



UNIVERSITY OF
CENTRAL FLORIDA

OSE 6650 - Optical Properties of Nanostructured Materials

Section: 0V02

Optics and Photonics

Course Information

Term: Spring 2026

Class Meeting Location:

Modality: V

Credit Hours: 3.00

Instructor Information

Name: Pieter Kik

Office Location: CREOL A220

Email: kik@creol.ucf.edu

Course Description

OSE 6650 OPT-OPT 3(3,0)Optical Properties of Nanostructured Materials:PR:
Graduate standing OSE 6111, OSE 5312, or C.I. Theory and application of
nanostructured optical materials: Effective medium theory, nanostructured surfaces,
plasmon waveguides, nanophotonic circuits, metallic near-field lenses, collective
modes in nanoparticle arrays, metamaterials. Spring.

This course covers topics dealing with the optical properties of nanostructured materials. In the first part of the course we will discuss effective medium theory, including the Maxwell-Garnett description of the refractive index of inhomogeneous materials. We will cover applications of nanostructured dielectrics, including metasurfaces and metalenses based on propagation phase and geometric phase. The second part of the course deals with the optical properties of nanostructured metallo-dielectric materials. We will introduce the concept of localized surface plasmons (LSPs) on metal nanoparticles, and discuss spectral control of the plasmon resonance frequency by tuning shape, size, and dielectric environment. This is followed by applications of LSPs, including surface enhanced Raman scattering (SERS) and index-based biosensing. The third part of the course covers electromagnetic surface waves known as surface plasmon polaritons (SPPs), and discusses the use of surface plasmon resonance (SPR) for biodetection. Finally, we briefly discuss the concept of metamaterials: composite materials that have been nanostructured to obtain a specific dielectric response. We will discuss how this can give rise to negative refraction, and we will discuss an early experimental realization of this concept.

The course concludes with a substantial hands-on simulation component with industrial level electromagnetics design software. Students choose a nanophotonic structure related to one of the topics covered in class, and investigate its optical response numerically. This allows direct visualization of several concepts covered early in the course.

Student Learning Outcomes

After successful completion of this course, students will have a basic understanding of plasmonics, nanophotonics, and metamaterials. The students will be able to use the knowledge gained in this course to numerically simulate nanophotonic elements, which will enable them to further their research and enhance existing technologies.

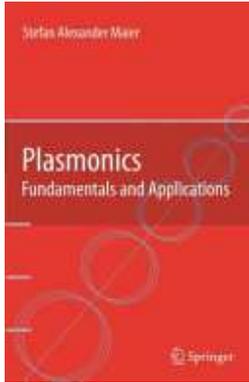
Required Course Materials and Resources

OSE6650 Slides

Authors: P. G. Kik

Online Access: [Webcourses > Files > Slides](#)

Recommended Course Materials



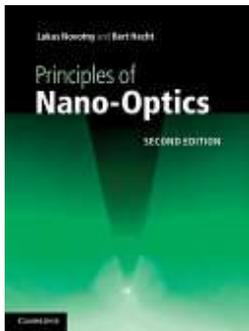
Title: Plasmonics: Fundamentals and Applications

ISBN: 9780387378251

Authors: Stefan Alexander Maier

Publisher: Springer Science & Business Media

Publication Date: 2007-05-16



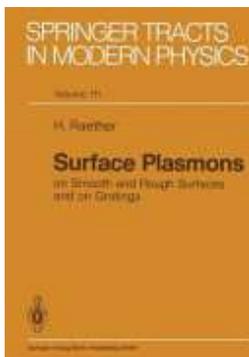
Title: Principles of Nano-Optics

ISBN: 9781139560450

Authors: Lukas Novotny, Bert Hecht

Publisher: Cambridge University Press

Publication Date: 2012-09-06



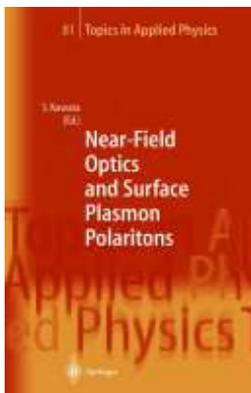
Title: Surface Plasmons on Smooth and Rough Surfaces and on Gratings

ISBN: 9783662151242

Authors: Heinz Raether

Publisher: Springer

Publication Date: 2013-10-03



Title: Near-Field Optics and Surface Plasmon Polaritons

ISBN: 9783540445524

Authors: Satoshi Kawata

Publisher: Springer Science & Business Media

Publication Date: 2003-07-01

Course Assessment and Grading Procedure

Students will carry out weekly simulations in CST Studio, based on provided templates or structure descriptions. Students will be asked to describe various observations made in the simulations. At the end of the semester, students will be sufficiently familiar with the simulation software to design and evaluate their own nanophotonic element / system. The results of this individual project will be submitted in the form of a final report, which takes the place of the final exam.

