Familiar / Experimenting

Set the frequency of the Sine Wave Generator to 5 Hz and slowly turn up the amplification nob causing the wire loop to vibrate. Slowly increase the frequency until a standing wave begins to form. Continuing to increase the frequency will cause the standing wave to disappear until the standing waves of shorter wavelengths form at higher frequencies.