

Physics of Complex Systems Master *Kickoff meeting*

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

September 3rd 2018




Welcome


Home - physics-complex-systems - Mozilla Firefox

Home - physics x +

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 ACCUEIL CURSUS CANDIDATURES ALUMNI PARTENAIRES EN FR



The international Master « Physics of Complex Systems » (i-PCS) is a two-year French-Italian program (M1 & M2), jointly operated by *Universities Paris Diderot, Pierre et Marie Curie, Paris-Sud/Paris-Saclay* in Paris, together with *Politecnico di Torino, SISSA* and *ICTP* in Trieste. It is possible to join the Complex System master at the M2 level.

SEPTEMBER 2017 >

M T W T F S S

The goal is to provide a state-of-the-art research-oriented education in fundamental physics. Complex systems are thereby

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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



The Abdus Salam ICTP and SISSA, in collaboration with the partner institutions of the Physics of Complex Systems (PCS) network, will organize the Spring College on the Physics of Complex Systems from 21 May to 19 June 2016.

Many complex systems in physics, biology, engineering and economics are characterized by a large number of interacting degrees of freedom giving rise to a non-trivial collective behavior. The theoretical and computational tools for a quantitative analysis of complex systems are often rooted in modern statistical, quantum physics. The Spring College on the Physics of Complex Systems aims to give students the opportunity to get in touch with a selection of topics at the forefront of research, during an intensive 4-week program, it consists of 5 courses of 9 lectures each, followed by final written tests.

Organizing Committee

- S. Flaxo (ICTP, Trieste, France)
- A. Gambassi (SISSA, Trieste, Italy)
- M. Marsili (ICTP, Trieste, Italy)
- A. Pelucco (Politecnico di Torino, Italy)
- M. Marsili (ICTP, Trieste, Italy)

Local Organizer

- M. Marsili (ICTP, Trieste, Italy)

DEADLINE

28 February 2016

2017



The Abdus Salam ICTP and SISSA, in collaboration with the partner institutions of the Physics of Complex Systems (PCS) network, will organize the Spring College on the Physics of Complex Systems from 25 April to 23 May 2017.

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Local Organizer

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DEADLINE

31 January 2016

2018



The Abdus Salam ICTP and SISSA, in collaboration with the partner institutions of the Physics of Complex Systems (PCS) network, will organize the Spring College on the Physics of Complex Systems from 10 April to 5 May 2017.

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Local Organizer

- M. Marsili (ICTP, Trieste, Italy)

DEADLINE

15 January 2017

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

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PCS complex systems

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UNIVERSITE PARIS SUD UPMC SORBONNE UNIVERSITÉS PARIS DIDEROT ICTP POLITECNICO DI TORINO SISSA

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See in particular Documents + Internships & PhD

The screenshot shows a Mozilla Firefox browser window displaying the website <https://physics-complex-systems.fr/en/>. The page features a navigation menu with links for ACCUEIL, CURSUS, CANDIDATURES, ALUMNI, and PARTENAIRES, along with language options for EN, FR, and FR. The main content area is divided into two columns. The left column is titled "If you are an L3 student majoring in FUNDAMENTAL PHYSICS" and describes the M1 & M2 international "Physics of Complex Systems" (i-PCS) program. The right column is titled "If you are an M1 student majoring in FUNDAMENTAL PHYSICS" and describes the M2 year "Physics of Complex Systems" (PCS) in Paris. A sidebar on the right contains a grid of navigation links: Documents, Internships & PhD, and FAQ. At the bottom of the page, there is a cookie consent banner and a social media follow button for @Phys_CS_Master.

