

SYSM 3: Single Molecule Spectroscopy of Nanoobjects III

Zeit: Donnerstag 16:30–18:45

Raum: VMP 8 HS

Hauptvortrag SYSM 3.1 Do 16:30 VMP 8 HS
Fluorophores as optical sensors for local forces — ●STEFAN MARAWSKE¹, DENIS DÖRR¹, DANIEL SCHMITZ², AXEL KOSLOWSKI³, YOU LU³, HELMUT RITTER², WALTER THIEL³, CLAUS A.M. SEIDEL¹, and RALF KÜHNEMUTH¹ — ¹Department of Molecular Physical Chemistry, Heinrich-Heine-University Düsseldorf — ²Department of Organic and Macromolecular Chemistry, Heinrich-Heine-University Düsseldorf — ³Max-Planck-Institut für Kohlenforschung, Mülheim an der Ruhr

In this work we designed a custom-tailored oligopara*phenylenevinylene (OPV) derivative, which according to previous theoretical studies was expected to show a significant change in geometry if an external force is exerted. Thin foils made of PVC stained with OPV have been prepared. By applying uniaxial force the foils were stretched. Three major optical effects were observed simultaneously. At first, the fluorescence anisotropy increased, which indicates a reorientation of the fluorophores within the matrix. Second, the fluorescence lifetime decreased by approximately 2.5 %. Finally we observed a blue shift in the emission spectrum by about 1.2 nm. To relate the observed spectroscopic changes to the underlying changes in molecular properties, quantum-chemical calculations have been performed. Both the observed blue-shift of fluorescence and the reduced lifetime of OPV under tensile stress are consistent with the results of the semiempirical calculations. Our study proves the feasibility of fluorescence-based local force probes for polymers under tension.

Hauptvortrag SYSM 3.2 Do 17:10 VMP 8 HS
Single molecule studies of electronic excitation energy transfer: From transfer rates and mechanisms to manipulation — ●THOMAS BASCHE — Institut für Physikalische Chemie, Johannes Gutenberg-Universität Mainz

Electronic excitation energy transfer plays a key role for the functioning of natural light-harvesting complexes and light-emitting devices. In recent years single molecule spectroscopy of molecular aggregates has provided new insights into the fundamentals of this process. In order of increasing structural complexity we have studied simple molecular dimers and multichromophoric aggregates and (conjugated) polymers. It will be shown that the combination of frequency selective single molecule spectroscopy and confocal fluorescence microscopy at 1.4 K is a unique tool to study energy transfer in these systems. In particular, from the line widths of single molecule excitation spectra rate constants of energy transfer can be deduced directly. Detailed analyses shows that for several cases the mechanism of energy transfer cannot be described by the simple Förster model (dipole-dipole coupling). Furthermore, novel single molecule pump-probe experiments will be presented which allow for redirecting the excitation energy flow in in-

dividual molecular aggregates.

Hauptvortrag SYSM 3.3 Do 17:50 VMP 8 HS
Femtosecond Time-Resolved Spectroscopy of Single Molecules — ●RICHARD HILDNER¹, DAAN BRINKS¹, and NIEK F. VAN HULST^{1,2} — ¹ICFO - Institut de Ciències Fotoniques, Mediterranean Technology Park, 08860 Castelldefels (Barcelona), Spain — ²ICREA - Institut Catalana de Recerca i Estudis Avancats, 08015 Barcelona, Spain

We present a study of the femtosecond dynamics of single molecules embedded in an inert polymer matrix at room temperature employing a fluorescence detected double pulse excitation scheme. By controlling the delay time between the excitation pulses as well as the relative phase between the electric fields of the pulses we are able to manipulate the excited state population probabilities of single molecules. An analysis of these data based on the optical Bloch equations for two- and three-level systems allows to retrieve the dephasing time of single molecules directly in the time domain. In addition the transition dipole moments (absorption cross sections) and thus the Rabi-frequencies can be determined from these data. We found dephasing times between 25 – 50 fs and the transition dipole moments were distributed between 0.8 and 16 D.

SYSM 3.4 Do 18:30 VMP 8 HS
Restricted Conformation Dynamics of Single Functionalised Perylene Bisimide Molecules — CHRISTIAN VON BORCZYKOWSKI, ●DANNY KOWERKO, JÖRG SCHUSTER, and STEFAN KRAUSE — Center of nanostructured materials and analytics, TU-Chemnitz, 09107 Chemnitz

Perylene bisimide molecules offer a large diversity of applications in science and technology due to its outstanding possibilities to introduce functional substituents both at the imide nitrogen and at the carbocyclic scaffold in the so called-bay area. The bay groups give rise to complex intramolecular conformational dynamics that can be uncovered by multiparameter single molecule spectroscopy in different matrices and on via functional pyridyl groups surface attached molecules. Synchronous analysis of polarisation, spectral and lifetime fluctuations also at low temperatures allows for discrimination between changes in orientation and conformation [1]. Discussion of our results in the scope of models reported in current literature gives a deeper insight to conformational interconversion processes and its consequences for radiative and non-radiative fluorescence decay rates.

[1] D. Kowerko, J. Schuster, C. von Borczykowski, Mol. Phys. 2009, (acc.)