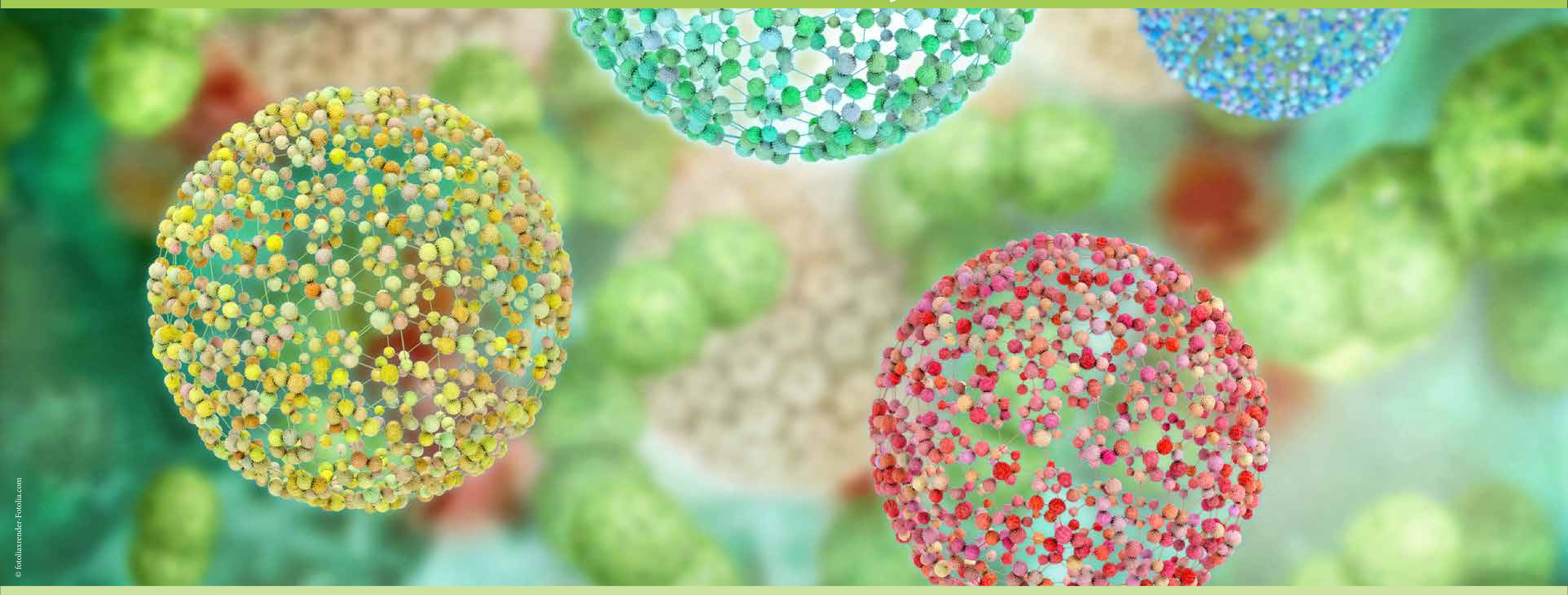
Thermodynamics and energetics of soft matter systems

Institut Laue-Langevin, Grenoble, France
from 24 to 26 July 2018



Soft matter pervades into daily life under several forms: biological matter, foams, food products, ink, tires, and many others. In contrast to their very different appearance, all these systems are governed by the same, fundamental physical laws. Aim of the school is providing an overview of the forces governing the behavior of soft matter systems and introducing the most relevant techniques to probe such interactions. The school proposes frontal lectures for doctoral students working in the field of soft matter given by recognized experts from all over Europe. Poster sessions will be opened for discussion on research topic and experimental results between students and invited lecturers.

Lecture 1: Introduction to colloid and interface Science
Emanuel Schneck
Introduction to colloid and interface science & its applications. Basic concepts. Van der Waals interactions, the electric double layer, and DLVO theory. Further interaction mechanisms (steric, depletion).

Lecture 2: Fundamentals of self-assembly processes
Christoph Schalley
Basic Principles in Supramolecular Chemistry. Non-Covalent Interactions and Host-Guest Complexes. Free energy landscape, polydispersity, cooperativity.

Lecture 3: Methods in calorimetry and volumetry
Giuseppe Lazzara
Free energy and its derivatives: the partial molar quantities. Relevance in colloidal systems and methods to access them. Enthalpy changes in supramolecular aggregates: van 't Hoff vs direct methods. Introduction and experimental tips in calorimetry and volumetry. Isothermal titration calorimetry: equilibrium and kinetics. Prediction abilities and case studies.

Lecture 4: Methods to probe energetics in biological systems
Roland Winter
Methods to probe the energetics, structure and conformational dynamics of biomolecular systems - Introduction to cell membranes, model biomembranes, lipid phase transitions. Proteins and their stability, free energy landscape, folding kinetics, interactions. Methods to probe the thermodynamics, conformation, dynamics and interactions of biomolecules (calorimetry (DSC, PPC, ITC), spectroscopies (FTIR, fluorescence techniques, etc.), AFM, fluorescence microscopy, small-angle scattering)

Lecture 5: Physics of macromolecular Systems
Julian Oberdisse
Conformation of polymer chains, chain statistics, polymer solutions and blends, thermodynamics, phase separation, mechanical properties.

Lecture 6: Thermodynamics of interfaces
Antonio Stocco
Thermodynamics of interfaces and adsorption, surface tension, contact angle, wetting. Interaction between surfaces and stabilisation mechanisms (foams, emulsions).

Lecture 7: Solvation and Solubilization
Dominik Horinek
Ideal and real mixtures and solutions. Molecules and macromolecules in solution. Free energy of solvation, chemical potentials, activity coefficients: experimental and theoretical approaches. A microscopic view from homogeneous to structured solutions: osmolytes, hydrotropes, surfactants. Concepts from Kirkwood-Buff theory. Solubilization in micro-structured solvents.

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