NORTHERN ILLINOIS UNIVERSITY

PHYSICS DEPARTMENT

Physics 374 – Junior Physics Lab Spring 2021

Problem Set #3

Problem Set Due: Thurs., Feb. 11, 2021
Read Bevington: Chapter 2&3

Chapter 2:

1. Full width at half maximum: FWHM

   (a) For the Gaussian probability distribution [Equation (2.23)], show that the *full width at half maximum*, Γ, is given by $\Gamma = 2.354\sigma$.

   (b) For the Lorentzian probability distribution [Equation (2.32)], show that the *full width at half maximum* is Γ (note: there is no definition of a standard deviation for Lorentzians).

Chapter 3:

2. The change in frequency produced by the Doppler shift when a sound source of frequency f is moving with a velocity v toward a fixed observer is given by

$$\Delta f = \frac{fv}{u - v}$$

   where u is the velocity of sound.

   (a) From the following values of u, f, and v and their uncertainties, calculate Δf and its uncertainty.

$$u = (332 \pm 8) \text{ m/sec}$$
$$f = (1000 \pm 1) \text{ Hz}$$
$$v = (0.123 \pm 0.003) \text{ m/sec}$$

   (b) Which, if any, of the uncertainties make a negligible contribution to the uncertainty in Δf?

3. Bevington **3.9** [Write Python code to do calculations & Plot (upload to Blackboard)].