Pre-Lab 1 - Standing Waves and Resonance

Text

- Tipler: Section 16.2 pp. 542-550
- Walker: Section 14.8, pp. 455-465

You should study the following concepts associated with oscillations and standing harmonic waves:

- Period $T$, frequency $f = 1/T$ (units are Hz, Hz=1/s): sinusoidal oscillation at a point. (Same as for the last lab)
- Wavelength $\lambda$: distance for which wave pattern repeats: for a standing wave, this is twice the distance between nodes.
- Formula for the wave speed: $T = Mg$ is the tension, where $M$ is the mass of the hanging weight attached to the string, and $\mu$ is the linear mass density for the string:
  \[ v = \sqrt{\frac{T}{\mu}} \]
- Note: the use of “$T$” to mean both “tension” and “period” is common. You will need to watch the context.

Objectives

- Observe standing waves in a stretched string
- Examine how an external oscillator can cause resonance
- Observe how changing the string length and tension affects the conditions for resonance
- Determine the frequency of oscillations in standing waves.

Standing waves

This lab concentrates on standing waves, corresponding to oscillations at a resonant frequency. You will work with a stretched string, pulled taught by a hanging weight, and excited by a vibrator. Not shown is the oscillator that allows us to choose the frequency.

We will vary the tension and length of the string. For a given tension and length, we will tune the variable frequency oscillator to discover the various resonant frequencies.