

# Topic 1: YAG lasers

## Setup 1:

Learn about laser safety

Make a working laser,

Explore the limits of the stability of the cavity,

Explore the transverse modes,

Create nanosecond pulses

Show the existence of multiple longitudinal modes

## Setup 2:

Learn about laser safety

Make a working laser

Explore the limits of the stability of the cavity,

Convert the laser to another wavelength

Explore the conversion efficiency

Explore the transverse modes,

## Topic 2: Laser diodes

### Setup 1:

Learn about laser safety

Explore the wavelength changes that you can obtain.

Discuss the changes observed in the coherence of the emitted light when changing the pump current

Measure the slope efficiency

Describe the 'optical power' as function of 'pump current' curve

### Setup 2:

Learn about laser safety

Explore beam profile and divergence of the laser diode emission.

What is the orientation of the p-n-junction?

What is the polarization state?

Measure the slope efficiency

Describe the 'optical power' as function of 'pump current' curve

## Topic 3: Optical modulation

### Setup 1: EOM

Understand your modulator

Can it modulate phase? Can it modulate amplitude?

Which additional elements are needed to create an optical free space transmission setup (for music)

Realize the setup

Understand the limits of the setup, distortions...

### Setup 2: AOM

Understand your modulator

Can it modulate phase? Can it modulate amplitude?

Which additional elements are needed to an optical free space transmission setup (for music)?

What is the best modulation contrast you can obtain?

This modulator is used for frequency stabilization of lasers. How is this done?

## Topic 4: Computer simulation

### Experiment 1:

Use computer simulation to create a rather simple zoom objective.

Explain how it works

Explain its limitations

Describe its performance

### Experiment 2:

Implement two coherent point sources that irradiate through a round aperture.

What is seen on a screen after the aperture?

Is there a particular (best) location for the screen?

Implement a lens in the aperture

How does this change the pattern on the screen?

Is there a particular (best) location for the screen?

Find and discuss the resolution of your imaging system.

Numerical calculations need to be validated by comparison to analytical calculations or other numerical calculations that are already validated (OSLO). Here this can be done using (i) the spacing of the interference fringes, (ii) the location of the image formation and (iii) the PSF of the imaging system.