SYAD 1: SAMOP Dissertation-Prize

Time: Wednesday 11:00–13:00 Location: RW 1

Invited Talk SYAD 1.1 Wed 11:00 RW 1

Exciton transport in disordered organic systems — •Franziska Fennel — Inst. für Physik, Universität Rostock, Albert-Einstein-Str. 23, 18051 Rostock — Center for Nanosystems Chemistry, Universität Würzburg, Theodor-Boveri-Weg, 97074 Würzburg

Large migration distances of Frenkel excitons in organic polymers and molecular systems are of high relevance for applications such as light harvesting systems and organic solar cells. A common property of spatially disordered organic systems, like polymers, is a substantially reduced exciton migration distance due to their significant energetic disorder, i.e. a variation of the electronic excitation energy between the individual sites. In order to calculate the exciton migration distance under the presence of energetic disorder, we developed an extension of the conventional Förster approach. It allows for a reliable prediction based on easy accessible observables like the absorption and emission spectrum. By means of transient absorption measurements, we characterized the energetic disorder of a model system and predicted the exciton diffusion length. In a second step the exciton diffusion length was experimentally determined by exciton exciton annihilation. The agreement between experiment and model demonstrates the reliability of the extended Förster approach.

Finally, I will show that the energetic disorder can be strongly reduced by self-assembly of molecules to large supramolecular structures and enhanced exciton migration distances result. Understanding the exciton migration on these complex structures and the formulation of design principles will pave the way for enhanced exciton migration.

Invited Talk SYAD 1.2 Wed 11:30 RW 1

Quantum dynamics in strongly correlated one-dimensional Bose gases — •Florian Meinert — 5. Physikalisches Institut and Center for Integrated Quantum Science and Technology, Universität Stuttgart, Pfaffenwaldring 57, 70569 Stuttgart, Germany

Quantum many-body systems exhibiting strong correlations give rise to fascinating novel phenomena in physics. In recent years, ultracold atomic gases confined to optical lattice potentials have opened compelling new routes for implementing many-body Hamiltonians with unprecedented parameter control. Moreover, they allow us to explore many-body systems also far out-of-equilibrium and trace their coherent dynamics in real time.

We have studied phenomena in the dynamics of strongly correlated bosonic quantum gases confined to a one-dimensional (1D) geometry. For a 1D Hubbard chain we investigated correlated tunneling dynamics when the many-body system is suddenly exposed to a strong force. This allowed us to observe how interacting quantum particles prepared in a Mott-insulator tunnel through multiple wells of the lattice for situations where a single particle cannot move at all. Our studies further comprise the coherent evolution of an interacting superfluid, which exhibits Bloch-oscillations modulated by interaction-driven collapse and revivals. Furthermore, we realized a tunable Luttinger liquid. Building on investigations of its collective excitations, we have recently probed the dynamics of a strongly coupled impurity atom injected into the liquid and found an intriguing Bloch-oscillation type motion induced in the correlated system in the absence of an imprinted lattice structure.

Invited Talk SYAD 1.3 Wed 12:00 RW 1

Dynamics and correlations of a Bose-Einstein condensate of light — •Julian Schmitt — Institut für Angewandte Physik, Universität Bonn

Large statistical number fluctuations are a fundamental property of the thermal behavior of bosons. At low temperatures and high densities however, when a gas of bosons undergoes Bose-Einstein condensation, large fluctuations of the condensate population for a closed system are damped out and coherence emerges. On the other hand, for a Bose-Einstein condensate coupled to an environment, i.e. in the presence of a very large reservoir, drastic modifications of the coherence properties have been predicted, though not yet experimentally observed. In my talk, I will describe measurements of the photon number correlations and phase correlations of a Bose-Einstein condensate of photons generated in a dye microcavity. In this system, the photo-excitable dye molecules act as a heat and particle reservoir for the photons, which in the condensed state allows to reach a regime with number fluctuations approaching the size the total particle number, as predicted by grand canonical statistical theory. Experimentally, effective photon reservoirs of different size can be engineered. For the first time this has allowed to experimentally demonstrate Bose-Einstein condensation at grand canonical statistical ensemble conditions, with its characteristic non-vanishing Hanbury-Brown Twiss correlations in the condensed phase. An intriguing feature of this regime is the occurrence of discrete phase jumps of the macroscopic wave function, allowing to *in-situ* monitor the spontaneous symmetry breaking of the condensate.

Invited Talk SYAD 1.4 Wed 12:30 RW 1

Circular dichroism and accumulative polarimetry of chiral femtochemistry — •Andreas Steinbacher — Institut für Physikalische und Theoretische Chemie, Universität Würzburg, Am Hubland, 97074 Würzburg — Massachusetts Institute of Technology, Department of Chemistry, 77 Mass Ave, Cambridge, MA 02139

Steady-state circular dichroism (CD) or optical activity (OA) are common techniques to analyze chiral samples in the liquid phase. However, the utilized long optical path lengths, high concentrations, and long integration times are not suitable for ultrafast spectroscopy. Hence, only few such approaches are known in literature. In this presentation recently developed ultrafast spectrometers for CD and OA detection are introduced.

For OA probing, a sensitive polarimeter based on heterodyne interferometry and accumulative spectroscopy was developed. With this setup it is possible to detect the OA change accompanying a chirality-modifying photochemical reaction with femtosecond time resolution. Furthermore, one can achieve all-optical discrimination between racemic and achiral molecular solutions.

Furthermore, broadband time-resolved CD spectroscopy based on a setup capable of mirroring an arbitrary polarization state of an ultrashort laser pulse is presented. By passing a broadband probe through this setup it is possible to switch between opposite handedness of the probe on a shot-to-shot basis to detect pump-induced CD changes. To demonstrate the capabilities of this approach the early photochemistry of hemoglobin was investigated.