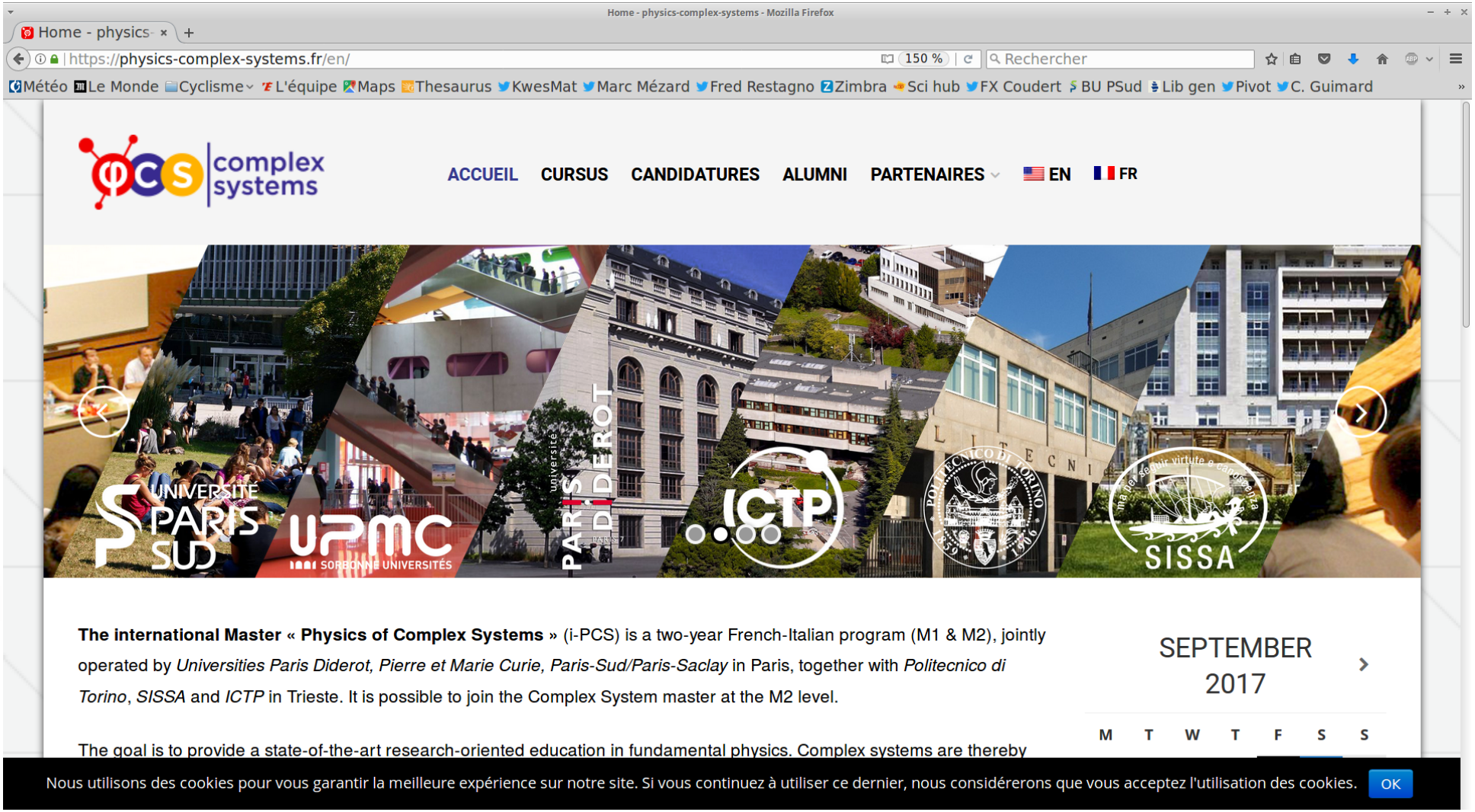
Physics of Complex Systems Master
Kickoff meeting

