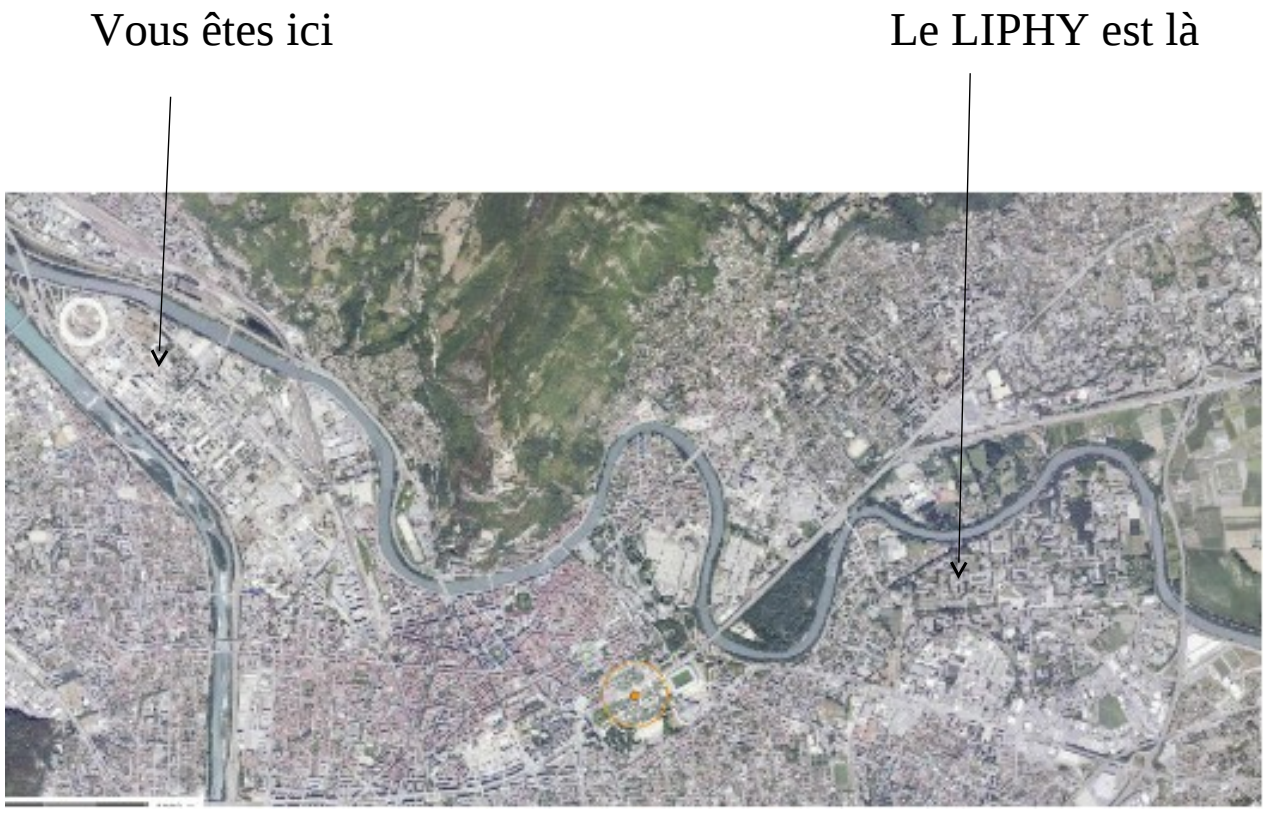
Internship / PhD Thesis 2020 in Statistical Physics and Modeling

Laboratoire Interdisciplinaire de Physique (LIPhy)

Univ. Grenoble Alpes and CNRS, Grenoble

Where is the LIPhy?



A nice campus...

