Waves on a String

Apparatus

taut cord or wire, oscillating driver with frequency control

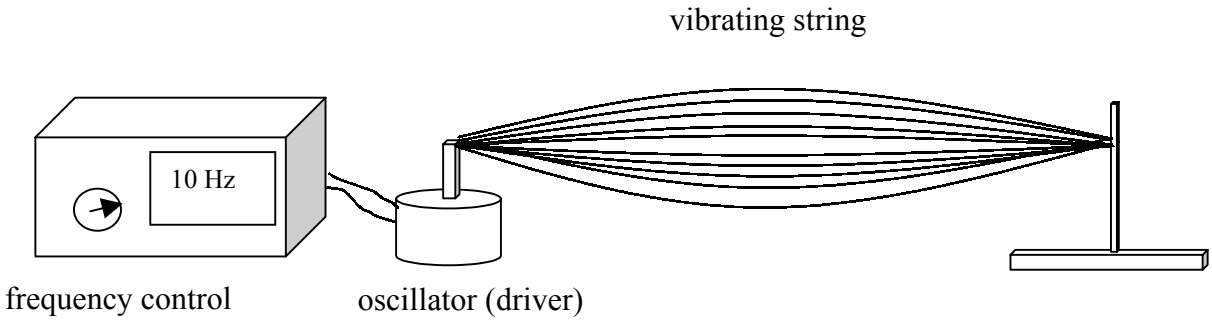
The driver with amplifier is attached to one end of the cord, the other end is fixed.

Action

The students vary the frequency of the oscillator to produce standing wave patterns.

The Physics

Only certain wavelengths are possible for the standing waves; $\lambda = 2l/n$, where l is the length of the cord and $n = 1, 2, 3\ldots$ This gives certain discrete values of energy for each mode. This is analogous to the electron as a standing wave in the quantum model of an atom. The electron is confined to a region surrounding the nucleus, and the solutions to the Schroedinger equation are standing waves for the wave functions of the electrons, with certain discrete values of energy.



Accompanying sheet:

Waves on a String

Change the frequency to find harmonics and sketch the patterns on the string.
Why are only certain wavelengths of the standing wave possible?

Describe the analogy between
the waves on the string and
an electron in an orbital as described by the quantum model of the atom.