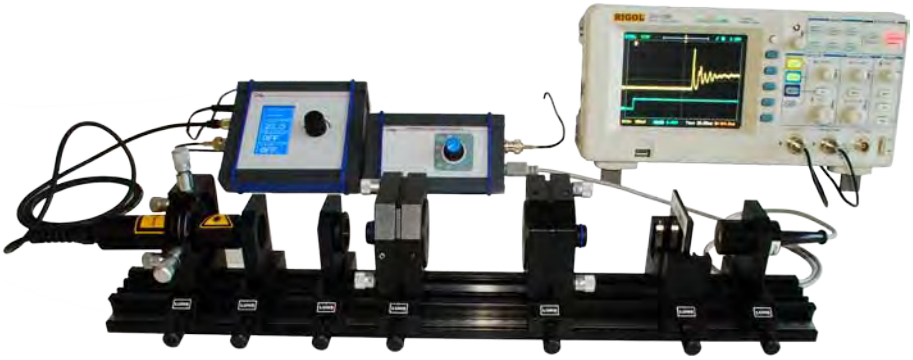
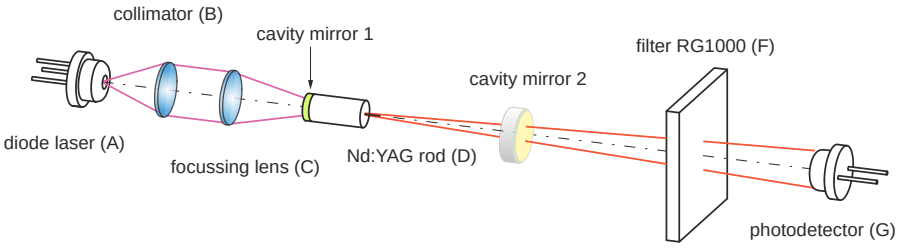
P5862 Diode pumped Nd:YAG Laser

- ✓ *Properties of diode laser*
- ✓ *Nd:YAG crystal*
- ✓ *Rate Equation Model*
- ✓ *Static and dynamic solution*
- ✓ *Laser output power*
- ✓ *Laser resonator*
- ✓ *Transversal modes*
- ✓ *Cavity stability criterion*
- ✓ *Demonstration of Spiking*



Principle of operation

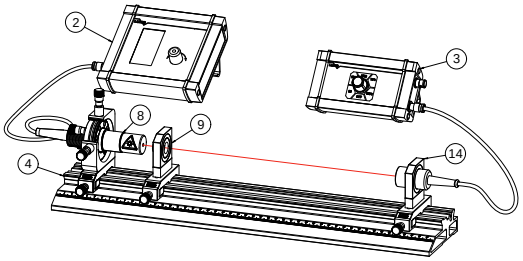
The radiation of the diode laser is focused by means of the collimator (B) and lens (C) into the Nd:YAG rod (D). The laser cavity is formed by the coating (1) of the rod and the mirror (2). The filter (F) absorbs the residual pump light and transmits the laser radiation. The relative intensity is measured by the photodetector (G)



Examples of investigation and measurement

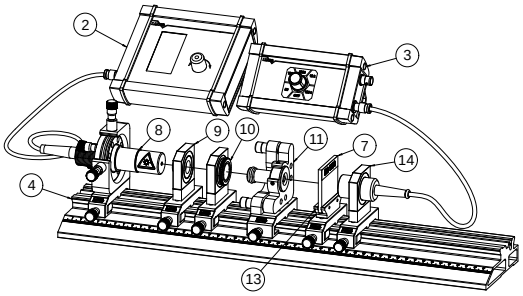
Characterization of the diode laser

In a basic set-up the characteristic parameters of the laser diode are measured. The diode laser is mounted into a housing (9) in contact with a Peltier element to control the temperature. The full digitally controller (2) sets and maintains the value for injection current, temperature and modulation frequency of the diode laser (9). The characteristic data of the diode laser is measured in relative units. For this purpose the signal conditioner (3) is used. The photodiode (14) is connected to this box where the input impedance can be selected. The output is available at a BNC connector for further connection to an oscilloscope or multimeter. The collimator (9) is used to set the beam divergence in such a way that the photodetector will not be saturated.



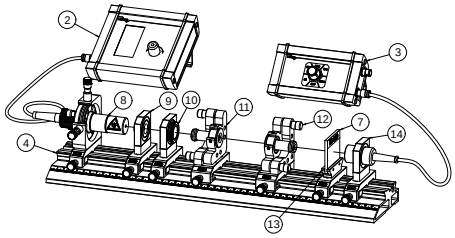
Optical pumping and spectroscopy

To the previous set-up the focussing lens (10) and the Nd:YAG rod (11) with its holder are added. The transmission spectrum of the laser diode radiation is measured by changing the temperature and therewith the emission wavelength. By means of the well known absorption lines the emission wavelength of the laser diode can be determined exactly. Adding the filter RG1000 (7) in front of the detector blocks the diode laser radiation and the fluorescence caused by optical pumping can be measured as function of the pump laser wavelength (temperature). At the maximum of the fluorescence emission the modulation of the diode laser is activated and the timely response displayed on an oscilloscope. From this curve the mean lief time of the exited laser state of the Nd:YAG material can be derived which inverse value represents the important Einstein coefficient for spontaneous emission.



Laser operation

Adding the second cavity mirror (12) to the set-up and aligning it properly laser oscillation at the wavelength of 1064 nm is obtained. The optimum laser parameters with respect to pump power and wavelength are ascertained. The laser threshold and efficiency are determined and by modulating the pump laser diode the so called spiking effect is demonstrated. By changing the length of the laser cavity the stability criterion is verified. This is accomplished by moving the adjustment holder (12) and reading its position with respect to the holder (11) containing the Nd:YAG rod including the coating for cavity mirror (1).



P5862 Diode laser pumped Nd:YAG laser consisting of:

Item	Qty	Description
1	3	BNC cable, BNC connector both sides, 1,5 m
2	1	Digital diode laser controller
3	1	Photodetector signal conditioning box
4	1	Profile rail MG-65, 500 mm
5	1	Crossed hair target in holder 25 mm
6	1	Infrared display card, range 0.8 -1.6 µm
7	1	RG1000 Coloured glass filter 50x50x4 mm
8	1	Module A - Diode laser in adjustment holder
9	1	Module B - Collimating optics on carrier
10	1	Module F - Focussing optics, f=60 mm
11	1	Module D - Adjustment holder with Nd:YAG rod
12	1	Module E - Adjustment holder "right" with laser mirror SHG 100
13	1	Module F - Filter plate holder
14	1	Module G - SiPIN photodetector
15	1	Optics cleaning set

Required Option:

	1	Oscilloscope 100 MHz digital, two channel