PHYS202 – Spring 2008

Homework 10 – Due 5/2

Not graded – Chapter 24 - 3, 11, 15, 19, 25, 33, 39, 47, 51

WileyPlus - Chapter 24 - 1, 12, 18, 24, 30, 46, 37, 48, 57, 61

Handed In:

1. **On a particular day, a radar beam is sent from Earth to the planet Mercury. The transmitting frequency is 438.000 MHz. The returning signal is spread out over a few milliseconds due to the curved surface of the planet. The return frequencies are in the data sheet to the right. The initial returned pulse has a frequency *shift* of + 61260.00 Hz. The final returned pulse (16.26 milliseconds later) has *two* frequency shifts: +61251.3 Hz and + 61268.7 Hz.**

For this problem use c = 2.99792 x 10^8 m/s. Consider all values as being significant to six decimal places. You must use a calculator or computer that can work with high precision (nine or more decimal places) to yield significant results for parts (c) and (e).

a) **What is the wavelength of the originally transmitted pulse?**

b) **The time between sending and receiving the radar pulse is 20 minutes 45.60 seconds. What is the distance to the planet Mercury on the day the pulse was sent?**

c) **Specify whether Mercury approaching or receding from the Earth, and with what velocity?**

d) **If the first and last pulses are separated by coming from the center and edge of Mercury, what is the planets radius?**

e) **Assume the last pulses come from the edge of the planet. What is its rotational speed (assume it is from the equator)? (Hint: Find the difference of the approaching (+) and receding (-) velocities – the rotation velocity will be half this value.)**

f) **From the answers for parts (b) and (c), what is the rotation period (i.e. of one revolution) of Mercury? (express your answer in Earth days)**

2. **Consider a vertically polarized light wave. A horizontal polarizer is placed in the waves path, so no light will be transmitted. Another polarizer is placed *before* the horizontal polarizer.**

a) **At what angle(s) (relative to the vertical) must the first polarizer's transmission axis be to allow 6.25% of the light to pass? (Hint: Knowledge of some trig identities will be helpful, e.g. double and/or half angle formulas and that $\cos(90^\circ - \theta) = \sin\theta$.)**

b) **At what angle(s) of the first polarizer's transmission axis will give the maximum light transmitted? Support your answer.**

c) **What is the maximum percentage of vertically polarized light transmitted through this set up of polarizer's? Support your answer.**