**OPTI 441/541. Introduction to Lasers**

The fundamental physical processes and introduction of engineering relevant to lasers, and explore a variety of specific laser systems. Topics to be covered include, optical laser gain and oscillation, resonators, numerical methods for beam propagation, and Q switching, and laser applications. P, OPTI 511R or similar.

**Instructor:** Carl Maes, Room 403A Meinel Building, Phone 520-626-8837 office, carl.maes@optics.arizona.edu

**Course Website:** [http://d2l.arizona.edu/](http://d2l.arizona.edu/)

**Office Hours:** Preferably not Thursday, but otherwise open door policy. May also schedule appointment

**Grading Criteria:**

- Homework 30%
- Project 20%
- Midterm exam 20%
- Final exam 30%

Exams and some homework will have a subset of questions particular to OPTI 441 or 541 students.

**Homework:** Approximately every week, due in class one week later.

**Project Details:**

- Written report and presentation on a specific laser system, laser application or engineering issue, NIF, frequency stabilization, LIGO, femtosecond frequency combs, natural MASERS and LASERS, etc.
- 15+ minute talk presented not later than November 30, 2012 and 5+ page written report. Distance Learning students are encouraged to do a web conference presentation if possible.
- Presentation & paper should be appropriately cited and be based on at least 3 different references.
- Peer review, feedback, questions, and/or discussion is expected and will be worth 10% of the project grade.
- Submission of project proposal is due September 14, 2012.
- Submission of draft outline is due October 5, 2012.
- Presentations will be given in November. Please schedule one week in advance.

**Recommended Text:**

*Laser Physics*, by Simon Hooker and Colin Webb

Note: textbook link works through UA Library agreement. If off campus you’ll need to install the University’s VPN.

References:

*Phontonic Simulation Software for Teaching:* [http://www.st-andrews.ac.uk/~psst/](http://www.st-andrews.ac.uk/~psst/)

*Lasers,* by Anthony Siegman

*Laser Physics,* by Milonni and Eberly (2010)

*Lasers,* by Milonni and Eberly (1988)

*Laser Resonators and Beam Propagation,* by Hodgson and Weber, online at [http://www.springerlink.com/content/n31g100834x7/](http://www.springerlink.com/content/n31g100834x7/)

*Solid State Lasers,* by Koechner


*Laser Electronics,* by Verdyen

*Principles of Lasers,* by Orazio Svelto

*Optical Electronics in Modern Communications,* by Yariv


FUNDAMENTALS OF LASER DYNAMICS, Y I Khanin,


*Problems in Laser Physics,* by Cerullo, Longhi, Nisoli, Stagira, Svelto.

*Laser Physics,* Sargent, Scully, and Lamb

*Field Guide to Lasers,* Rudiger Paschotta, SPIE

Atoms, Molecules and Photons: An Introduction to Atomic-, Molecular- and Quantum-Physics by Wolfgang Demtröder, Online at [http://www.springerlink.com/content/v87552/?v=editorial](http://www.springerlink.com/content/v87552/?v=editorial)


Casimir Course Laser Physics, J. P. Woerdman

A Short Introduction to Laser Physics,

[http://www.springerlink.com/content/j48733/?p=0ce29a29f4c4517a8192ed57d10547d&pi=0](http://www.springerlink.com/content/j48733/?p=0ce29a29f4c4517a8192ed57d10547d&pi=0)

LASER TECHNOLOGIES FOR LASER GUIDED ADAPTIVE OPTICS,

[http://www.springerlink.com/content/w82q4pq2544v21p8/](http://www.springerlink.com/content/w82q4pq2544v21p8/)


Investigation of laser fundamentals using a He Ne

* Laser Beams and Resonators,* Kogelnik and Li, Appl Opt, 5, 10, 1966


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* Laser Beams and Resonators,* Kogelnik and Li, Appl Opt, 5, 10, 1966


Mode-Locking of Lasers Haus IEEE JOE 2000

*CW Theory of quasi-three level end-pumped laser oscillators,* R. Beach
http://nano.ece.uci.edu/eecs285blasers.htm  P. Burke
http://lasercomm.jpl.nasa.gov/PAGES/about.html
Laser Applets from PhET
MIT OPEN COURSEWARE

Optical physics, By Henry Lipson, David Stefan Tannhauser, 9.5.3 confocal resonators
The Method of Fox and Li, Masud Mansuripur, Optics & Photonics News, Volume 8, Issue 9, September 1997, pp.38-41
http://people.seas.harvard.edu/~jones/ap216/ Optical Physics and Quantum Electronics, R. Victor Jones
http://nano.ece.uci.edu/eecs285blasers.htm uses Verdeyen
http://www.optics.arizona.edu/opti544/
  Emission and Absorption, Rate Equations
  Vector Model of the 2-Level Atom
  Maxwell-Bloch Equations
  Semiclassical Laser Theory
  Laser Linewidth

EE231 Lasers Stanford Professor Olav Solgaard—uses Siegman:
http://ee.stanford.edu/~solgaard/ee231.html
ge based on project presentations.