

SEA-EU Virtual Module description

Module offers for the 'SEA-EU Virtual Modules'

General Information

Module/Course Name	Nano-Optics: from Classical to Quantum	
Module/Course Code	-	
Field of Education	Generic programmes and qualifications	☐
	Education	☐
	Arts and humanities	☐
	Social sciences, journalism and information	☐
	Business, administration and law	☐
	Natural sciences, mathematics and statistics	☒
	Information and Communication Technologies	☐
	Engineering, manufacturing and construction	☐
	Agriculture, forestry, fisheries and veterinary	☐
	Health and welfare	☐
	Services	☐
Study programme	Master of Science Physics	
Number of ECTS and total student workload	4 ECTS and 120 hours (There is the possibility to attend the course till December with 3 ECTS and 90 hours)	
Contact hours and Independent study hours	37,5 contact hours and 82,5 independent study hours	
Typology of contact hours	Lecture, discussion and exercises (ca. 37,5 hours in class), self-study (ca 82,5 hours) reading, preparations, assignment preparation. All lectures will be recorded and available afterwards.	
Academic Year	2026/2027	
Semester / Specific period	Winter semester (i.e. October to February), with the option for SEA-EU students to attend up to end of December and get a 3 ECTS certificate.	
Teaching Language	English	

Delivery mode	This module is taught in a hybrid format by lecturers from Kiel University (CAU) and the University of Oldenburg (UOL). Lectures given by Prof Nahid Talebi take place in Kiel, and lectures given by Prof Christoph Lienau take place in Oldenburg. Students at the lecturer's location can attend in person, while students at the other university join online: via Zoom for lectures held in Kiel, and via BigBlueButton for lectures held in Oldenburg. All lectures are recorded and made available on OpenOlat. Each lecture is followed by a hybrid exercise and discussion session. We strongly encourage you to take part and to engage directly with the lecturers.
Responsible Lecturer	Name: Nahid Talebi E-Mail: Talebi@physics.uni-kiel.de
Other lecturers	Name: Christoph Lienau E-Mail: christoph.lienau@uni-oldenburg.de
Learning outcomes	☐ explain the optical properties of materials and the behavior of propagating, evanescent, plasmonic and guided waves at the nanoscale. ☐ compare optical and electron-based techniques for probing nanoscale optical fields, including SNOM, EELS, cathodoluminescence and PINEM. ☐ describe light–matter interaction semiclassically, including Rabi oscillations and strong coupling leading to polaritons. ☐ choose and justify an appropriate classical, semiclassical or quantum description for a given nano-optical problem. ☐ apply field quantization to describe quantum states of light and quantum optical phenomena in nanoscale systems. ☐ critically discuss current research on emerging topics in nanoscale optics.
Course contents	Classical Nano-Optics: - Introduction, Electromagnetic waves – propagating and evanescent, Dielectric function and refractive index – atoms, molecules, semi-conductors and metals, Surface plasmons: physics and applications Quasi-confined guided waves, Electron energy-loss spectroscopy and cathodoluminescence spectroscopy Scanning near-field optical microscopy Semi-classical: Semiclassical light-matter interactions, Density matrix and Rabi oscillations, Strong emitter-photon interactions: polaritons, Photon induced near-field electron microscopy. Quantum: Light quantization, Quantum states of light,

	Quantum optical phenomena in nanoscale systems, Emerging topics in nanoscale optics.
Prerequisites and/or recommended academic background	Bachelor-level knowledge of electrodynamics, quantum mechanics, optics and basic solid-state physics. Students from materials science, chemistry, electrical engineering or related disciplines are welcome, but should be prepared to acquire the necessary foundations
Assessment	Oral exam (100%); assignments in class are not graded.
Main bibliography	Nano-Optics: From Classical to Quantum · UltraSpecT · Kiel University

Organisational Information

Maximum number of SEA-EU participants
15
Learning Management System
We will make use of OpenOlat.
Course schedule (date and time)
23.10.2026 -12.02.2027 Lectures: Fridays 14:15-15:45 CEST/CET Exercises: Thursdays 12:00-13:00 CET
Application deadline
15.10.2026 is registration deadline.