Physics 223
Experiment 2: Sound Waves

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Sound is simply a traveling wave of pressure rarefactions and compressions

$$\Delta p = \Delta p_m \sin(kx - \omega t + \phi)$$

where Δp_m is the maximum pressure deviation, k is the wave number, ω is the angular frequency, and ϕ is a phase shift. The speed of sound v is related to these parameters by $v = \omega/k$. The intensity of this sound wave is proportional to the square of the maximum amplitude of the pressure deviation emitted by the source. A simple derivation can show that the intensity $I = power/area$ of a wave (sound or light) emitted by a point source varies as the inverse square of the distance from the source, $I \propto 1/r^2$.

If a sound wave is reflected from a surface, the two oppositely traveling waves will interfere, however there will usually never be complete destructive interference because of this $1/r^2$ variation of the amplitude and the fact that surfaces are rarely 100% reflective.

You will have two ultrasonic emitter/microphones, an optical rail, a function generator to drive the emitter and an ocilloscope to measure the sound detected at the microphone. Devise an experiment to determine how the intensity of sound varies as a function of distance from these, admittedly, non-ideal point sources. Does the intensity variation behave as expected from our understanding of ideal point sources? Does the emitter really act like a point source? Remember to take into account the superposition of traveling waves.