# Lab 3: Measuring waveforms

## Part I. The physics classroom: Sound Wave and Music

http://www.physicsclassroom.com/Class/sound/

## Part II. Measuring period and frequency.

Record the sounds of the two tuning forks we have in the lab, one after another. For each sound, plot 10 cycles of its waveform using Praat. From the Praat pictures, calculate the period and the frequency of each sound. Why do we use 10 cycles not just one in calculating period and frequency? Understand what is damping.

## Part III. Measuring SNR.

Measuring the SNR (sound-to-noise ratio) of your recording of "the eye book". You can estimate SNR by following these steps:

1. Load the sound file into Praat;
2. Edit the sound object, make sure that View > Sound autoscaling is checked on;
3. There are two numbers shown on the left side of the sound wave window. The top one is positive and the bottom one is negative. Record the greater absolute value of these numbers. This is the maximum air pressure of the signal, P_signal, measured in Pa.
4. Select a silent portion of the recording, click on sel to show the selected portion only. Again, record the greater absolute value of the two numbers shown on the left side of the sound wave window. This is the maximum air pressure of the noise, P_noise, measured in Pa.
5. Calculate SNR (in dB):

$$SNR = 20*\log_{10}(P\_signal/P\_noise)$$

6. Now convert both P_signal and P_noise to dB. How do they relate to the SNR calculated in 5?

## Part IV. Spectrum and sampling.

In Praat, use "Create Sound from formula…" to create the following waves:

1. 1/2*sin(2*pi*270*x) + 1/2*sin(2*pi*2290*x): sampling rate 44100
2. 1/2*sin(2*pi*730*x) + 1/2*sin(2*pi*1090*x): sampling rate 44100
3. 1/2*sin(2*pi*270*x) + 1/2*sin(2*pi*2290*x): sampling rate 16000
4. 1/2*sin(2*pi*270*x) + 1/2*sin(2*pi*2290*x): sampling rate 4000
5. 1/2*sin(2*pi*270*x) + 1/2*sin(2*pi*2290*x): sampling rate 2000

How do they sound different? Why? Draw a spectrum of sound 1 and 2 by hand. Understand what is aliasing.