J.-B. Fournier, D. Mouhanna, E. Trizac

September 3rd 2018

Welcome



Jointly operated with Polito, SISSA, ICTP

Organization of the year (PCS+ PCS-like iPCS)
See below for true iPCS

- **First semester** → Dec 7
- Autumn break and tour of labs : Oct 29 – Nov 2
- Second semester courses presentation mid November
- 1 week of revisions
- First round of exams before Xmas
- Second round early January
- **Second semester courses** : Mid Jan → March 1nd
- Exams mid March
- Internships → defense end of June

More details available on the web

iPCS version

- First semester common
- Start of internship earlier : mid January
- Internship sandwiches
  Trieste “Spring” College : Feb 25 → March 22

2016

2017

2018

Program changes every year ; see web
Also open to some Master & PhD students + **some PCS as well**

- Internship defense : mid July in Italy
- Graduation ceremony in October in Italy

First semester schedule

S3 - Physics of Complex Systems (PCS) - 2018 / 2019

	MONDAY (Paris Diderot)	TUESDAY (UPMC, Jussieu)	WEDNESDAY (Paris Diderot)	THURSDAY (UPMC, Jussieu)	FRIDAY (Paris Diderot)
08:30 10:30		**Advanced nonlinear physics** *L. Foret & N. Pavloff* T23/24 201	**Statistical field theory** *J.-B. Fournier* HF 234C (17/10 : HF 379F)	**Mathematical tools** *G. Roux* T23/24 201	**Computational science** *F. Krzakala* HF 418C
10:45 12:45	**Nonlinear physics and dynamical systems** *C. Nore* ODG 153	**Quantum field theory** *J. Serreau* T23/24 201	**Statistical physics of simple & complex fluids** *M. Durand & G. Foffi* HF 234C (17/10 : HF 379F)	**Biophysics** *M. Lenz* T23/24 201	**Stochastic processes** *D. Mouhanna & C. Deroulers* HF 419C
13:45 15:45	**Statistical field theory** *J.-B. Fournier* HF 418C (3/9-10/9 : ODG 153) (24/9 : HF 470E) (22/10 : ODG 1)	**Numerical simulations** *P. Viot* T23/24 201	**Stochastic processes** *D. Mouhanna & C. Deroulers* SG 1021		**Nonequilibrium and active systems** *J. Tailleur* HF 470E
16:00 18:00	**Advanced statistical mechanics** *L. Cugliandolo* HF 418C				

ODG = Olympe de Gouge, HF = Halle aux farines, SG = Sophie Germain
T23/24 = Tour 23/24

