

---

**Modulbezeichnung:** M2: Basics of Laser (FUND/LAS) 5.0 ECTS  
 (M2: Basics of Laser)

Modulverantwortliche/r: Nicolas Joly  
 Lehrende: Nicolas Joly

---

|                             |                       |                       |
|-----------------------------|-----------------------|-----------------------|
| Startsemester: WS 2021/2022 | Dauer: 1 semester     | Turnus: jährlich (WS) |
| Präsenzzeit: 60 Std.        | Eigenstudium: 90 Std. | Sprache: Englisch     |

---

**Lehrveranstaltungen:**

Basic of Lasers (WS 2021/2022, Vorlesung, 4 SWS, Nicolas Joly)  
 Basic of Lasers - Lab sessions (WS 2021/2022, Praktikum, N.N.)

---

**Inhalt:**

Laser technology developed enormously since its first demonstration in 1960. Although at that time laser was described as "a solution in search of a problem" it is nowadays used everywhere, from high-precision spectroscopy to bar-scanner in supermarkets, from eye-surgery to metal welding for car industry. The lecture focuses on the basics of laser and serves as a first glance in the fascinating world of coherent light sources. It reviews four major aspects of lasers: (i) the description of the active material, which provides the gain for the system (ii) the laser cavity, which defines the spatial structure of the laser beam (iii) the propagation of laser beam using the ABCD matrices formalism and (iv) the different dynamical regimes of laser, in particular the way to generate pulses. Besides the lecture/exercises the students are invited to test the concepts seen during the lecture on two laser systems: a solid-state Nd:YAG laser and a Er-doped fibre laser.

**Lernziele und Kompetenzen:**

Students will be able to: Describe the active material using the rate equations Check the stability of a laser cavity and extract the beam parameters from the physical parameters of the cavity (length, radius of curvature of the mirrors. . . etc.) Use ABCD matrix to define the spatial properties of a laser beam and shape the beam (focusing, coupling. . . etc.) Align a laser cavity and observe the different spatial modes that can be generated Understand the different dynamical behaviours of a laser (mode-locked laser, Q-switch laser, continuous).

**Literatur:**

"Laser" by A.E. Siegman, University Science book, 1986 "Handbook of Lasers and Optics" by F. Träger, Springer, 2007 "Les lasers" by D.Dangoisse, D. Hennequin and V. Zehnlé)Dhaoui, Dunod 1998 "Principles of Lasers", 5th ed. by Orazio Svelto, Springer 2010

---

**Verwendbarkeit des Moduls / Einpassung in den Musterstudienplan:**

Das Modul ist im Kontext der folgenden Studienfächer/Vertiefungsrichtungen verwendbar:

[1] **Advanced Optical Technologies (Master of Science)**

(Po-Vers. 2018w | TechFak | Advanced Optical Technologies (Master of Science) | Gesamtkonto | Basics of Laser)

---

**Studien-/Prüfungsleistungen:**

Basics of Laser (written examination) (Prüfungsnummer: 21051)

(englische Bezeichnung: Basics of Laser (written examination))

Prüfungsleistung, Klausur, Dauer (in Minuten): 90

Anteil an der Berechnung der Modulnote: 80%

weitere Erläuterungen:

gemäß Corona-Satzung wird als alternative Prüfungsform festgelegt: mündliche Prüfung mit 30 Minuten Dauer

Erstablingung: WS 2021/2022, 1. Wdh.: SS 2022, 2. Wdh.: SS 2022

1. Prüfer: Nicolas Joly

Basics of Laser (internship report) (Prüfungsnummer: 21052)

(englische Bezeichnung: Basics of Laser (internship report))

Prüfungsleistung, Praktikumsleistung

Anteil an der Berechnung der Modulnote: 20%

weitere Erläuterungen:

Two lab sessions and report about the sessions

Prüfungssprache: Englisch

Erstablingung: WS 2021/2022, 1. Wdh.: WS 2022/2023

1. Prüfer: Nicolas Joly

---