# Optics I: Theory CPHY 6/72250
# Assignment 4.

P. Palffy-Muhoray

Oct. 18, 2016

Due: Oct. 25, 2016

1. Read Chapter 7: Polarized Light (http://mpalffy.lci.kent.edu/optics)

2. Red light with wavelength $\lambda = 632.8nm$ and intensity of $1kW/m^2$ is normally incident on a mirror. Calculate the radiation pressure. (Force is the rate of change of momentum; consider the rate of change of linear momentum of the photons.)

3. Circularly polarized green light $\lambda = 532nm$ and intensity $1kW/m^2$ is normally incident on a black piece of paper with dimensions $1cm \times 1cm$. The light is completely absorbed. Calculate the torque on the paper (give magnitude and direction.) (Torque is the rate of change of angular momentum; consider the rate of change of angular momentum of the photons.)

4. Consider two identical plane electromagnetic waves propagating in opposite directions.

   (a) Sketch the electric field **E** in space at different times.

   (b) Sketch the magnetic field **H** in space at different times.

(c) Give an expression for the Poynting vector $\mathbf{S} = \mathbf{E} \times \mathbf{H}$.

(d) Sketch the energy density averaged over time as function of position.