The exams

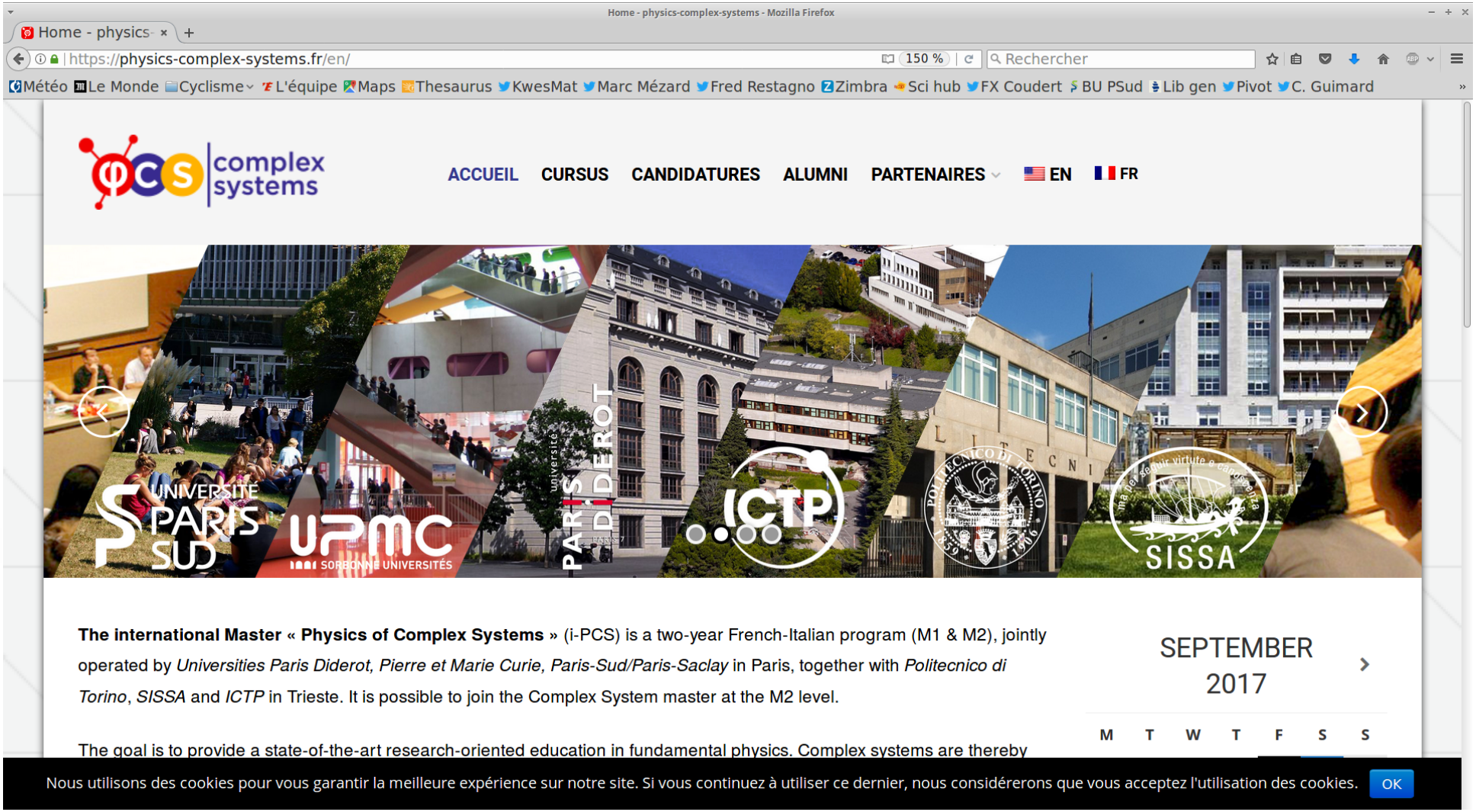
- In December or March (Spring college apart)
- Written ; grade over 20
- If grade < 10, possibility of an oral exam.
  Course grade is *saturated to 10*.
-  Narrow time window for orals
  (1 week, before the jury in Jan)

- Very different from Italian system
- Exams are concentrated (written+oral)
- In practice : 1 session only
  The second session arrives after doct school competition
  → too late / irrelevant
- **First semester usually harder**

and some PhD applications (abroad)
are in March : second semester irrelevant

→ Work all courses simultaneously
And start now !

Relevant information on the web



See in particular
Documents + Internships & PhD

Home - physics-complex-systems - Mozilla Firefox

Home - physics

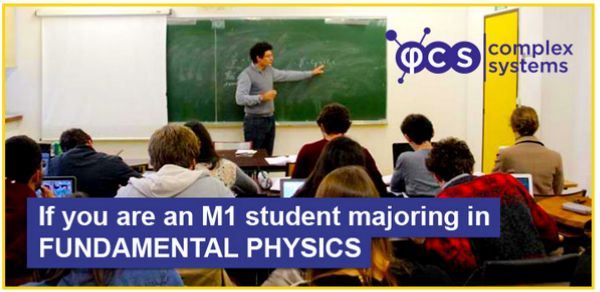
https://physics-complex-systems.fr/en/

Météo Le Monde Cyclisme L'équipe Maps Thesaurus KwesMat Marc Mézard Fred Restagno Zimbra Sci hub FX Coudert BU PSud Lib gen Pivot C. Guimard

ΦCS complex systems

ACCUEIL CURSUS CANDIDATURES ALUMNI PARTENAIRES EN FR

matter, the interface between social sciences and physics, soft matter, biological systems, complexity in the quantum realm, of questions raised in the context of « big data » and « machine learning ».



