

The IFF Spring School & Solid-State, Soft-Matter and Biophysics Research in Jülich

The annual IFF Spring School arises from the tradition of the Institut für Festkörperforschung (IFF) which was founded in 1969. The institute's research topics ranged from electronic and structural properties of solids, and nanoelectronics, to the thermal and dynamical behavior of soft matter. The IFF had organized this spring school for over 40 years. Since the restructuring in 2011, research of electronic systems and phenomena, as well as their applications in information technology, is combined in the Peter Grünberg Institut (PGI) named after the IFF scientist who received the Nobel Prize for physics in 2007. Soft matter and biophysics research is integrated in the Institute of Complex Systems (ICS). These institutes are linked together and supported by the Institute for Advanced Simulation (IAS), which focuses on developing and applying high-performance computing to understand complex systems, and the Jülich Centre for Neutron Science (JCNS), which is dedicated to the operation of neutron scattering instruments and national and international neutron sources. The IFF Spring School is now organized in turns by PGI, ICS and JCNS.

The Institute of Complex Systems (ICS) consists of 8 departments: neutron scattering, theoretical soft matter and biophysics, soft matter, cellular biophysics, molecular biophysics, structural biochemistry, biomechanics, and bioelectronics. Designing functional soft materials, predicting their properties and fine-tuning their performance is the visionary goal of soft matter science. A major objective of biophysics is to understand processes far from equilibrium, which distinguish dead and living matter. Proteins are exquisitely designed nano-machines; understanding their structural and dynamical properties on the basis of elementary molecular interactions and physical principles is a prerequisite for the development of cures for many diseases.

An essential part of the mission of the Institute of Complex Systems is the interdisciplinary education of graduate students at the interface between physics, chemistry and biology. Here, the International Helmholtz Research School on Biophysics and Soft Matter (IHRS BioSoft) provides a program of introductory and advanced lectures, seminars, lab courses, retreats, and transferable skills courses. More information is provided on the webpage <http://www.ihrs-biosoft.de>.

Further the institute is coordinating the Marie Skłodowska Curie Initial training network SOMATAI which provides continuous scientific education and soft skills training to a team of 14 early stage researchers. Further details are given at <https://somatai.eu>.

How to find us:



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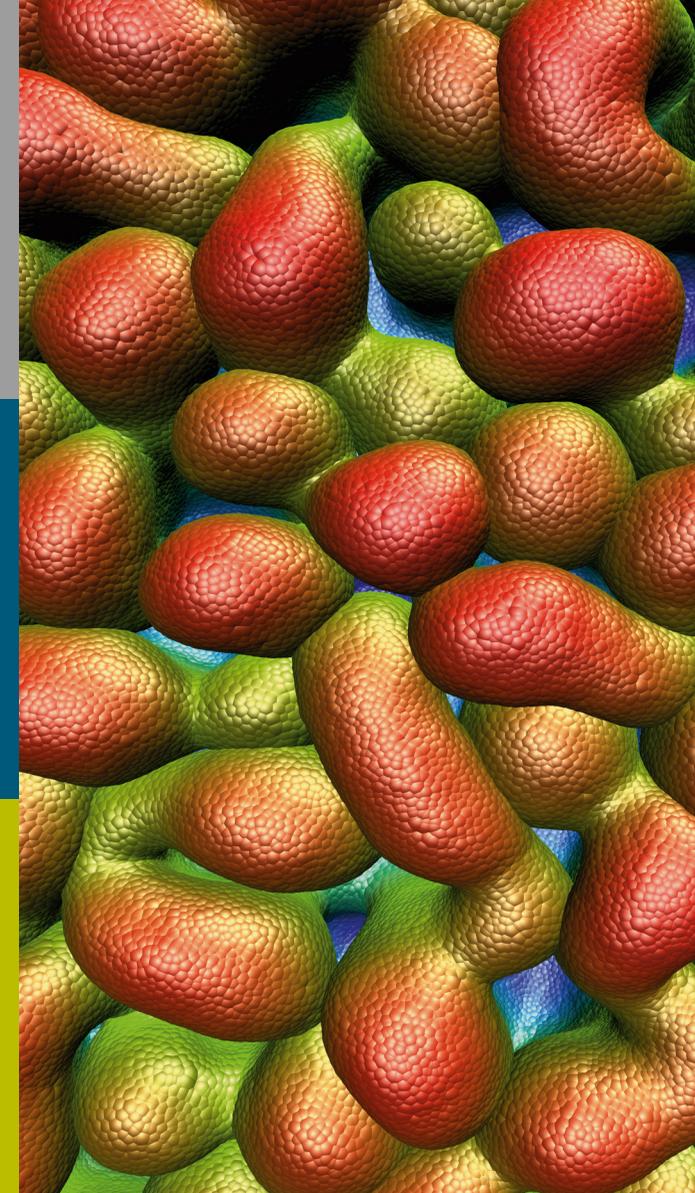
Registration and Further Information

www.iff-springschool.de

The lecture programme, travelling information, and participant card will be sent in due course to all registered participants.



Member of the Helmholtz Association



Functional Soft Matter

46th IFF Spring School 2015
23 February – 6 March 2015 in Jülich, Germany

Overview

The spring school intends to give an introduction to and an overview of current research topics of soft matter systems with the emphasis on biological and technological functionality. Synthetic and biological polymers, polyelectrolytes, amphiphiles and colloids are the building blocks of many materials. The understanding of their structural and dynamical properties is important for the rational design of structures with predefined functionality and is challenging due to the enormous complexity of these systems.