After about three months each student will choose a nanophotonics-related recent scientific publication to present in a short (12 minute) PowerPoint presentation to demonstrate understanding of the core concepts. The presentation grade will depend on effort, understanding, clarity, enthusiasm, critical thinking, and timing.

Simulation assignments and the final project report must be submitted on Webcourses as a PDF attachment by the submission deadline. The annotated graded homework PDF will be uploaded as an attachment to the homework submission.

Grading Scale

Letter Grade	Cutoff
A	94%
A-	90%
B+	87%
B	84%

Letter Grade	Cutoff
B-	80%
C+	77%
C	74%
C-	70%
D+	67%
D	64%
D-	61%
F	0%

Policies for Course Grade

Makeup Work Policy

If an emergency arises and a student cannot take an exam on the scheduled date, the student must give notification to the instructor no less than 24 hours before the scheduled time. The instructor will specify a new date for taking the exam. Any illness will be considered a medical emergency only if an official Doctor's note confirming the illness is submitted to the CREOL Graduate Office.

Missed/Late Assignments

Missed or Late assignments without prior consent from the instructor will not receive credit. An extension of the submission deadline may be granted at the discretion of the instructor if the following criteria are met:

- The extension request was sent before the original submission deadline.
- The student provided a plausible excuse for the delayed submission.
- The student provided a reasonable updated submission deadline.

Grade Objections

All objections to grades should be made in writing within one week of the work in question. Objections made after this period has elapsed will not be considered.

Artificial Intelligence (AI) Use Policy

All assignments must be carried out by the students. Verbatim copying of answers provided by AI (LLM's) is not allowed. Use of AI for clarification of concepts is encouraged, provided that students are aware that LLMs confabulate (make things up) and that AI responses could include topics that are not part of the course.

Disability Access & Accommodations

The University of Central Florida is committed to providing equal access to all students with disabilities (ADHD, learning disabilities, Autism, chronic medical conditions, physical disabilities, etc.). To receive consideration for reasonable disability-related course accommodations, disabled students must contact Student Accessibility Services (SAS) and complete the steps required for SAS to review accommodation requests. More information can be found on the UCF [Student Accessibility Services](#) website under the Start Here tab or by contacting SAS directly (Ferrell Commons 185; sas@ucf.edu; Phone - 407-823-2371).

Approved accommodations are shared with course instructors via the SAS Course Accessibility Letter. Implementing certain accommodations may require discussion about specific considerations of the course design, course learning objectives, and the individual academic and course challenges experienced by the student. While students with disabilities or chronic health needs are also encouraged to discuss any course concerns with professors in addition to contacting SAS, professors are not required to facilitate disability-related adjustments to the course unless the professor has received a Course Accessibility Letter from SAS that outlines approved accommodations.

Academic Integrity

Students should familiarize themselves with UCF's Code of Conduct at Student Conduct and Integrity Office. According to Section 1, "Academic Misconduct," students are prohibited from engaging in:

1. Academic misconduct is defined as any submitted work or behavior that obstructs the instructor of record's ability to accurately assess the student's

understanding or completion of course materials or degree requirements (e.g., assignment, quiz, and/or exam). Examples of academic misconduct include but are not limited to: plagiarism, unauthorized assistance to complete an academic exercise; unauthorized communication with others during an examination, course assessment, or project; falsifying or misrepresenting academic work; providing misleading information to create a personal advantage to complete course/degree requirements; or multiple submission(s) of academic work without permission of the instructor of record.

2. Any student who knowingly helps another violate academic behavior standards is also in violation of the standards.
3. Commercial Use of Academic Material. Selling of course material to another person and/or uploading course material to a third-party vendor without authorization or without the express permission of the University and the instructor of record. Course materials include but are not limited to class notes, the instructor of record's slide deck, tests, quizzes, labs, instruction sheets, homework, study guides, and handouts.
4. Soliciting assistance with academic coursework and/or degree requirements. The solicitation of assistance with an assignment, lab, quiz, test, paper, etc., without authorization of the instructor of record or designee is prohibited. This includes but is not limited to asking for answers to a quiz, trading answers, or offering to pay another to complete an assignment. It is considered Academic Misconduct to solicit assistance with academic coursework and/or degree requirements, even if the solicitation did not yield actual assistance (for example, if there was no response to the solicitation).

