

Physics 564 (ECE 564), Laser Physics II
Mondays and Wednesdays, 16:00 to 17:15 pm, *CHTM Room 101*
Spring 2025

Instructor

Jean-Claude Diels
Physics & Astronomy room PAIS 2236, phone 277 4026
CHTM, room 114A, phone 272 7830
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Reference material

Lectures summary, homework assignments will be posted on dielslab.unm.edu.
Possibly the only reference book written by an experimentalist is:
LASERS, by Anthony E. Siegman, University Press.

Other references:

- Ultrafast Phenomena, J.-C. Diels and W. Rudolph, 3rd Edition (will be posted on the We).
- Solid state laser engineering, W. Koechner, Springer verlag
- Photonics, Saleh

Assignments

The grade will be shared between

- Homework problems will be assigned on a regular base, due generally on Wednesdays.
- Presentation and written report on a laser related research

Questions, Communication

Please call me at 272 7830 or 277 4026 to make appointment. Please leave a message.
We can meet either in my office in Physics (PAIS 2236) or at CHTM (114A).

Accessibility

In accordance with University Policy 2310 and the Americans with Disabilities Act (ADA), academic accommodations may be made for any student who notifies the instructor of the need for an accommodation. It is imperative that you take the initiative to bring such needs to the instructor's attention, as he is not legally permitted to inquire. Students who may require assistance in emergency evacuations should contact the instructor as to the most appropriate procedures to follow. Contact Accessibility Resource Center at 277-3506 for additional information.

Title IX

UAP 2720 and 2740. Our classroom and university should always be spaces of mutual respect, kindness, and support, without fear of discrimination, harassment, or violence. If you ever need assistance or have concerns about incidents that violate this principle, please access campus support resources. These include confidential services at LoboRESPECT Advocacy Center, the Women's Resource Center, and the LGBTQ Resource Center. The University of New Mexico prohibits discrimination on the basis of sex (including gender, sex stereotyping, gender expression, and gender identity). UNM faculty and graduate teaching assistants are considered "responsible employees." "Responsible employees" must communicate reports of sexual harassment, sexual misconduct and sexual violence to Compliance, Ethics and Equal Opportunity. For more information on the campus policy regarding sexual misconduct, reporting, and reporting for "responsible employees," please see UAP 2720 and UAP 2740.

Academic Integrity

Each student is expected to maintain the highest standards of honesty and integrity in academic and professional matters. The University reserves the right to take disciplinary action, up to and including dismissal, against any student who is found guilty of academic dishonesty or otherwise fails to meet the standards. Any student judged to have engaged in academic dishonesty in course work may receive a reduced or failing grade for the work in question and/or for the course. Academic dishonesty includes, but is not limited to, dishonesty in quizzes, tests, or assignments; claiming credit for work not done or done by others; hindering the academic work of other students; misrepresenting academic or professional qualifications within or without the University; and nondisclosure or misrepresentation in filling out applications or other University records.

COVID-19 message from the Provost James Paul Holloway

Respect the UNM Community by Preserving Health

You have the ability to prevent the spread of COVID-19 and to preserve the health of fellow students, your instructor, staff and the community by following UNM health protocols. The UNM Provost Administrative Directive on Mandatory Student Face Covering and Symptom Reporting of July 9, 2020 requires that all students on UNM-Main and UNM branch campuses wear face masks in the face-to-face classroom and on campus unless they have a specific mask accommodation (confidentially documented with the Accessibility Resource Center). UNM Provost Administrative Directive is consistent with Governor Lujan Grisham's Public Health Emergency Order, as amended, and the Public Health Order of the New Mexico Health Secretary. *It also requires daily participation in symptom screening through covidscreen, which will be sent via UNM e-mail.*

Acceptable masks and mask wearing in class: A two-layer mask that covers the nose and mouth and that is cleaned regularly is acceptable. A face shield is not sufficient protection. It is vital that you wear your mask correctly, covering your nose and mouth. Removing your mask for an extended period to eat or drink in class violates the Provost Administrative Directive and endangers others.

Mask Wearing Accommodation: Individuals with a documented disability or diagnosis may seek accommodation with the UNM Accessibility Resource Center (ARC) (arc.unm.edu). Individuals do not need

to reveal private information to an instructor. ARC will require documentation of health requirements, which will be kept confidential. The instructor will be informed only of any need for accommodation.

Consequences of not wearing a mask properly: Unless you have an ARC-approved accommodation, if you don't wear a mask, or if you do not wear a mask properly by covering your nose and mouth, you will be asked to leave class. If you fail to wear a mask properly on more than one occasions, you can expect to be dropped from the class. If you insist on remaining in the classroom while not wearing a mask (without an ARC-determined accommodation), class will be dismissed for the day to protect others and you will be dropped from the class immediately.

This class may move to remote delivery at any time to preserve the health and safety of the students, instructor and community. Please check [Dielslab.unm.edu](https://dielslab.unm.edu) regularly for updates about our class and please check <https://bringbackthepack.unm.edu> regularly for general UNM updates.

Topics covered

Manipulation of laser beams

Polarization - in Pump-probe experiments time resolved fluorescence

How good can you maintain polarization?

Faraday rotation - isolators Magnetic field detection

Spectral interferometry – How to make a movie of a plasma

Standard solid state lasers

Vanadate - Nd YAG glass Yb YAG LISAF LICAF

Multilevel coherent interactions

Application to Raman transitions

Brillouin scattering

Is there anything such as backward Raman scattering?

Lab Demo

BIG SYSTEMS

Short pulse amplification from GW to TW to PW

Contrast enhancement

Optical Parametric Oscillator (OPO); PPLN

Optical Parametric Chirped Pulse Amplification (OPCPA)

PPLN

LASER INDUCED PLASMA

Electron plasma

Plasma mirrors

Making gratings in air without plasma

Z-pinch diagnostic

LASER COOLING

SEMICONDUCTOR LASERS

Junction, VECSEL,

FIBER LASERS

Integrated optics lasers

SENSOR APPLICATIONS

Intracavity sensing

quantum limit of noise

Squeezing

Gravitational waves detection

Lab demo

THZ radiation

X-Ray generation

Attosecond pulses