You may attend the M1 & M2 international "Physics of Complex Systems" (i-PCS) program, in Italy for the M1 and in Paris for the M2. All courses are delivered in English. You obtain a double Italian-French degree. A small amount of additional integrative exam allow to obtain the engineer diploma of the Politecnico di Torino

You can directly attend the M2 year "Physics of Complex Systems" (PCS) in Paris. The first semester is common with the international i-PCS Master. All courses are delivered in English.

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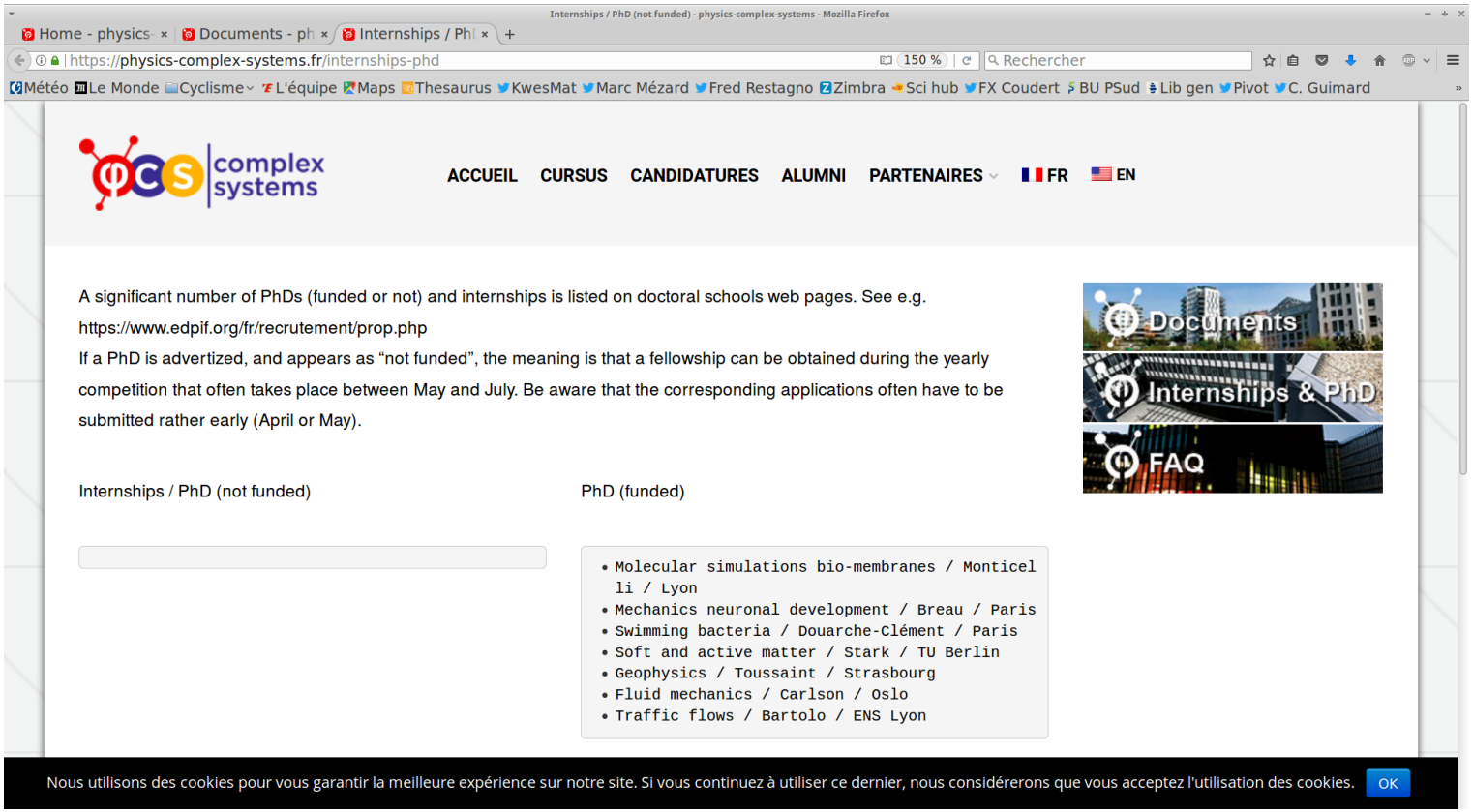
https://physics-complex-systems.fr/candidature/

