"Dancing" Fire
Sound and Waves Demonstration with a Rubens' Tube
## Department of Physics & Astronomy

Sound

Sound is a traveling wave caused by the vibration of any substance (medium). In the case of a human voice, the initial medium is the vocal cords, which in turn create a pressure wave traveling through the air around us. The absence of a medium would imply the absence of sound; that is why there is no sound in space (vacuum).

Waves

A wave is a disturbance that propagates through space. The most important distinguishing features of waves are: the wavelength (the length of a full wave) , the frequency (how often a full wave passes through a point), and the speed of the wave (related to both frequency and wavelength).

For two waves that travel at the same speed, higher frequency means smaller wavelength (and vice versa). This is obvious since a higher frequency means more waves are passing through a given point every second. In order for a wave to achieve that the length of its wave must be shorter.
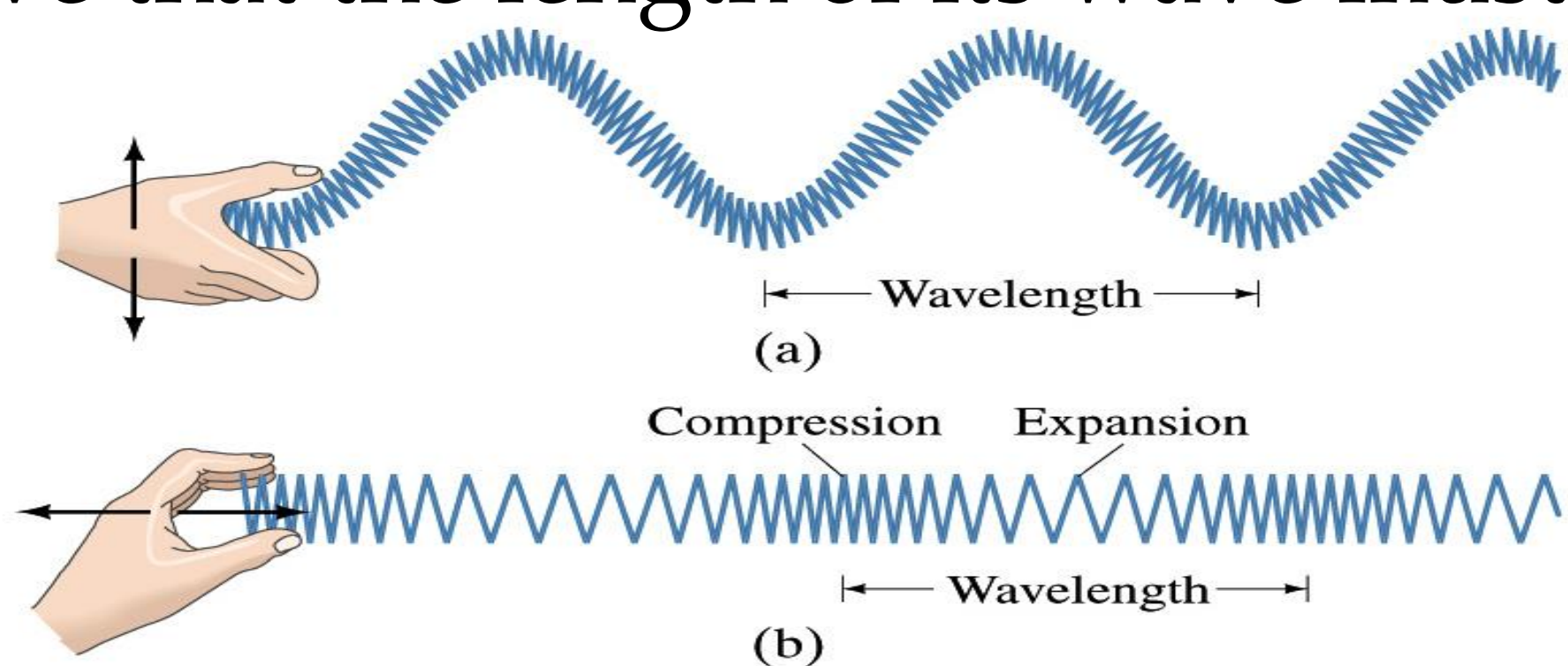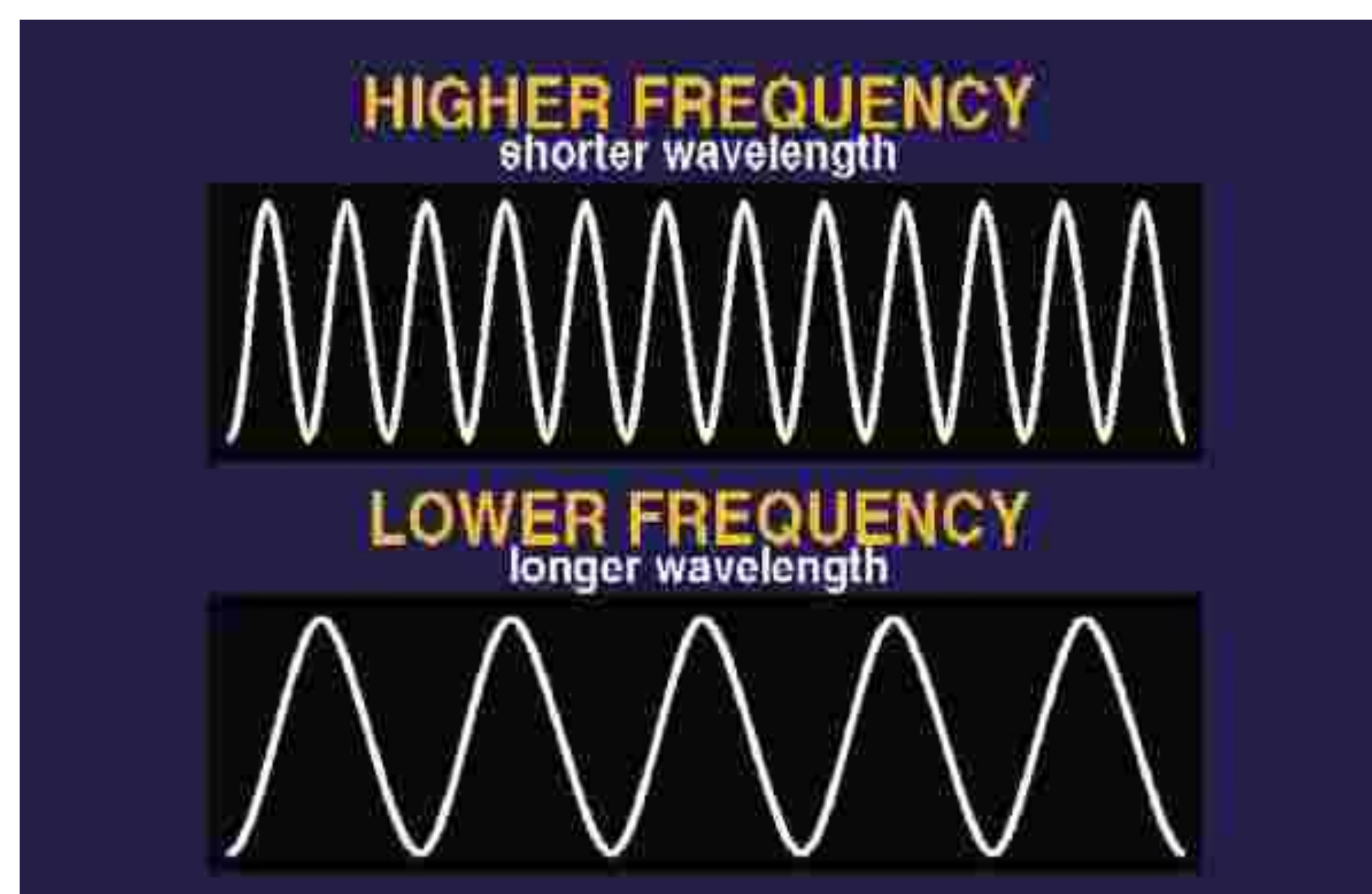
Above(Left): The picture shows two different waves and their wavelenghts (peak-to-peak, highest-compression-point to next highest-compression-point), (b) is a better representation of sound waves. (Center): Representation of a human voice traveling through air.