Presentation of the Laboratory

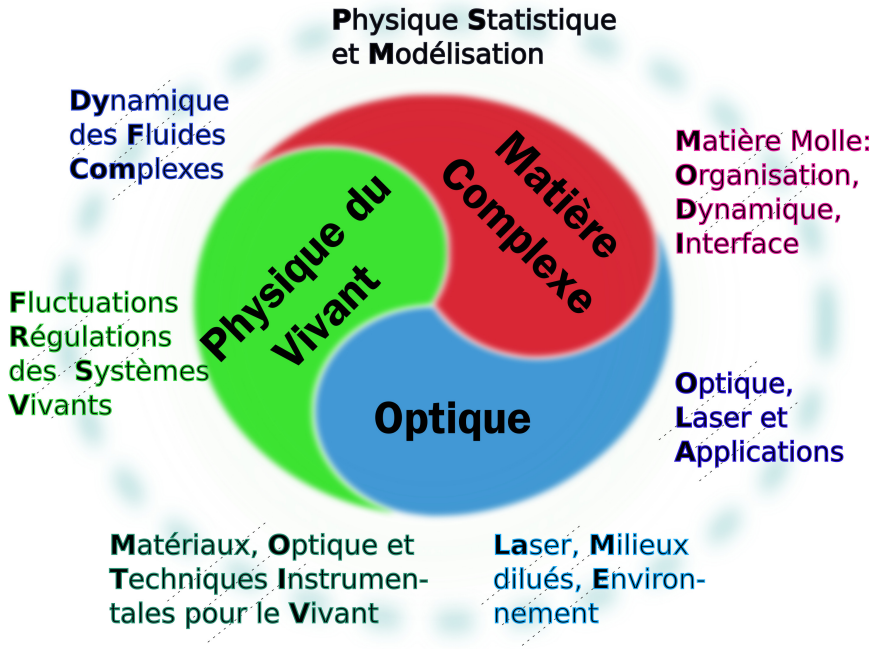
- 3 axes of research, 7 teams, 140 people, 60 permanent researchers
- Mostly working at the interface with other disciplines, collaboration with other labs:
  - Life sciences (biology, medicine, neurosciences)
  - Geosciences, astrophysics
  - Mechanics, applied maths, materials
  - Chemical aspects of complex matter
- Strong tradition in instrumentation development
  + Modeling and numerical simulations

Research at LIPhy

3 axes of research, 7 teams

- 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, medecine
- 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

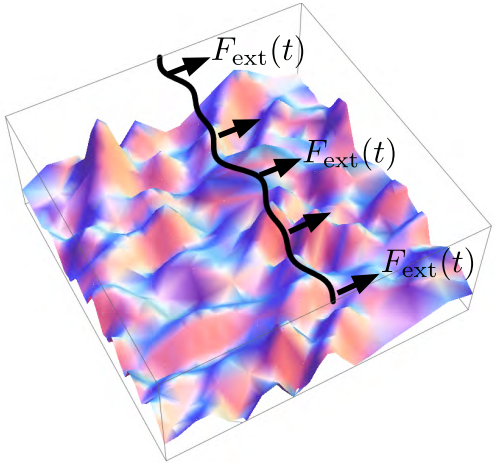
- Statistical physics of collective phenomena out of equilibrium (active matter and self-propelled particles, growing interfaces,...) Theory/Modeling
- Multi-scale modeling of driven amorphous materials (emulsions, suspensions, gels, etc. under shear) Theory/Modeling
- Modeling at molecular level, from 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 2020

"Statistical Physics and Modeling" team

Memory and inertia in problems of statistical mechanics

Driven disordered systems

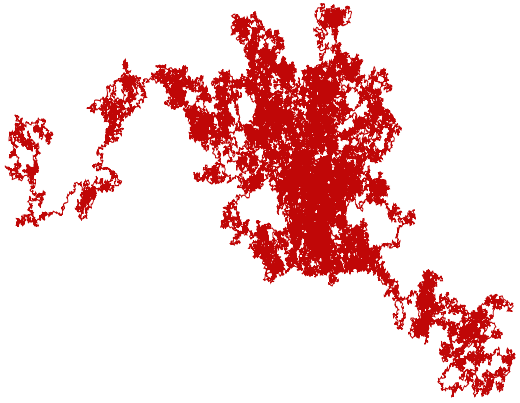


Role of internal degrees of freedom?

Active matter

Role of time-correlated noise?

Stochastic path integrals



Discretization for a massive particle?

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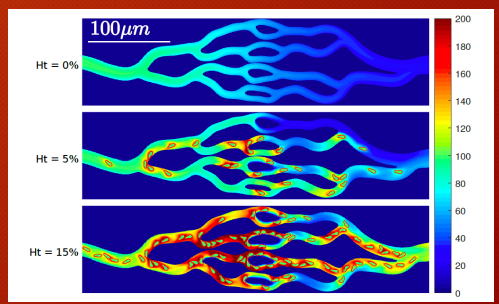
M2 internship ↦ PhD is possible

"Dynamics of Complex Fluids" team

Chaouqi 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 dysfynction, world's leading cause of mortality**
- **Coupling simulation/experiments/medical science**
- **Phd possible**



Preliminary simulations

Contact

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See also the webpage of the "Statistical Physics and Modeling" team