

Laser Physics

Credit: 2 credits

Room: TBD

Time of class: Tuesday and Thursday weekly basis

Instructor: Titus Yuan, Phone #: 797-2959, email: titus.yuan@usu.edu, Office: SER318D

Course description:

Ever since the invention of laser in the 60s of last century, its impacts can be felt in almost every scientific field. It also affects people's everyday lives with its various applications in health care, entertainment, defense and homeland security etc. In this course, we will cover the basic physical concept behind laser, such as spontaneous and stimulated emission, gain, laser mode, etc. Different laser resonators and their features, some basic electrical-optical technologies that are applied in building lasers, such as Q-switch and seed injection, are also topics of this lecture.

We will have laboratory demonstrations for various types of laser as well, including high power flash lamp pumped Nd: YAG laser, solid state Nd:YVO₄ laser and Ring dye laser, etc. during the course of this lecture. The optical technologies described in the lecture will also be shown during the demonstration.

Goal and expectation:

The expectation is that students would gain the basic knowledge of laser physics, including the optical technologies involved in the performance of a laser system by the end of the semester.

Course schedule:

Below is the proposed schedule. Please be aware that this list includes only the estimated schedule. Since the course is going to cover lots of ground within one semester, so we may not be able to discuss every item in the list.

- 8/31 – 9/4 Introduction concepts
- 9/8 – 9/11 Black body radiations
- 9/14 – 9/18 Spontaneous and stimulated emission
- 9/21 – 9/25 Line-broadening mechanisms
- 9/28 – 10/02 Energy level and Saturation
- 10/05 – 10/09 laser resonators
- 10/12 – 10/15 Stable and unstable resonators
- 10/19 – 10/23 Mid-term exam
- 10/26 – 10/30 Gaussian beams

11/2 – 11/6 laser principles

11/9 – 11/13 laser Cavity Q

11/16 – 11/20 Q-switch

11/23 – 12/4 mode locking

12/7 – 12/11 Solid-state and semiconductor lasers

12/14 – 12/19 Final exams

Grade:

50% homework; 50% exams (one mid-term exam before fall break and final exam). Homework will be handed out on weekly basis.

Note:

For Graduate students, this is not a core class and must be put on your plan of study with approval from your committee in order for tuition waiving. Student should have taken advance optics class, Electro-dynamics, modern physics.