The Rubens' Tube

Named after Heinrich Rubens, a German physicist who first built a similar aparatus, the Rubens' tube (or flame tube) is a device used to demonstrate standing waves. It consists of a hollow tube with many small holes, filled with flammable gas. As a sound wave is 'fed' into the tube it creates high and low pressure points (pressure wave) which translate to the amount of gas that is let out of each individual hole (higher gas pressure = bigger flame, lower gas pressure = smaller flame). Below is a picture of the Texas A&M Physics And Astronomy Department Rubens' Tube.
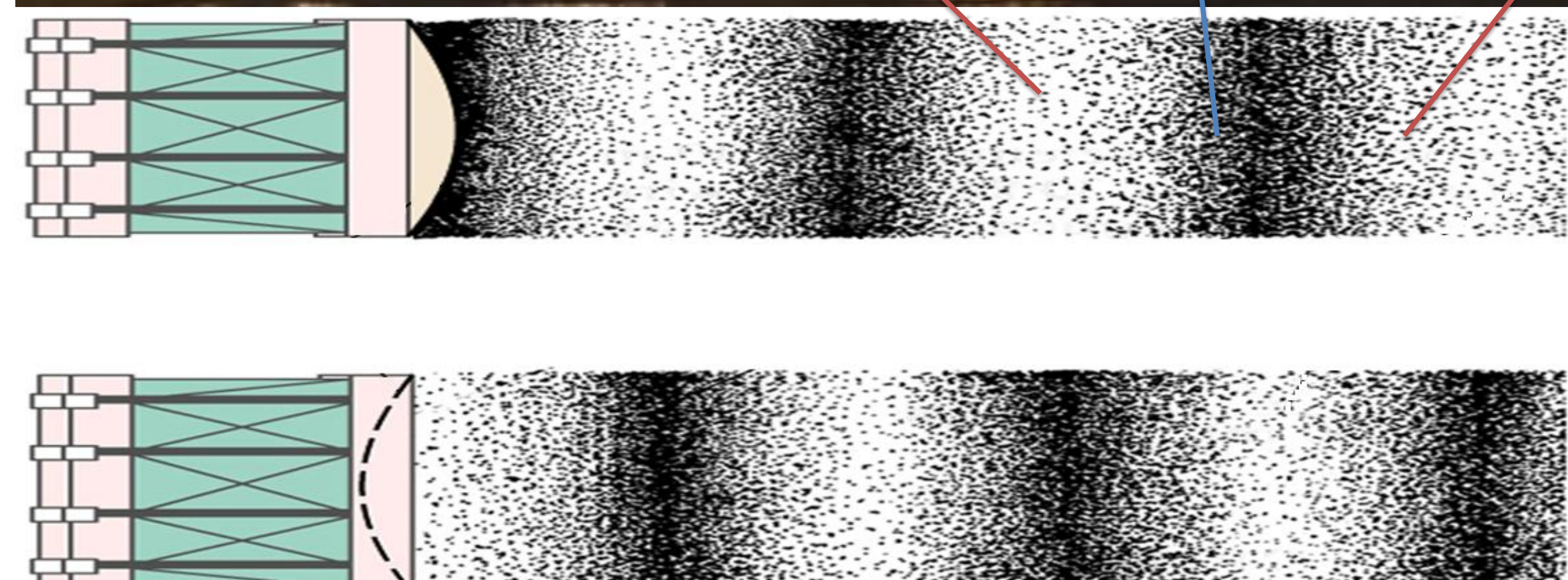
On the left we see a drawing of a pressure wave in which the darker areas mean higher gas molecule concentration and thus a higher pressure point, similarly the lighter areas mean lower pressure points. The tube takes advantage of this property to give us a very "cool" physical representation of a standing wave constructed with fire.