Experimental Techniques in Optical Spectroscopy

Andries Meijerink#

Debye Institute of Nanomaterials Science, Utrecht University, The Netherlands

This tutorial lecture aims to teach students (and we are all students) operating principles of the various components used in optical spectroscopy, outline common pitfalls that can compromise results in luminescence spectroscopy and finally give an overview of recent developments and advanced spectroscopic techniques. I will start with a basic introduction to the three types of elements needed: light sources, light dispersing elements and light detectors. Different types of lamps and lasers will be discussed, the characteristics of grating monochromators will be outlined and photomultiplier tubes and CCD detectors are explained. Both steady state spectral measurements and time resolved spectroscopic techniques (MCS, TCSPC, streak camera) will be discussed. Problems that may arise from e.g. second order effects, detector saturation, spectral correction will be illustrated with examples from the literature.

In the second part there is a focus on recent developments: fs/ps pump-probe spectroscopy, confocal techniques, single particle/single ion spectroscopy, synchrotron studies, high resolution cathode luminescence and combining techniques such as luminescence with thermoluminescence or photoconductivity. The insights obtained during this tutorial will hopefully help to be more effective in recording meaningful spectra, limit erroneous results and give new ideas to solve scientific problems with new spectroscopic tools.

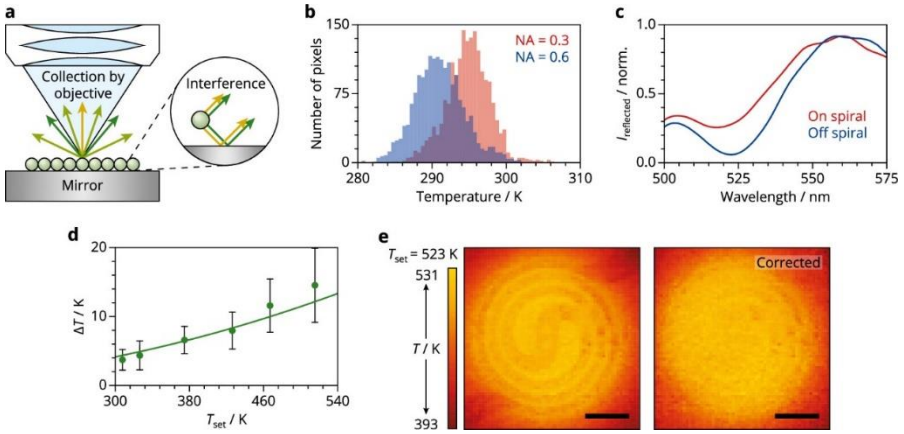

Figure 1 – High resolution emission measurements of a microheater for mapping of the 2D temperature profile with μm resolution using a confocal microscope.

corresponding author: a.meijerink@uu.nl