

SCIENTIFIC AND METHOD MODULES

Module name	Nanomanipulations: spectroscopy on the nanometric scale
Number	2010-M01
Aims	Spectroscopies localized at nanometric lengthscales or aiming to measure interactions at similar separations have gained strong impact in modern Nano(bio)physics and materials science. The module gives an introduction into these modern techniques and the physical principles behind it.
Basics	Quantum mechanics and molecular spectroscopy, experiments with nanometric holes
Contents	<ol style="list-style-type: none"> 1. Absorption spectroscopy from 10³ Hz to the IR 2. Broadband Dielectric Spectroscopy (BDS) using nanostructured electrodes 3. Time-resolved FTIR spectroscopy and IR transition moment orientational analysis 4. Force spectroscopy using single nanometric holes 5. Fluorescence spectroscopy and related techniques (FCS and FRET) 6. Force spectroscopy using magnetic tweezers
Methods	Broadband Dielectric Spectroscopy (BDS), Fourier-Transform InfraRed Spectroscopy (FTIR), Fluorescence Spectroscopy including FRET and FCS, Force Spectroscopies using optical and magnetic tweezers
Type	Two-day block course/ yearly recurrence with modification
Date (month/year)	30.September – 1.October
Time	9:00 – 18.00
Work load	15 hours presence/ 45 hours self-study
Examination	written
Credit points	2
Responsible scientists	F. Kremer
International guest lecturers	Dr. U. Keyser, University of Cambridge
Industrial partners	JPK Instruments, Berlin; Novocontrol Technologies GmbH & Co KG, Hundsangen
Recommendations for literature, e-learning	H.Haken/H.C.Wolf "Molecular Physics and elements of quantum chemistry", J.M.Hollas "Modern Spectroscopies", F.Kremer and A. Schönhalz (Eds.) "Broadband Dielectric Spectroscopy"

SCHEDULE for Module 2010-M01

Time	Lecturer	Program	Location
Day 1 (Thursday, 30.9.2010)			
9:00-10:30	F.Kremer	Introduction to the subject and lecture: Broadband Dielectric Spectroscopy (BDS) in Soft Matter research	
10:30-12:00	P. Papadopoulos	Time-resolved Fourier Transform Infrared Spectroscopy (FTIR) in Soft Matter research.	
12:00-13:00	<i>Lunch</i>		
13:00-14:30	F.Kremer and P.Papadopoulos	Absorption spectroscopies (BDS and FTIR) as applied to nanometer thin samples	
14:30-16:00	F.Kremer and P.Papadopoulos	Tour through and demonstrations in the labs for Broadband Dielectric Spectroscopy and Fourier Transform Infrared Spectroscopy	
16:30- 18:00	R.Seidel	Magnetic Tweezers: Videomicroscopy-based force and torque spectroscopy	
19:00	Dinner in the "Bayrischer Bahnhof"		
Day 2 (Friday, 01.10.2010)			
9:00-10:30	U.Keyser	Forces during DNA electrophoresis: investigations by force spectroscopy and simulations	
10:30-12:00	E.Petrov	"Fluorescence Correlation Spectroscopy: Basic principles and applications"	
12:00-13:00	<i>Lunch</i>		
13:00-14:00	F.Kremer	Examinations	

Didactic elements:

Lecture, discussions, practical training – lab demonstration, etc.

Expected performance:

Active participation in discussions during lab demonstration etc.