

Experiment 8: Bragg Scattering of Microwaves

Purpose:

In this experiment, we will study the scattering of microwaves from a "crystal" made up of ball bearings embedded in styrofoam. We will find diffraction maxima that are similar in form to those encountered in Bragg scattering of X-rays from atomic crystal lattices.

Procedure

1. Set up the microwave transmitter and receiver on a meter stick so that the horn antennas face each other. Turn on the transmitter and turn up the receiver sensitivity to about -half-scale. Tune the transmitter's klystron for a maximum response from the receiver. As you perform the experiment, periodically check the tuning. Be careful with the apparatus, as the klystron can get quite hot.
2. Determine the wavelength of the microwaves by slowly moving the receiver along the meter stick and observing the standing wave pattern. Take readings over a wide range of distances to minimize the error.
3. Now place the transmitter and receiver on the arms of the goniometer. Systematically look for Bragg scattering from the "crystal" planes, specifically the 100, 110 and 111 planes (your TA will explain the terminology). In each case, verify the Bragg formula

$$2d \sin \theta = n \lambda$$

4. Determine the ball bearing spacing from your scattering results and compare with directly measured values.