

# Lasers



## Introduction to Lasers and Laser Systems, EE 472

Spring 2018, Tu/Th 9:30-10:50am

Contact mag@USC.EDU

Modern laser technology has gone from dreams of science fiction death rays of the 1920s to 1950s (Figure 1) to massive implementation in many applications such as scanners in supermarket checkout stands (Figure 2). The word “laser”, actually an acronym (LASER: Light Amplification by Stimulated Emission of Radiation) first showed up in the late 1950s, and the first visible laser appeared in 1960. LASER derived from an earlier acronym, MASER,  $\approx$ 1954, where Microwave rather than Light was the first term—the first demonstration of a device that produced stimulated emission was a microwave device. The acronym laser is now accepted as a word that includes essentially all devices that produce stimulated emission of electromagnetic radiation -- from microwaves through infrared, visible, UV, and beyond.



Figure 1. Science fiction versions of laser type weapons from the movies. A “ray gun” (left) and a high power space weapon being used to heat popcorn (right).

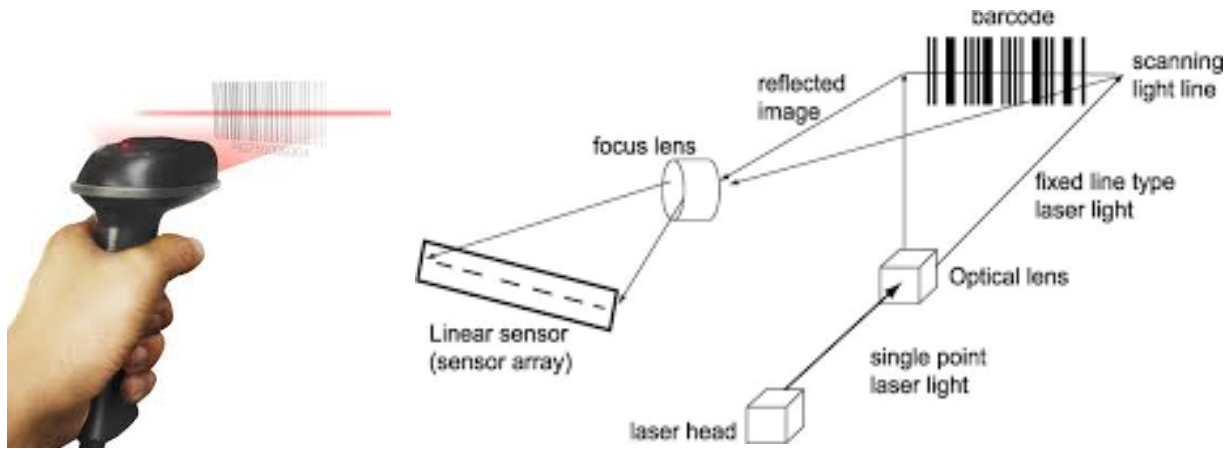


Figure 2. Laser scanner and schematic of its implementation.

Course is to initially follow the text, Laser Electronics (J. Verdeyan), which is a good introduction to laser optics and certain types of lasers. Because there are so many kinds of laser devices we will have to limit our coverage – it would be easy to add more courses to extend the material and study more devices. This is an introductory course, but we will be able to develop a good understanding of important basic ideas and how lasers work. We may also be able to work a little on a few experiments that will give hands on experience.

The grading is to be in two parts. There will be homework based on the text and problems assigned in class that will account for half of the grade. A report will be required at the end of the class that will cover the second half. This will include a written report on a laser topic to be selected by the student in consultation with Dr. Gundersen, along with a presentation at the end of the class. More details will be provided, but it is expected that the report will not be a long document, but one that is concise and follows IEEE formatting.

### Summary of Course (tentative)

- History and discovery of laser
  - How lasers work, what is stimulated emission, early work by Einstein
  - When the principles were discovered, and when the laser was invented
  - The first maser, discovered by C. Townes.
- Laser optics, following the text.
- Optical amplification and a laser gain equation
- Examples and applications (more later about this)