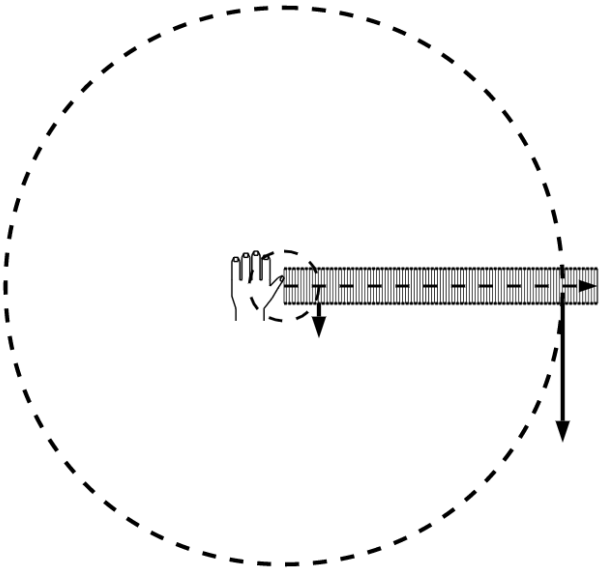
Euphonic Harmonics

Theory

In the video, I experimented with a 'whirly tube', also called a corrugaphone, producing harmonics by putting one end out of a moving car. I was able to produce sounds with frequencies of 220 Hz, 450 Hz and 670 Hz.



The reason that the whirly tube produced sound is because as air moved through the tube it producing vibrations due to the corrugations inside the tube. Air moved through the tube due to differences in pressure on the two ends of the tube. The faster moving end had lower air pressure (Bernoulli's principle).

Vibrations had a range of frequencies, but vibrations of frequencies corresponding to resonant frequencies of the tube increased the amplitude of those vibrations. The series of resonant frequencies of the tube are called harmonics. The frequency of the nth harmonic, f_n, can be calculated using the formula $f_n = nf_0$, where f_0 is the fundamental frequency.

Possibilities for you

In your home, you will have things that resonate. A bottle can be made to resonate if one blows across the top, for example. There are free apps available for smartphones that can be used to measure frequency of sound, or websites such as this one:

https://webaudiodemos.appspot.com/pitchdetect/index.html

You will find a way to produce stationary waves of different harmonics. Use the appropriate equation to predict what the frequencies of the harmonics should be; then you will measure the frequencies of the harmonics to confirm the equation.

You could briefly write up your results – at most one A4 side – and, if you wish share them on Twitter with the hashtag #IsaacPhysicsCovid19

Health and safety

Most accidents happen in the home. Think carefully about what you are using to investigate sound. Do not do anything dangerous. If you choose to share your work on Twitter, make sure you are doing so in a way that does not put yourself at risk.