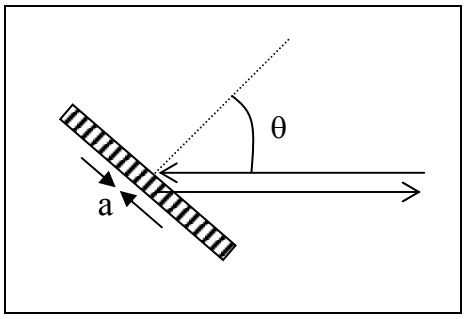
PHYC/ECE 463 Advanced Optics I
Fall 2007
Homework #11, Due Wednesday Nov. 28

1. Interference (Grating)

(a) Obtain the angle of incidence θ at which a reflection grating (grating period = *a*) retro-reflects (reflects back) the m-th order of a monochromatic incident beam at wavelength λ_0. (See figure below). *3 points*

(b) For a CO_2 laser at λ_0=10.6 μm, which of the following gratings is suitable for the above experiment: (1) 800 lines/mm, (2) 300 lines/mm, and (3) 50 lines/mm? Explain. What is (are) the order (m≠0) and the incidence angle(s) at which retro-reflection occurs? *4 points*



(c) In part (b), what is the highest resolution (Δλ) attainable if the CO_2 laser has a diameter of 1 cm? *3 points)*

2. Interference (Fabry-Perot)

Light from an IR laser source (λ=8-10 μm) is incident on a Germanium parallel plane thin slab (d=10 μm, n=4) as shown.

(a) Plot the transmission versus wavelength (in the range of 8 to 10 μm) at normal incidence. Be quantitative and give values for T_{max}, T_{min}, Finesse, and $\Delta\lambda_{1/2}$ (assume high finesse for the latter) *(6 points)*

(b) b) Fix the wavelength at one of the transmission peaks. Can we rotate the sample by an amount Δθ such that the transmission becomes a minimum? Is this practical? *(4 points)* (Assume surface reflectivities remain constant)