

Internship / PhD Thesis 2021 in Statistical Physics and Modeling

Laboratoire Interdisciplinaire de Physique (LIPhy)

Univ. Grenoble Alpes and CNRS, Grenoble



Where is the LIPhy?

Vous êtes ici

Le LIPHY est là



A nice campus...



Presentation of the Laboratory

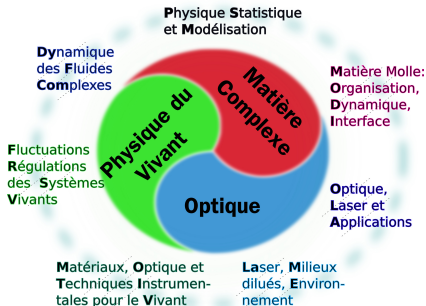
- 8 teams, 140 people, 60 permanent researchers
- Mostly working at the interface with other disciplines, collaboration with other labs:
 - Life sciences (biology, medicine, neurosciences)
 - Geosciences, astrophysics
 - Mechanics, applied maths, materials
 - Chemical aspects of complex matter
- Strong tradition in instrumentation development
+ Modeling and numerical simulations

Research at LIPhy

3 axes of research

- Optics, laser techniques and applications
- Physical models of biological objects (e.g., vesicle as a model of red blood cell)
- Soft matter and statistical physics: complex fluids, interfaces, microfluidics, materials...

Both **experiments** and **theory**



First axis of research

Optical instrumentation and applications

- Ultra-sensitive spectrometry: planetology, climatology, environmental sciences, medicine
- Laser: imaging, telemetry, microfabrication
- Non-conventional microscopies and life sciences

Second axis of research

Physical models of biological objects

- Fluctuations and regulation in biological systems:
transcription, evolution, modeling of ecosystems
Theory/Modeling
- "Biomechanics": adhesion and cellular motility, rheology of
biological fluids
Theory/Modeling

Third axis of research

Complex matter and statistical physics

- Statistical physics of collective phenomena out of equilibrium (active matter and self-propelled particles, growing interfaces,...) **Theory/Modeling**
- Multi-scale modeling of driven amorphous materials (emulsions, suspensions, gels, etc. under shear) **Theory/Modeling**
- Modeling at molecular level, from biophysics to material sciences (atomic or molecular clusters, interactions between DNA and proteins in the cells,...) **Theory/Modeling**
- Microfluidics and suspensions of microswimmers and other small deformable objects (vesicles,...) **Theory/Modeling**

Internships / PhD thesis
in STATISTICAL PHYSICS
and MODELING
proposed for 2021

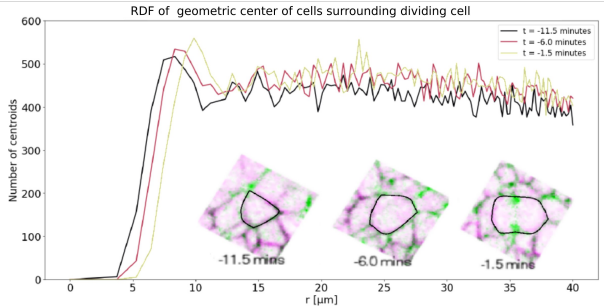
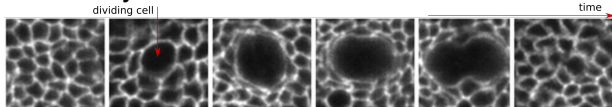
Modeling biological tissues

Biophysics: Inferring the mechanics of living tissue from statistical analysis of its deformation

The emergent mechanical properties of tissue are still not understood.

We will use a large dataset of tissue deformation around dividing cell records to extract statistical information on the structure of the tissue and characterize it.

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LIPHY, Domaine Universitaire
Poursuite en thèse souhaitée

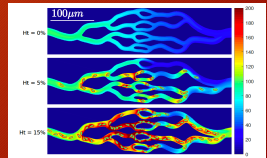


Dynamics of Complex Fluids

Chauqi Misbah
Liphy

Simulation of Blood flow and biochemical signaling

- **Lattice Boltzmann Simulation and artificial intelligence**
- Red blood cells (RBCs) interact via hydrodynamics,
- RBCs release ATP under flow, interact with endothelial cells, leading to Calcium waves, Nitric Oxide generation (vasodilator) → Blood flow regulation
- RBC interact via depletion forces due to fibrinogen (plasma proteins) → Adhesion (clot formation) thromboembolism
- Fundamental questions: rheology (global and local); complex fluid
- Application: cardiovascular dysfunction, world's leading cause of mortality
- Coupling simulation/experiments/medical science
- Phd possible



Preliminary simulations

Contact

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*See also the webpages of the different teams (and in particular the **“Statistical Physics and Modeling”** team) on the LIPhy website*