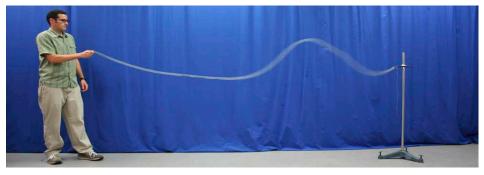
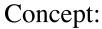
Oscillations and Waves

Wave Motion







The **reflection at a fixed end is inverted** because the incoming pulse exerts a force on the rigid boundary that is opposite in direction to the reaction force the boundary exerts on the spring. The **reflection at a free end is** *not* **inverted**. If the mass density of the spring is  $\mu_1$  and that of the boundary is  $\mu_2$ , then a fixed end reflection is modeled by  $\mu_2 >> \mu_1$  and vice-versa for a free end reflection. In the demonstration, a fixed end is accomplished by attaching the spring to the rod clamp while a free end is approximated by attaching the spring to a light string.



# **Equipment:**

- Large Support Stand
- Long Spring with String
- Large Rod Clamp
- Slotted End Clamp

## Procedure:

#### **Fixed End Reflection**

- 1. Clamp the spring end as close to the slotted end clamp as possible (see top left picture).
- 2. Give the spring a sharp pulse by snapping your wrist and forearm up and down with spring in hand.
- 3. Dampen spring by bringing handheld end to the ground.

#### **Free End Reflection**

- 4. Loosen screw in slotted end clamp and let out about 50 cm (2 ft) of string.
- 5. Tighten clamp and repeat steps 1-3.

### Notes and Extras:

- Video Link: <a href="http://blip.tv/file/1439394">http://blip.tv/file/1439394</a>
- The details of the reflection process can also be understood as a <u>superposition</u> of a real and an <u>imaginary</u> <u>pulse</u>.