**Lab 2: Phonon Scattering**

5% of final grade

**Premise:** Given a material, the group velocity and heat capacity are largely fixed. As such, controlling the thermal conductivity comes down to adjusting the phonon scattering rates. Using the results from lab and knowledge of the thermal conductivity, we will determine the phonon mean free path. Key here will be a comparison of different analytical approaches/assumptions and the differences they provide for the phonon mean free path.

**Deliverable:**Prepare a 1 page document concisely outlining your methods, results, and conclusions. As always, error analysis and potential future work to further justify your conclusions should be considered. You can attach additional information/output in Appendices, but my focus will be on the first page.

**Additional inputs:** The thermal conductivity is 20 W m-1 K-1 ­for the sample you measured. The gravimetric heat capacity is 880 J kg-1 K-1 and the density is 3.7 g/cm3. Phonon-phonon scattering has a relaxation time () proportional to -2.

**Analysis goals:** Determine the phonon mean free path in this material. Compare your results between more advanced models (eg frequency-dependent relaxation time and/or group velocity) to simpler models (eg frequency independent scattering and/or Debye model for the dispersion).

You’ll have approximately two weeks to write up the lab. Relevant due dates:  
**Wednesday Oct 12** – rough draft lab report due.

<Toberer provides feedback on rough draft>

**Final due date:** 7 days after it is commented by Toberer