



Investigating Refraction of Sound with a Gas Lens

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This project is an investigation into how sound is refracted through a gas-filled balloon. Sound, like light, travels as a wave so it is subject to the same properties such as reflection (echoes), diffraction and refraction. Refraction is the bending of waves when entering a new medium in which their speed is different. This investigation is dealing with four different variables and how they influence the refraction of sound. The type of gas within the balloon, the size of the balloon, the frequency of the sound and the amplitude (loudness) of sound are the variables being tested. With the exception of the type of gas within the balloon it is as of yet unknown how these factors affect the refraction of sound.

Carbon Dioxide is denser than air while helium is less dense than air. The densities determine which way and how significantly sound is refracted since air on the inside of a balloon has the exact same properties as the air on the outside.

The investigation is being conducted within a science laboratory in four stages, each one dealing with one of the variables. The equipment comprises of: a speaker, a microphone and a software program called Addestation that acts as a computer-generated oscilloscope. The program emits a set sound through the speaker at a certain frequency and amplitude that is projected through a gas-filled balloon. The microphone then detects the sound and turns it into a visual wavelength on the program. To find out how the sound is being spread out by the balloon the microphone needs to be moved to multiple, reproducible positions and have measurements of the amplitude taken with and without the test balloon to determine how it bends the sound inwards or outwards.

Preliminary results have been gathered on the different gases. An air-filled balloon does not refract sound at all. The change in amplitude is audible when the Helium and Carbon Dioxide balloons are placed between the speaker and investigator's ear. The early Addestation results with the Helium-filled balloon confirm that it refracts the sound outwards (convex lens), lowering the amplitude. The Carbon Dioxide-filled balloon appears to refract the sound inwards (biconvex lens) increasing the amplitude by focusing the sound inwards.

At the time of writing not all results have been collected and analysed, the results will be presented at the ISSC in July, 2012.