TIME TABLE

(Registration on Monday at 8:30)

TIME	Monday	Tuesday	Wednesday	Thursday	Friday
	June 30	July 1	July 2	July 3	July 4
9.00 - 9.45	Morozov	Squires	Marenduzzo	Pouliquen	Wyart
9.45 - 10.30	Morozov	Squires	Students	Pouliquen	Wyart
11.00 - 11.45	Morozov	Squires	Saintillan	Pouliquen	Wyart
11.45 - 12.30	Morozov	Students	Saintillan	Pouliquen	Students
14.00 - 14.45	Morozov	Marenduzzo	Saintillan	Pouliquen	
14.45 - 15.30	Students	Marenduzzo	Saintillan	Students	
16.00 - 16.45	Squires	Marenduzzo	Saintillan	Wyart	
16.45 - 17.30	Squires	Marenduzzo	Students	Wyart	

ADMISSION AND ACCOMMODATION

Applicants must apply at least one month before the beginning of the course. Application forms should be sent on-line through our web site: http://www.cism.it or by post.

A message of confirmation will be sent to accepted participants. If you need assistance for registration please contact our secretariat.

The 700,00 Euro registration fee includes a complimentary bag, four fixed menu buffet lunches (Friday subject to numbers), hot beverages, downloadable lecture notes and wi-fi internet access.

A limited number of participants from universities and research centres who are not supported by their own institutions can be offered board and/or lodging in a reasonably priced hotel. Requests should be sent to CISM Secretariat by **April 30, 2014** along with the applicant's curriculum and a letter of recommendation by the head of the department or a supervisor confirming that the institute cannot provide funding. Preference will be given to applicants from countries that sponsor CISM.

Information about travel and accommodation is available on our web site, or can be mailed upon request.

For further information please contact:

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Piazza Garibaldi 18
33100 Udine (Italy)
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e-mail: cism@cism.it

Centre International des Sciences Mécaniques
International Centre for Mechanical Sciences

ACADEMIC YEAR 2014

The Simo Session

FLOWING SOFT MATTER: BRIDGING THE GAP BETWEEN STATISTICAL PHYSICS AND FLUID MECHANICS

Advanced School
coordinated by

Denis Bartolo
ENS Lyon
France

David Saintillan
University of California
San Diego, La Jolla
CA, USA

Udine ***June 30 - July 4*** 2014

FLOWING SOFT MATTER: BRIDGING THE GAP BETWEEN STATISTICAL PHYSICS AND FLUID MECHANICS

Polymer solutions, colloidal suspensions, emulsions, gels, granular matter, biological materials such as the cytoskeleton, bacterial suspensions, and cellular tissues are all complex materials lying at the interface between fluids and soft solids. Their mechanical properties result from the subtle interplay between their microstructure at the mesoscales, and the forces driving the flows either at the macroscale (e.g. sheared, and advected fluids) or at the microscale (e.g. thermal fluctuations, or local self-propulsion).
Much research efforts have been devoted to understand the flow properties of these soft materials, in fields as diverse as soft-condensed matter physics, biophysics, materials science, chemical and mechanical engineering. Two main complementary descriptions have emerged in these different communities: on the one hand, these complex fluids can be described as continua using the equations of fluid mechanics with phenomenological constitutive laws; on the other hand, they can also be described using non-equilibrium statistical physics. In this context the constitutive laws and the mesoscale fluctuations are accurately described, but only yield minimalistic mechanical models. Both approaches have their merits, and their combination has proven to yield outstanding advances in the understanding of the large-scale mechanical properties of some complex systems such as polymeric fluids. However, over the last 20 years, interactions between the fluid-mechanics, soft-condensed-matter and statistical-physics communities have been scarce.
The objectives of this Summer School are twofold: first, present the participants with an overview of the exciting field of flowing soft matter, with focus on a few topics of active research interest; second, reconcile the statistical-physics and fluid-mechanics descriptions of these systems, by bringing together lecturers from both communities to discuss similar problems from the perspective of their own discipline. The contents of the School will articulate around three main themes:

(1) Fluctuations at all scales in Viscoelastic Fluids,
(2) Mechanics and Structure of Active Fluids,
(3) Flows and Arrest in Dense Suspensions and Granular Materials.

These themes have been selected to reflect current interests in soft-matter research, while being distinct enough from one another to provide a broad and general introduction of the field to the participants.
Our purpose is to provide the Summer School participants with two complementary lectures on each theme: two researchers of different backgrounds will give 5 lectures each on a subject related to their research interests.
The targeted audience for this Summer School will be advanced PhD students as well as postdoctoral researchers in departments of Physics, Biophysics, Engineering, and Materials Science.
The participants are also invited to give a short oral presentation on their research.