Internships & PhDs

- Doctoral schools websites
- Laboratory web sites
- PCS site



→ special session on **October Mon Oct 22**

Internships & PhDs

- On you to search for internship/PhD
- Do not hesitate to contact researcher before visit
- Internships (in France) require “convention de stage”, to be completed *before* the beginning

Presentation of courses : compulsory / 18 ECTS

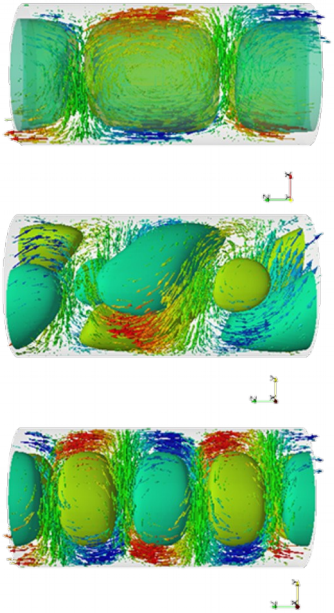
- Non linear physics & dynamical systems
- Stochastic processes
- Computational Science
- Statistical Field Theory

+ 4 elective courses, choose among 8 → 70 possibilities

C. Nore

Non-linear physics and dynamical systems

- Study systems with increasing complexity
- From 1d onwards
- PDE and beyond
- Bifurcation and chaos



See also the elective
“advanced non-linear physics”

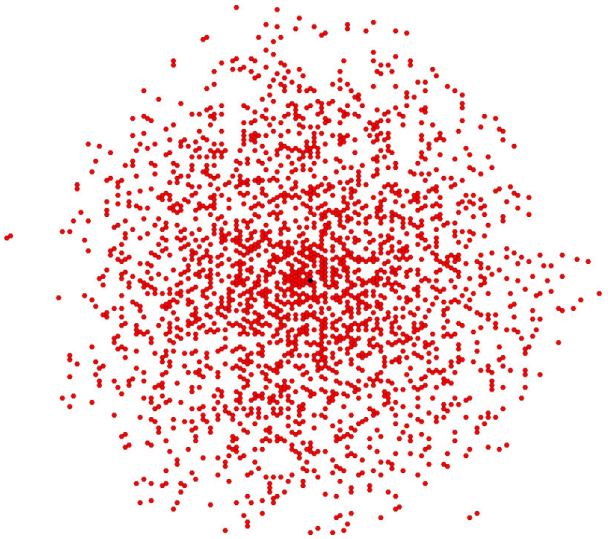
Using a term like nonlinear science is like referring to the bulk of zoology as the study of non-elephant animals (Stanislaw Ulam)

