

Phys 4061/5061 – Tutorial One

Topics Covered in Tutorial

- Properties of Diode Lasers
- Principles of Faraday Isolators
- Overview of Rubidium Spectroscopy

Details Pertaining to laboratory experiments covered in this tutorial can be found in the lab manual under the following sections

1. Absorption/Emission Spectroscopy / EOM
2. Farby-Perot – Laser Linewidth
3. Lockin Amplifier
4. Zeeman Shift

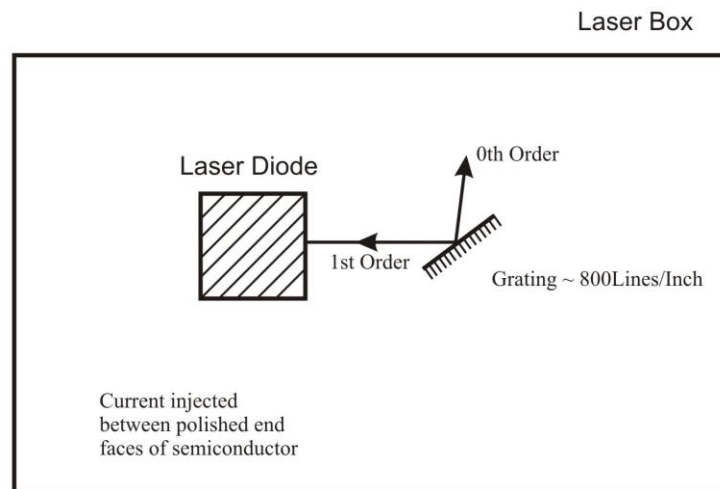
Lasers used in Laboratory experiments are external cavity diode lasers (ECDLs)
ECDLs used in laser diodes similar to those in CD players.

Review ECDL components and their functions

1. Cavity
2. Controllers for:
 - Scan
 - Temperature
 - Current
3. Role of grating in providing optical feedback to narrow line width
 - Through the process of stimulated emission the diode is forced to emit laser light over a narrow frequency range selected by the grating

Review Properties and Applications of a Typical External Cavity Diode Laser

- 1 MHz Linewidth
- 0.2 mA Current Drift
- 1/500 °C Temperature Drift
- 100 mW Power
- 1 % Intensity Variation



- need stable current to control intensity and frequency of light
- Need stable temperature and scan control to control the length of external cavity
- That determines frequencies of cavity modes
- A faraday isolator protects EDCLs from optical feedback
- Labs that use EDCLs include
 1. Lock-in Amplifier
 2. Zeeman Shift/Power broadening
 3. Fabry Perot – Laser Linewidth
 4. absorption/emission spectroscopy/EOM

Why Use Rubidium?

- Principle resonance line matches the energy band-gap in diode laser at 780nm

Rb vapour at room temperature is a good approximation to an ideal gas. The optical depth of a 5cm vapour cell is of order unity. So the atomic response can be measured with adequate signal to noise in introductory undergraduate experiments on spectroscopy.

- A rubidium cell at room temperature contains 72% ^{85}Rb and 28% ^{87}Rb
- Rb resides in Group IA of the periodic table and represents a 1 electron atom
- It is reactive toxic and easily oxidized
- Vapour pressure at STP $\sim 3 \times 10^{-7}$ T