

# Laser Physics: PHYS 5734/4734

## Spring 2009

Instructor : Surendra Singh

Place : PHYS 132 TUE/THU 9:30 AM - 10:50 AM

Office: PHYS 218

Office Hours: TUE/THU 1:00-2:30 PM

Lab TA: Arnab Mitra

### Topics to be discussed:

Review of classical electromagnetic wave propagation, Ray optics, ABCD matrices, laser beam propagation and focusing properties, mode-matching, laser resonators - stable and unstable, resonator modes, some specific cavities - SW and CW, two-waist cavities.

Absorption and amplification of light; Einstein  $A$  and  $B$  coefficients, rate equations, saturation, two- three-, and four-level gain media; laser threshold; relaxation oscillations, mode competition, laser dynamics; phase and amplitude modulation (EOM and AOM), mode locking, Q-switching, optical diodes, wavelength tuning - prisms, birefringent tuners; specific laser systems : gas, dye, and semiconductor lasers; elementary quantum theory of the laser, coherence properties.

### References:

1. *Lasers*, A. Siegman (University Science Books, New York, NY 1989)
2. *Lasers*, P. W. Milonni and J. H. Eberly (John Wiley, New York, NY 1988)
3. *Quantum Electronics*, A. Yariv (John Wiley, New York, NY 1989)
4. *Principles of Lasers*, O. Svelto (Plenum, New York, NY 1989)

Grade: The final grade for the course will be based on

1. Laboratory + a report (30%). For the report you will choose a topic in consultation with me related to lasers and prepare a 8 - 10 page report complete with references, graphs, and diagrams, present a 20-30 minute talk and answer questions on your report.
2. Homework (20%)
3. Mid-term (20%, March 10 in class)+ Final (May 5, 3:00 - 5:00 PM PHYS 132, 30%)

### Grade distribution:

Your final grade scale is :  $A \geq 85$ ;  $85 > B \geq 70$ ;  $70 > C \geq 55$ .

INCLEMENT WEATHER POLICY: We will follow the University's Weather Inclement Policy. If the weather is bad (Fayetteville Public Schools are closed) and an exam is scheduled on that day, we will postpone the exam.