The goal of this spring school is not only to teach selected topics from soft matter science and biophysics to students and postdocs in physics, chemistry and biology but also to establish the interdisciplinary connection between these fields. This includes, in particular, to introduce biologists and chemists to physical experimental methods and theoretical modelling, and to introduce physicists to the large variety of fascinating chemical and biological phenomena.

Introductory lectures will present the basics of soft matter science and biophysics. These lectures are intended to establish a common level of basic interdisciplinary knowledge. Subsequent lectures will then treat more advanced topics within both disciplines and emphasize interdisciplinary aspects. In addition, experimental and computer simulation techniques will be introduced and explained, and examples of applications will be given.

Program

The school provides about 50 hours of lectures, including discussions, and offers the opportunity to visit the participating institutes at Forschungszentrum Jülich. All lectures will be given in English. All registered participants will receive a book of lecture notes, which contains all the material presented during the school. The lectures are grouped together in seven sections. The first three sections introduce the fundamental concepts of the field, the next three cover special fields of application, and in the last future technologies are presented.

Materials

Colloidal and polymeric building blocks that are used to design functional materials have the unique property that interactions, enthalpic and entropic, can be tuned precisely such that new structures with specific and optimized functionality can be engineered. Biomolecules like proteins, DNA and lipids are optimized by evolution and form the building blocks for complex structures with a versatile biological functionality.

Theory & Simulation

The structure and dynamics of soft matter systems is most commonly described within the framework of classical statistical mechanics, by continuum hydrodynamics and by using scaling theory.

Basic lectures will be presented on these theoretical approaches. Many phenomena, however, are too complex to obtain quantitative information from analytical theories necessitating numerical techniques of which molecular dynamics, Monte Carlo, mesoscale hydrodynamics simulations will be introduced here.

Experimental Methods

The study of soft matter systems is particularly challenging since very often the microscopic building blocks are inherently complex and the relevant length and time scales in these systems span many orders in magnitude. Success requires a combined effort of preparative techniques (synthesis), the elucidation of structural and dynamical properties by scattering, microscopy, rheology and single molecule techniques.

Interface-Dominated Materials

In many soft matter systems, interfaces are of major importance because the area per volume is unusually large. The school will cover materials which show a spontaneous development of interfaces as microemulsions and cell membranes as well as situations where interfaces are created artificially in nanocomposites or nanoconfinement.

Biological Matter

The investigation of structure-property relations in biomatter is a key-prerequisite for the understanding of diseases and the development of new treatment options. The structure and interactions of proteins play a central role. Emphasis will be given to the ability of proteins to form complex 3-D structures ruling extraordinary dynamical behavior and their specific inter-domain dynamics. Advanced lectures will discuss proteins that are embedded in membranes. As a prominent medical example, recent developments concerning Alzheimer's disease will be presented.

External Fields and Active Matter

Many systems, in technological applications and in living organisms, are far out of equilibrium either by external stimuli or due to intrinsic properties. Therefore, a series of lectures will be provided which encompass the action of external fields on matter, such as flow, pressure, electric fields, and temperature. In addition, intrinsically non-equilibrium systems, like microswimmers or active gels will be addressed.

Future Technologies

Functional soft matter bears a large potential for technological applications. Many of these are related to the grand challenges of the 21st century: Polymers are used as membranes in batteries and fuel cells. Bioelectronic devices are new tools for the treatment of diseases. Also, novel types of materials will be covered, such as polymers with tailored architecture and self-healing materials.

General Information

Venue

The IFF-Spring School will take place in the Auditorium of the Forschungszentrum Jülich from 23rd February – 6th March 2015.

Participation

Participants are expected to have a basic knowledge of soft matter science and biophysics.

Registration Deadline

All participants are asked to register via internet at www.iff-springschool.de before 15th December 2014.

Travel Information

A shuttle service will take participants to Forschungszentrum Jülich in the morning and back to their accommodation after the lectures are concluded. The daily transfer is free for all registered participants.

Accommodation, Lunch and Dinner

Low-cost accommodation will be arranged at a youth hostel in Aachen. The accommodation fee of € 360 includes breakfast and dinner. Lunch will be provided at the Forschungszentrum Jülich from Monday to Friday at your own cost.

Arrival: Sunday, 22nd February 2015

Begin of lectures: Monday, 23rd February 2015

Departure: Friday afternoon, 6th March 2015

Students who have not yet finished their Master's degree can apply for financial support from the Forschungszentrum Jülich to cover part of the accommodation costs. To qualify for this support, valid proof of student status must be supplied. Accommodation for participants from nearby universities can only be provided if there are still places available after the registration deadline.

Payment and Cancellation Policy

On completing registration for IFF-Spring School you will receive E-Mail confirmation. Participants who are in need of accommodation at the Youth Hostel will receive an invoice with all relevant information regarding the transfer of the accommodation-fee in due time. Cancellations must be received before 26th January 2015, otherwise a payment of 50 Euro is required.

Hotels in Aachen and Jülich

If you would prefer to stay in a hotel in Aachen or Jülich at your own cost, please contact springschool@fz-juelich.de for an accommodation list.