PRELIMINARY SUGGESTED READINGS

A.N. Morozov and W. van Saarloos, "An introductory essay on subcritical instabilities and the transition to turbulence in visco-elastic parallel shear flows", Phys. Rep. 447, 112 (2007).

T.M. Squires, T.G. Mason, “Fluid mechanics of microrheology,” Annu. Rev. Fluid Mech. 42, 413-438 (2010).

M.C. Marchetti, J.-F. Joanny, S. Ramaswamy, T.B. Liverpool, J. Prost, M. Rao, R. Aditi Simha, “Soft active matter”, Rev. Mod. Phys. 85, 1143-1189 (2013).

D. Saintillan and M.J. Shelley, "Active suspensions and their nonlinear models", C. R. Physique 14, 497 (2013).

J.J. Stickel, R.L. Powell, “Fluid mechanics and rheology of dense suspensions”, Annu. Rev. Fluid Mech. 37, 129-149 (2005).

E. Lerner, G. During, M. Wyart, “A unified framework for non-Brownian suspension flows and soft amorphous solids”, PNAS 109, 4798-4803 (2012).

INVITED LECTURERS

Alexander Morozov - University of Edinburgh, UK
5 lectures on: Non-Newtonian Fluid Mechanics and Elastic Instabilities.
Basics of non-Newtonian fluid mechanics will be reviewed, with emphasis on viscoelastic fluids and the effects of fluid elasticity on the emergence of large hydrodynamic fluctuations (viscoelastic instabilities, and transition to chaos and turbulence).

Todd Squires - University of California, Santa Barbara, CA, USA
5 lectures on: Microrheology of Complex Fluids.
This section will focus on the microscopic basis for non-Newtonian behavior, and more specifically on the theory of microrheology as a tool for the measurement of complex rheological properties and small-scale fluctuations.

Davide Marenduzzo - University of Edinburgh, UK
5 lectures on: Active Liquid Crystals and Active Soft Matter. This section will review recent developments in the field of active liquid crystals and other active materials, from a soft-condensed matter perspective.

David Saintillan - University of California San Diego, La Jolla, CA, USA
5 lectures on: Fluid Mechanics of Active Suspensions.
Recent models for the fluid mechanics of suspensions of self-propelled microorganisms will be presented, from the description of individual swimmers to the modeling of collective dynamics.

Olivier Pouliquen - IUSTI, Polytech Marseille, France
5 lectures on: Fluid Mechanics of Dense Suspensions.
Flow properties of dense particulate suspensions and wet granular materials will be discussed, with an emphasis on hydrodynamics and rheological behavior.

Matthieu Wyart - New York University, NY, USA
5 lectures on: Jamming and Unjamming Transitions in Disordered Solids.
This section will also consider dense suspensions and granular matter, but will focus on the statistical physics of the (un)jamming transition in these systems.

LECTURES

All lectures will be given in English. Lecture notes can be downloaded from the CISM web site, instructions will be sent to accepted participants.

FLOWING SOFT MATTER: BRIDGING THE GAP BETWEEN STATISTICAL PHYSICS AND FLUID MECHANICS

Udine, June 30 - July 4, 2014
Application Form
(Please print or type)

Surname _____

Name _____

Affiliation_____

Address_____

_____

E-mail _____

Phone _____Fax_____

Method of payment upon receipt of confirmation (Please check the box)

The fee of Euro 700,00 includes IVA/VAT tax and excludes bank charges

❑ *I shall send a check of Euro* _____

❑ *Payment will be made to CISM - Bank Account No. 094570210900, VENETO BANCA - Udine (CAB 12300 - ABI 05035 - SWIFT/BIC VEBHIT2M - IBAN CODE IT46 N 05035 12300 09457 0210900). Copy of the receipt should be sent to the secretariat*

❑ I *shall pay at the registration counter with check or VISA Credit Card (Mastercard/Eurocard, Visa, CartaSi)*

IMPORTANT: CISM is obliged to present an invoice for the above sum. Please indicate to whom the invoice should be addressed.

Name _____

Address _____

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C.F.* _____

VAT/IVA* No. _____

(*) Only for EU residents or foreigners with a permanent business activity in Italy.

Only for Italian Public Companies

❑ *I ask for IVA exemption (ex law n. 537/1993 - art. 14 comma 10).*

Privacy policy: I understand that data received via this form will be used only to provide information about CISM and its activities, within the limits set by the Italian legislative decree no. 196/2003 and subsequent amendments.
Complete information on CISM's privacy policy is available at www.cism.it.

I have read the "Admission and Accommodation" terms and conditions and agree.

Date _____ Signature _____