

Lab 1 Tasks

Report due Monday, September 14th at 6pm

Read Ch. 1, Secs. 1.1-7 in your Lyons text (pp 1-21)

1. Measure the speed of sound by placing a microphone at 10 cm intervals from a speaker. Plot the time delay for 10 different distances. Fit the plot to a straight line using Mathematica and use the slope to find the speed of sound. Separately, calculate the speed from the delay for each of the 9 different 10 cm intervals. Find the mean and variance of these 9 measurements.
2. Repeat the experiment from 1, but with wind from a fan blowing towards the sound source. Use 5 cm intervals instead of 10 cm ones so that you can keep the mic and speaker closer together and see the signal over the fan's noise. Calculate the mean and variance of the measurements. Does the mean speed you found with the wind blowing differ by a statistically significant amount from what you found without it blowing?
3. Use the time delay between light signals sent along short and long paths in air to find the speed of light in air. Estimate the variance of each of your measurements. Develop a technique to combine your error estimates and use it to get an estimate of the error on the speed you found. Be sure to explain why you think your technique does a good job of combining the errors. Does the defined value of c fall within your margin of error? For each experiment, remember to identify the largest sources of random error and any significant sources of systematic error.