Speaker: Prof. Jens-Uwe Sommer

Title: Gluonic and Regulatory Solvents: From Con-Nonsolvency to RNA-droplets.

Abstract:
A generic theoretical concept for phase segregation of polymers in the presence of multi-component selective solvents is presented. Phase separation is caused by non-specific attractive interactions between the polymers and a smaller component in the solution instead of repulsion between monomers and solvent molecules. We call the component which adsorbs on the polymers and thus causes condensation “gluonic”. It is shown that a discontinuous phase transition from a diluted or semi-diluted state to the condensed state takes place if the fraction of the gluonic component is increased. The origin of the discontinuous transition even in the absence of translational entropy of the chains is the appearance of higher-order negative virial coefficients in the free energy. The location of the phase coexistence can be shifted and tuned by influencing the binding efficiency of the gluonic component. This is achieved by introducing a regulatory component to the solution. The latter can bind to the polymer and thus block monomers from the interaction with the gluonic component. In this way switching of polymer state from dissolved to condensed can be controlled without changing the chemical properties of the polymer-solution-system. Applications of this model range from co-nonsolvency in synthetic polymers, to polymer-nanoparticle systems, to biological systems such as the formation of protein-RNA droplets.