

Phys 2053: Homework III

due February 3, 2016

1. Hydrogen Spectra (3 p)

Calculate the wave lengths of the following transitions:

- (a) the first member of the Lyman Series
- (b) the third member of the Balmer Series
- (c) the second member of the Paschen Series

2. Beryllium Spectra (2 p)

Calculate the two longest wave lengths of the Balmer series of triply ionized Beryllium ($Z=4$), and determine if they are in the visible spectrum.

3. Bragg Scattering II (4 p)

Monochromatic X-rays are incident on a crystal in the geometry of Fig. 1.10 in Morrison. The first order Bragg peak is observed when the angle of incidence is 34° . The crystal spacing is known to be 0.347 nm.

- (a) What is the wavelength of the X-rays.?
- (b) Consider a set of crystal planes that make an angle of 45° with the surface of the crystal as indicated in Fig 1. For X-rays of the same wavelength, find the angle of incidence measured from the surface of the crystal that produces the first order Bragg peak. At what angle of the surface does the emerging beam appear in this case?

4. Mars Science: Curiosity Rover (4 p)

With it rover named Curiosity, the Mars Science Laboratory's mission is part of NASA's Mars Exploration program, a long-term effort of robotic exploration of the red planet. Curiosity was designed to assess whether Mars ever had an environment able to support small life form. For this, Curiosity has to determine the composition of the Mars surface.

Go to the Mars Science Laboratory website mars.nasa.gov/msl/ and check the instruments on Curiosity. List them and explain which physics principles you already learned about are used for which instrument. What does the instrument measure, what data are sent to the lab for evaluation.

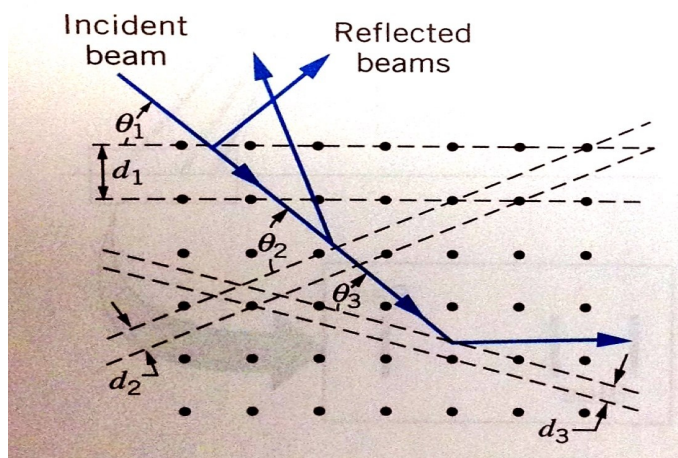


Figure 1: An incident beam of X-rays can be reflected from many different crystal planes.