Course Contents

In this lecture series an introduction will be given into the science of soft condensed matter (SCM), which includes systems such as polymers, surfactants, liquid crystals, and colloids. These systems behave like viscous fluids or soft solids and are also called complex fluids. They require insights and methods from both chemistry and physics. In the first lectures the foundations of thermodynamics and statistical mechanics (ensemble theory, liquid state theory) are reviewed, as they form the basis for a theoretical description of SCM. This formalism is applied to Debye-Hückel theory, pair distribution functions, and to the description of phase transitions in SCM systems (liquid-gas, hard-sphere crystallization, isotropic-nematic liquid crystal). The lecture series will also include an introduction to computer simulation methods, which form an important means of investigating these complex systems. Interparticle interactions are treated: electrical double layers, Van der Waals forces, DLVO theory, and depletion forces. Experimental methods that are used in the study of SCM are explained: scattering methods (using light, x-rays or neutrons), microscopy, and direct methods to measure forces. Using the concepts thus introduced, a more in-depth treatment is then given to the properties of concentrated dispersions, which include systems consisting of polymers, emulsions, and quantum dots. In a few more advanced lectures, the dynamics of colloidal dispersions will be addressed. This will include Brownian motion, rheology (flow and deformation properties), and behaviour in external fields. The lecture series will include lectures on the synthesis of colloidal dispersions and on the use of colloidal building blocks for the fabrication of advanced nanoscale materials such as photonic crystals.

Participants

The course is intended for interested masters or PhD students, although any interested postdoc is welcome as well. The first week gives a general introduction to soft condensed matter (20 hour lectures; 15 hour problem classes with teaching assistants), week two gives a more advanced course on colloids (about the same length).

Level

The participants are expected to have mastered on an introductory (Bachelor) level: statistical mechanics, classical mechanics and electrostatics.

Lecturers

All lecturers are staff of Utrecht University and the Debye Institute in which Physics & Chemistry groups work together on interfaces and nanomaterials.

Soft Condensed Matter Group, Physics Department:
Alfons van Blaaderen, ***Marjolein Dijkstra***, ***Arnout Imhof***

Institute for Theoretical Physics
René van Roij

Van `t Hoff Lab., Chemistry Department:
Willem Kegel, ***Henk Lekkerkerker***, ***Gert Jan Vroege***

Condensed Matter & Interfaces, Chemistry Department
Daniel Vanmaekelbergh (DvM)

Advisors

Albert Philipse, Henk Lekkerkerker, Alfons van Blaaderen

Contact:

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Webpage: WWW.COLLOID.NL/UCC

Course Layout Week I (hours, lecturer)

Layout of the day
9:00-11:00: Lectures; 11:00-12:30: Problem Classes
12:30-14:00: Lunch
14:00-16:00: Lectures; 16:00-17:30: Problem Classes

Monday, April 16th
Introduction
(2, van Blaaderen)
Thermodynamics / Statistical Mechanics
(2, van Roij)

Tuesday, April 17th
Liquid State Theory: Classical Fluids
(2, van Roij)
Static and Dynamic Scattering Techniques
(2, Imhof)

Wednesday, April 18th
Static and Dynamic Scattering Techniques
(1, Imhof)
Computer Simulations
(1, Dijkstra)
Thermodynamics / Statistical Mechanics of Interfaces (2, Kegel)

Thursday, April 19th
Polymers
(2, Vroege)
Surfactants
(2, Kegel)

Friday, April 20th
Quantum Dots
(2, Vanmaekelbergh)
Polymers
(2, Vroege)

Saturday, April 21st
Social event

Course Layout Week II (hours, lecturer)

Layout of the day
9:00-11:00: Lectures; 11:00-12:30: Problem Classes
12:30-14:00: Lunch
14:00-16:00: Lectures; 16:00-17:30: Problem Classes

Monday, April 23rd
DLVO Potential
(2, van Blaaderen)
Theory of Soft Condensed Matter
(2, van Roij)
Afternoon: posters

Tuesday, April 24th
Synthesis & Characterization of Colloids
(2, van Blaaderen)
Simulations
(2, Dijkstra)

Wednesday, April 25th
Techniques to Measure Interaction Forces
(2, van Blaaderen)
Phase Behavior
(2, Lekkerkerker)
Afternoon: lab visits

Thursday, April 26th
Phase Behavior
(2, Lekkerkerker)
Dynamics
(2, Imhof)

Friday, April 27th
Phase Behavior
(2, Lekkerkerker)

Registration:

Registration will be by filling out a form on the website of the course: WWW.COLLOID.NL/UCC
Deadline: 1st of March, 2007 (Max. # of students: 40; first come, first serve).

Accommodation and Travel:

Accommodation should be arranged by the participants themselves. Suitable options can be found on the course website: www.colloid.nl/ucc , where travel directions can also be found.
Lectures will take place in the Minnaert building, Leuvenlaan 4, on the campus of Utrecht University.

Fee:

One week only:	125 €
Full course, two weeks:	250 €

The course fee includes lecture notes, coffee/tea, welcome lunch, farewell lunch, and social event. Dinner and lunch are NOT included but can be obtained cheaply at the university cafeteria or in the city centre.
Full reimbursement will only be possible if notification of cancellation is received before March 16th, 2007.

Posters:

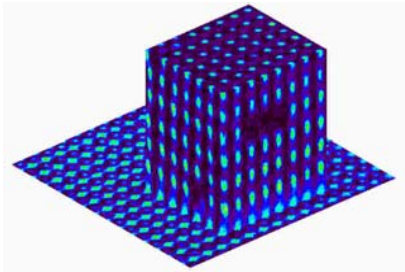
Although not obligatory, students are encouraged to bring a poster describing their research topic. During a poster session early in the course one can learn about each other's research area.

The course is kindly supported by:

Utrecht University, SFB-TR6, SoftComp NoE.

2-Week Masters/PhD Course

Introduction to Soft Condensed Matter & Advanced Colloid Science



16 – 27 April, 2007
(Registration before 1st of March, 2007)

Utrecht University, Netherlands

Universiteit Utrecht

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