Phys 532 Assignment 7 Due March 19

Problems 1–3 are "research" problems, rather than the usual analytical type. You should look up the requested information in a book, a catalog, or on-line. Your response should cite what source you used. If you correctly cite an incorrect source you will receive partial credit, so you should try to double check all information (particularly that obtained from the web.)

1. **Laser Outputs:** For each of the following lasers, find the typical output wavelengths (or range if the laser is tunable) and whether the laser is typically pulsed, typically CW, or if both are common:
(a) XeCl excimer laser
(b) Alexandrite solid state laser
(c) Copper vapor laser
(d) HeCd laser

2. **Laser Medium:** For the Cr:Forsterite laser medium, find
(a) the range of laser wavelengths possible
(b) typical pumping wavelengths
(c) the upper laser level lifetime τ_2 (sometimes this is called the "fluorescence lifetime" since it describes how long the medium will continue to fluoresce after pumping stops.)
(d) the estimated radiative lifetime t_s.

3. **Diode Laser Power:** Suppose your experiment requires 25 mW (or more) of laser light at a wavelength of 635 nm, and you would like to use a diode laser source. Find a company that sells a laser diode meeting these requirements.

Phys 822 students only:

4. **Diode Laser Inversion:** Suppose a GaAs diode laser is driven with sufficent current to produce a density of conduction electrons of 2×10^{18} cm^{-3}, and an equal density of valence holes. In the limit of temperature $T = 0$, find the range of wavelengths over which the medium will exhibit gain. Note that the bandgap for GaAs is 1.42 eV, the electron effective mass is $m_c = 0.07m_0$ and the hole effective mass is $m_v = 0.5m_0$. Here m_0 is the free electron mass.