KEMS448 Physical Chemistry Advanced Laboratory Work
Scanning near-field optical microscopy (SNOM), 2 ects credits

Developments in nanoscience, biotechnology, and photonics now offer great challenges for the characterization and exploration of optical interactions on the nanoscale, with an ever-increasing need for optical imaging tools having the ability to resolve features with sizes in the range of 1 nanometer to 1 micrometer. This laboratory project is concerned with a new approach, near field microscopy, which has opened up optical processes on the nanoscale for direct inspection. The subsequent progress in near-field microscopy has led to the development of new area of research of “nano-optics”, which studies the interaction of light and matter on the nanoscale, the manipulation of light in subwavelength dimensions, and nanolocal spectroscopy. Nano-optics addresses the key issues on nanometer length scale, covering basic studies in physics, biology and chemistry as well as making significant impact on novel technologies such as nanomaterials, nanophotonics, and single molecule devices.

In this laboratory project the students are first familiarized to the physical background of nano-optics at the level of detail allowing understanding the key principles, and their connection to scanning near-field optical microscopy (SNOM). We study general concepts related to confinement of light below the diffraction limit as well as the information content provided by the near-field interaction. We continue by introducing the SNOM technique, its modes of operation, the type of optical probes as well as the feedback mechanisms to control the probe position. In the lab work the students get their hands on a state-of-the-art SNOM microscope (Nanonics Imaging) and learn its basic operation principles in practice. Depending on the sample, various nano-scale images are recorded and analyzed. The time for the laboratory work is agreed personally with the supervisor prof. Henrik Kunttu, and 1 to 2 students can participate at a time.