

PHYC/ECE 463 Advanced Optics I
 Fall 2007
Homework #4, Due Wednesday Sept. 19

1. Metal Optics

Plot the surface reflectivity R ($=|r|^2$) versus wavelength (λ) for a metal having $\omega_p = 4 \times 10^{15}$ rad/sec and $\tau = 25$ femtosecond (10^{-15} sec.). Assume normal incidence. Under white-light illumination, describe the color of the reflected (or scattered) light from this metal surface. (4 pts.)

2. Reflection: Problem 2.22 (K&F) (3 pts.) (hint: angle of incidence!)

3. TIR (10 pts.)

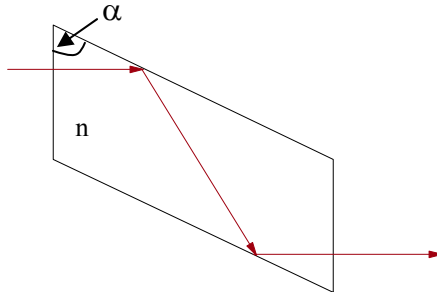
1. (a) Show that the phase difference $\Delta = \phi_\pi - \phi_\sigma$ in total internal reflection from a glass-air interface can be given by:

$$\tan\left(\frac{\Delta}{2}\right) = \frac{\cos\theta\sqrt{\sin^2\theta - 1/n^2}}{\sin^2\theta}$$

(where $n = n_{\text{glass}}/n_{\text{air}}$)

(b) For a given glass with refractive index n , what is the largest phase difference (Δ), and at what incident angle θ ?

(c) In a Fresnel rhomb, as shown below, Δ_{total} (upon two reflections) should be $\pi/2$. Determine the angle α when $n = 1.55$.



(d) In constructing a Fresnel rhomb, what restriction is imposed on the material's refractive index..

4. FTIR: Problem 2.29 (K&F) (3 pts.)