LACNS

Louisiana Consortium for Neutron Scattering

SEMINAR SERIES 2018

Monday, April 16
3:00 pm
1008B Digital Media Center
Louisiana State University

Mechanics of Colloidal Suspensions driven either by dynamics or by structure

Guest Speaker

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The colloidal scale, the size range between nanometer and micrometer, is a fascinating world of foams, emulsions and particles of any shape and of any type of materials. The applications reach from cosmetics and wall paint, to membranes and concrete. At the colloidal length scale, experimental methods of the millisecond to minutes range can be applied due to the slowdown of a factor of 109 of dynamics compared to molecular systems. Colloids are driven by Brownian motion and can be prepared in various shapes and surface properties. Colloidal suspensions can be used as a model system of utmost simplicity in order to compare it to theory: the hard-sphere suspension. The special focus of this talk is located on concentrated colloidal suspensions, their phase transitions from the fluid to the glassy or the crystalline state and structural changes resulting in enhanced mechanical properties. These fluid-to-solid transitions are characterized by the mechanics and flow properties with rheological approaches, the structure by scattering methods, and the combination of these techniques (here: rheology and small angle neutron scattering (rheo-SANS)).

The first part will focus on the dynamical arrest of a concentrated suspension resulting in the glassy state. Resulting rheological properties will be compared to the Mode Coupling Theory. This theory and its underlying mechanism will be confirmed by diverse rheological experiments. In combination with the theory, predictions of complex history dependent glassy mechanics are possible and can be transferred to other types of glasses.

The second part will focus on enhancing the mechanical properties by structural changes: the crystallization of colloidal suspensions and shear-aligning of crystals are followed by means of rheo-SANS and compared with simulations. Finally, neutron small angle scattering combined with cryo-TEM revealed the mechanism of the build-up of a very strong self-healing gel.

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