D. Mouhanna

Stochastic processes

C. Deroulers

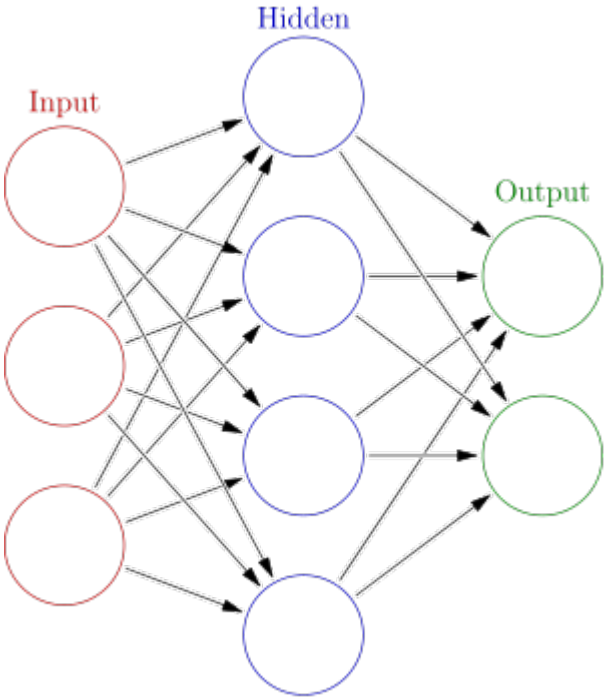
- How to model randomness ?
  Large number of applications
- How to account for random features ?
- Reminder in probability
- Brownian motion
- PDE description
- Example driven → formal notions
  and their universal character

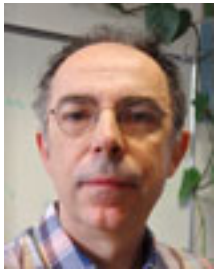


Computational science

F. Krzakala

- Use computing tools
- Applications in stat phys, but also in interdisciplinary subjects like machine learning
- Balance physics/math/algorithms/programming
- Tutorials & homework

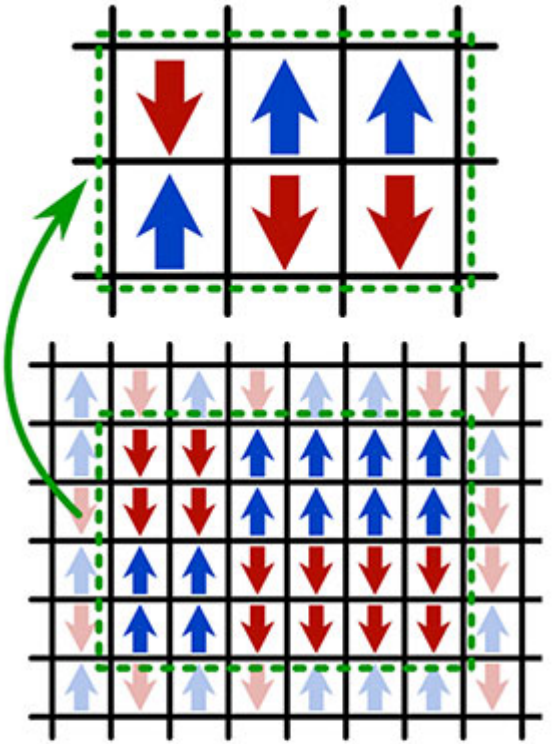


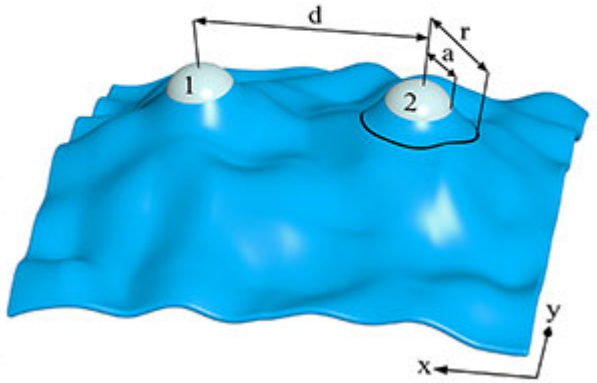


J.B. Fournier

Statistical field theory

- Describe spatial fluctuations of fields
  coarse graining / importance sym.
- Learn functional integrals, Feynman diagrams, renormalization group
- Emphasis on critical phenomena
  → understand universality
- Scaling ideas





Elective courses
choose 4 → 12 ECTS

- Mathematical tools
- Advanced non linear physics
- Advanced statistical mechanics
- Non equilibrium and active systems
- Numerical simulations
- Statistical physics of simple and complex fluids
- Biophysics
- Quantum field theory