ECIS 2022

36th European Colloid and Interface Society Conference – SHORT COURSE

Program – Syllabus

1st day (Friday, 2 September)

Experimental rheology (Jan Vermant) and Computer Simulations (Roseanna Zia & Vangelis Harmandaris)

(1) Rheology: *Jan Vermant*

9.00 - 10.30: Rheology basics: Landmark observations and rheological material functions for suspensions - Linear viscoelasticity: what is it good for? Brownian hard spheres and beyond.

30 min. break

11.00 - 12.30: Stable dispersions: Shear thinning and thickening in colloidal suspensions - Gelation: The ugly ducks in rheology - the yield stress and thixotropy - Advanced rheometrical tools for non-linear rheology and structure probing.

Lunch break 12.30 - 14.00

(2) Computer Simulations: *Roseanna Zia & Vangelis Harmandaris*

14.00 - 15.30: Introduction to computational modelling and simulation methods for complex molecular systems: Mathematical modeling and simulation methods, Molecular interactions: From atoms to colloids, Monte Carlo methods, Molecular dynamics simulations, Brownian dynamics, Fluctuations and time correlations, Hierarchical simulations across spatiotemporal scales

Simulations of colloids and interfaces: Interfaces and Interphases, Friction and gradient of dynamics at interfaces, Structural properties: Phase diagram of colloids, Structure and morphology of polymer and/or colloids at interphases, From atoms to macroscopic properties

30 min. break

16.00 - 17.30: Making simulations and experiments “talk” to each other: Brief overview of microscopic forces (hydrodynamic, entropic, enthalpic; short vs. long range), Reprise: The connection between microscopic forces, structure, phase behavior, & rheology, Equilibrium and dilute suspensions: a relatively easy task to match colloidal interactions in models to experiments, Gels, glasses, dense self-assembly: paving a new road

30 min. break

18.00 - 18.45: Outlook and future opportunities: Physics based models at very large scales, Machine and deep learning overview, Physics-based machine learning & opportunities

2nd day (Saturday, 3 September)

Scattering and Microscopy (Stefan U. Egelhaaf and Roberto Cerbino)

(3) Scattering techniques: Stefan U. Egelhaaf

9.00 - 10.30: Light Scattering techniques: Static light scattering (average intensity, interference, form and structure factor with simple models, SLS set-ups, examples)

30 min. break

11.00 - 12.30: Dynamic light scattering: fluctuations, correlation function, intermediate scattering function, homo-/heterodyne scattering with simple cases (sizing/polydispesity; diffusion versus directed motion) and not so simple cases (concentrated suspensions), DLS set-ups, examples

Neutron and x-ray scattering (briefly) Still waves but different radiation-matter interaction, set-ups, examples

Lunch break 12.30 - 13.30

Lab tour 13.30 - 14.30

(4) Microscopy and applications: Roberto Cerbino

14.30 - 16.00: Anatomy of a microscope: from light sources to detectors (a primer), Mechanisms of sample contrast: scattering (absorption, dephasing, birefringence) vs fluorescence, Diffraction-limited microscopy: bright-field, dark-field, phase-contrast, DIC, wide-field, confocal, light-sheet, digital holographic microscopy, Basics of super-resolution microscopy: single-molecule localization (PALM/STORM, PAINT) vs REversible Saturable OpticaL Fluorescence Transitions (STED)

30 min. break

16.30 - 18.00: Soft matter microscopy, Direct space experiments: particle localization and tracking in 2D and 3D (correlation, MSD, van Hove, rotational tracking, errors and artifacts), ensemble-averaged approaches (spatio-temporal image correlations, PIV), nanoscopy and applications, Reciprocal space experiments: Digital Fourier Microscopy, Differential Dynamic Microscopy and applications, Microscopy-based microrheology: passive (one- and two-points) microrheology, active microrheology, Poking while watching: microscopy meets rheology

18.00 - …: Round table and Barbeque