

**Single Crystal X-ray Diffraction**  
**Carl Adams, Fall 2008**

1. **Purpose:** Using the equipment and information available make the best possible determination of the lattice constant of NaCl using single crystal diffraction.
2. **Secondary Goals:**
  - (a) Learn about the operation of the Tel-X-ometer X-ray generator and goniometer.
  - (b) Learn how to change the characteristics of the peaks by changing the collimators.
  - (c) Learn about signal versus noise.
  - (d) Learn how to fit scattering peaks.
  - (e) Learn a bit about X-ray safety..
  - (f) Measure two peaks in the  $(h00)$  zone.
3. **Key Buzzwords:** *systematic absences, Bragg scattering,  $\theta - 2\theta$*
4. **Background:** look at Kittel
5. **Broad Procedure:** These jobs can be divided between people.
  - (a) Re-derive the expression for Bragg scattering.
  - (b) Determine what atoms comprise the (200) and (400) planes of NaCl
  - (c) Convince yourself that you will not see (100) and (300) peaks.
  - (d) Estimate at what  $2\theta$  scattering angles you will see the (200) and (400) peaks.
  - (e) Learn how to turn the X-rays off and on and use the translucent screen. See how the collimators work.
  - (f) Make some measurements of background with the provided GM tube.
  - (g) Find a peak and see how the measurement is affected by the  $\theta$  setting.
  - (h) Measure the two peaks with two collimator settings.
  - (i) Fit the peaks and see if there is evidence of the two strong characteristic wavelengths of copper.
  - (j) Determine (with an uncertainty) the lattice constant for NaCl (how have you accounted for possible offsets in  $2\theta$ ?).