Announcement

Nano-Optics

Prof. Hoerber

Description

The course on Nano-Optics will provide an understanding of the problems traditional Electrodynamics is facing when interactions between radiation and matter become localized far below the wavelength of the radiation involved. The path followed in a series of lectures will be along the old particle-wave discussion, which ended after Huygens with the great success for the wave description of light helping in developing a large array of optical instruments.

In 1902 Lenard observed that the energy of electrons released in an ionisation process induced by radiation is proportional to the frequency of the radiation and not to the intensity, as Maxwell's wave theory of light predicted. This problem was solved by Einstein with the reintroduction of particles of light called photons and this lead to the development of Quantum-Mechanics in the 20tiest century with its concept of wave-particle dualism and its statistical interpretation of light interactions with matter.

With the improvement of detectors and light sources in the last 20 years experiments to measure the interaction of single photons with single nano-structures became possible, for which the Copenhagen-Interpretation of Quantum-Mechanics does not provide a really satisfying physical description. For the development of new communication technologies a broad investigation into the interaction between light and nano-structures has started. In the second half of the course students will present recent research papers on this topic to develop an understanding of the scientific discussion and the different paths of investigations pursued.

The aim of the course is to provide students with the necessary background knowledge to understand recent developments in the use of light in new technologies and to enable them to apply it for own research projects.

Content

- Introduction to electromagnetic radiation
- Wave description of electromagnetic radiation
- Interaction of electromagnetic radiation with matter
- Detection of electromagnetic radiation
- Optical Microscopy
- Beyond the diffraction limit
- The eye as an image sensor

Prerequisites

None

Literature

- Feynman R, Leighton R, and Sands M. (2006). *The Feynman Lectures on Physics* Vol. I+II. ISBN 0-8053-9045-6
- Hecht, Eugene (2001). *Optics* (4th ed.*)*. Pearson Education. ISBN 978-0-8053-8566-3.
- *Essential Principles of Image Sensors*, 12.8.2014
  Takao Kuroda, Apple Academic Press
  ISBN: 1482220056
- *Anatomy and Physiology of Eye*, 2nd Edition 1.12.2008
  A.K. Khurana, CBS publishers & Distributors
  ISBN: 8123912677

Additional information

Lecture with exercises (24 hours lecture)

Examination: student presentations of recent research papers

4 ECTS credits

Lecturer

Dr. J.K.H. Hoerber, Senior Professor