Responses to Academic Dishonesty, Plagiarism, or Cheating

Students should also familiarize themselves with the procedures for academic misconduct in UCF's student handbook, [The Golden Rule](#). UCF faculty members have a responsibility for students' education and the value of a UCF degree, and so seek to prevent unethical behavior and respond to academic misconduct when necessary. Penalties for violating rules, policies, and instructions within this course can range from a zero on the exercise to an "F" letter grade in the course. In addition, an Academic Misconduct report could be filed with the Office of Student Conduct and Academic Integrity, which could lead to disciplinary warning,

disciplinary probation, or deferred suspension or separation from the University through suspension, dismissal, or expulsion with the addition of a "Z" designated on one's transcript.

Being found in violation of academic conduct standards could result in a student having to disclose such behavior on a graduate school application, being removed from a leadership position within a student organization, the recipient of scholarships, participation in University activities such as study abroad, internships, etc.

Let's avoid all of this by demonstrating values of honesty, trust, and integrity. No grade is worth compromising your integrity and moving your moral compass. Stay true to doing the right thing: take the zero, not a shortcut.

Title IX

Title IX prohibits sex discrimination, including sexual misconduct, sexual violence, sexual harassment, and retaliation. If you or someone you know has been harassed or assaulted, you can find resources available to support the victim, including confidential resources and information concerning reporting options at [Let's Be Clear](#) and [UCF Cares](#).

For more information on access and community engagement, Title IX, accessibility, or UCF's complaint processes contact:

- Title IX – ONAC – [Office of Nondiscrimination & Accommodations Compliance](#) & askanadvocate@ucf.edu
- Disability Accommodation – Student Accessibility Services – [Student Accessibility Services](#) & sas@ucf.edu
- [Access and Community Engagement](#) (including the Ginsberg Center for Inclusion and Community Engagement, Military and Veteran Student Success, and HSI Initiatives)
- UCF Compliance and Ethics Office – [Compliance, Ethics, and Risk Office](#) & complianceandethics@ucf.edu
- The [Ombuds Office](#) is a safe place to discuss concerns.

Reporting an Incident or Issue

If you believe you have experienced discrimination by any faculty or staff member, contact the Office of Nondiscrimination & Accommodations Compliance via the [ONAC website](#) or at 407-823-1336. You can also choose to report using the UCF Integrity Line either anonymously or as yourself at 1-855-877-6049 or by using the [online form](#). UCF cares about you and takes every report seriously. For more information see the [Reporting an Incident or Issue Webpage](#).

Deployed Active-Duty Military Students

Students who are deployed active-duty military and/or National Guard personnel and require accommodation should contact their instructors as soon as possible after the semester begins and/or after they receive notification of deployment to make arrangements.

Campus Safety

At UCF's Public Safety and Police, safety is the top priority. Emergencies on campus are rare, but if one should arise, it's important to be familiar with some basic safety and security concepts.

- In an emergency, always dial 911.
- Every UCF Classroom has an Emergency Procedure Guide posted on a wall near the door, which will show you how to respond to a variety of situations. This guide can also be found online [here](#).
- In the event of an active threat, remember **AVOID, DENY, DEFEND**. Choose the best course of action and act immediately. Watch the video [here](#) to learn more.
 - **AVOID**. Pay attention to your surroundings and have an exit plan. Get as much distance and as many barriers between you and the threat as quickly as possible.
 - **DENY**. When avoiding is difficult or impossible, deny the threat access to you and your space. Lockdown by creating barriers, turning the lights off

and remaining quiet and out of sight. Make sure your phone is silenced, but do not turn it off.

- **DEFEND.** When you are unable to put distance between yourself and the threat, be prepared to protect yourself. Commit to your actions, be aggressive and do not fight fairly. Do whatever it takes to survive.
- For emergencies on campus, UCF will utilize the [UCF Alert](#) system. All UCF students, faculty, and staff are automatically enrolled to receive these email and text alerts, however, it's a good idea to frequently ensure your [contact information is up to date](#).

Financial Aid Accountability

All instructors are required to document students' academic activity at the beginning of each course. In order to document that you began this course, please complete this activity by the end of the first week of classes or as soon as possible after adding the course. Failure to do so may result in a delay in the disbursement of your financial aid.

Class Schedule

Topic No.	Topic
1	Effective medium theory
2	Metasurfaces and metalenses
3	Metasurfaces optics using geometric phase
4	Near-fields and Near-field Microscopy
5	Localized surface plasmon resonances on metallic nanospheres
6	LSP resonances - effect of particle size and host index
7	Effect of radial composition - biodetection using selective binding
8	SPPs on planar metal films - dispersion + prism coupling
9	Near-field and grating based SPP excitation
10	SPPs beyond single planar interfaces
11	Surface Enhanced Raman Scattering (SERS)
12	Negative index materials

Topic No.	Topic
13	Photonic bandgap materials

