Stimuli-Responsive Polymer Materials

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Stimulus responsive polymer materials are of great interest for variety of applications in the field of sustainable energy, water management, food packaging and healthcare. For precise responsive functional properties, well-defined hierarchically ordered materials are crucial. The self-assembly of liquid crystals has proven to be an extremely useful tool in the development of such materials. In my lecture, examples of photopolymerizable hydrogen bonding and photochromic mesogens will be presented showing that a wide variety of responsive functional materials can be made from a relative simple set of building blocks. Upon mixing reactive mesogens, nematic, chiral nematic, and smectic liquid crystalline phases can be formed that after photopolymerization can be used as luminescent solar concentrators, actuators, sensors, and nanoporous materials.

Theory of Light Emission and Quantum Statistics of Molecule - Metal - Nanoparticle Hybrids

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Nanoplasmonics offers the possibility to manipulate light on a nanometer scale beyond the optical diffraction limit. An important ingredient for nanoplasmonic circuits is a stable plasmon source with variable plasmon statistics. In this context, a central question to realize such sources is to provide efficient pumping of the plasmons to compensate for losses in plasmonic nanostructures such as metal nanoparticles. One possible solution is the use of hybrid devices consisting of many gain providing identical quantum emitters like molecules or quantum dots located in proximity of the metal nanoparticle.

However, the basic operation mechanisms of such a hybrid strcutures is still intensively investigated. In this talk, we focus on the description of the plasmon and exciton number distributions giving a direct characterization of the underlying many body physics.

The developed density matrix method covers numerically exact the transition of the few emitter to many emitter limit up to more than one hundred identical quantum emitters and different limits of the plasmon emission statistics. The work presented is done in collaboration with Michael Gegg, T. Sverre Theuerholz, and Marten Richter.