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

PCS complex systems

PCS complex systems

If you are an L3 student majoring in FUNDAMENTAL PHYSICS

If you are an M1 student majoring in FUNDAMENTAL PHYSICS

Documents

Internships & PhD

FAQ

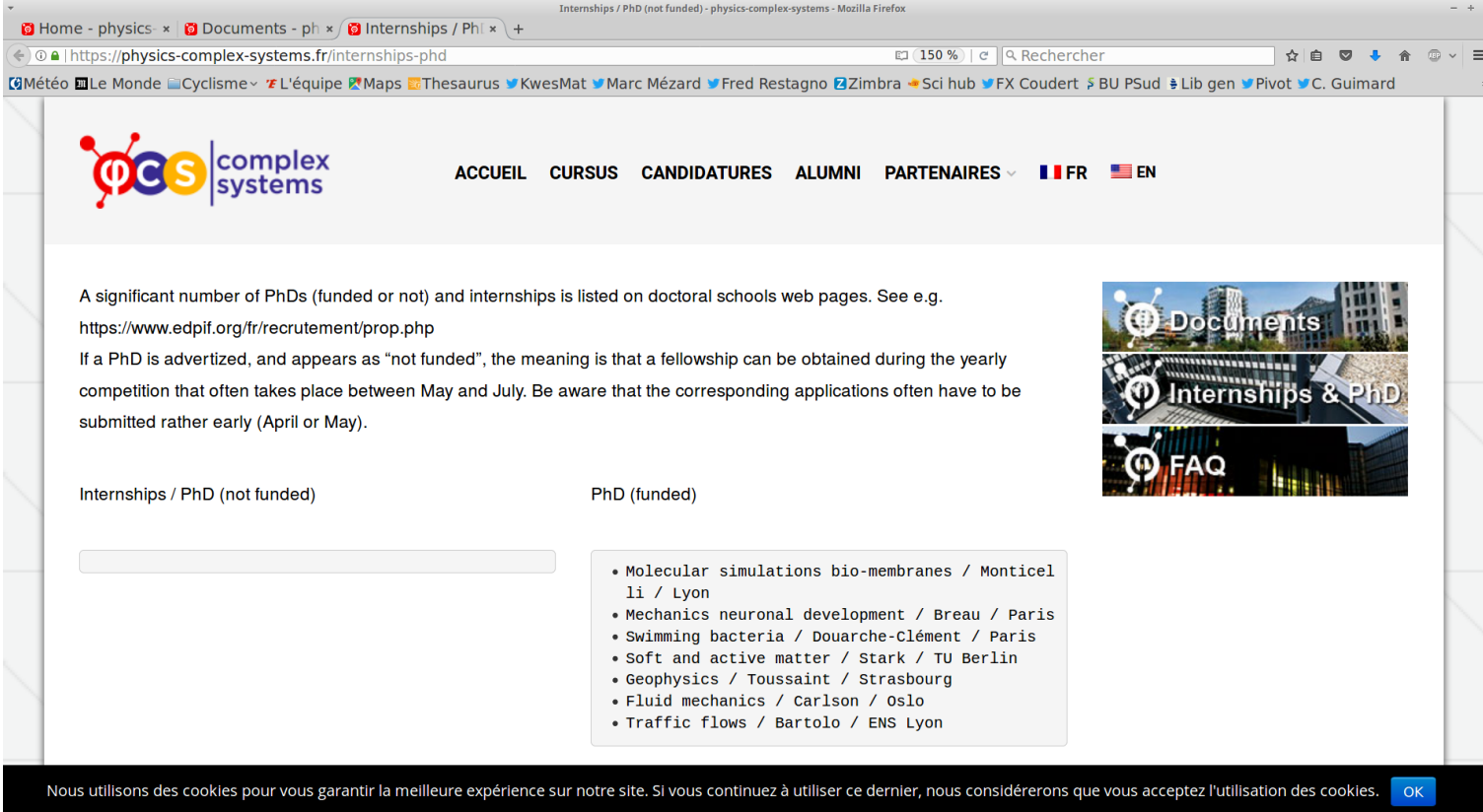
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<https://physics-complex-systems.fr/candidature/>

Internships & PhDs

- Doctoral schools websites
- Laboratory web sites
- PCS site



The screenshot shows the website for Physics Complex Systems (PCS). The header includes the logo and navigation links: ACCUEIL, CURSUS, CANDIDATURES, ALUMNI, PARTENAIRES, and language options for FR and EN. The main content area features a text block explaining that a significant number of PhDs and internships are listed on doctoral schools web pages, with an example URL: <https://www.edpif.org/fr/recrutement/prop.php>. It also notes that if a PhD is advertised as "not funded", it means a fellowship can be obtained during a yearly competition between May and July, with applications due early (April or May).

Below this text, there are two columns of listings:

- Internships / PhD (not funded)**: This column is currently empty.
- PhD (funded)**: This column contains a list of research topics and locations:
 - Molecular simulations bio-membranes / Monticelli / Lyon
 - Mechanics neuronal development / Breaux / Paris
 - Swimming bacteria / Douarche-Clément / Paris
 - Soft and active matter / Stark / TU Berlin
 - Geophysics / Toussaint / Strasbourg
 - Fluid mechanics / Carlson / Oslo
 - Traffic flows / Bartolo / ENS Lyon

On the right side of the page, there are three image-based navigation buttons: Documents, Internships & PhD, and FAQ.

At the bottom of the page, there is a cookie consent banner: "Nous utilisons des cookies pour vous garantir la meilleure expérience sur notre site. Si vous continuez à utiliser ce dernier, nous considérerons que vous acceptez l'utilisation des cookies." with an "OK" button.

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

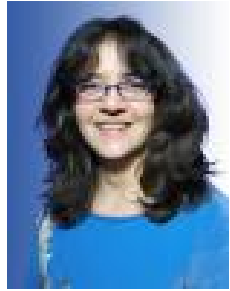
Internships & PhDs

- 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

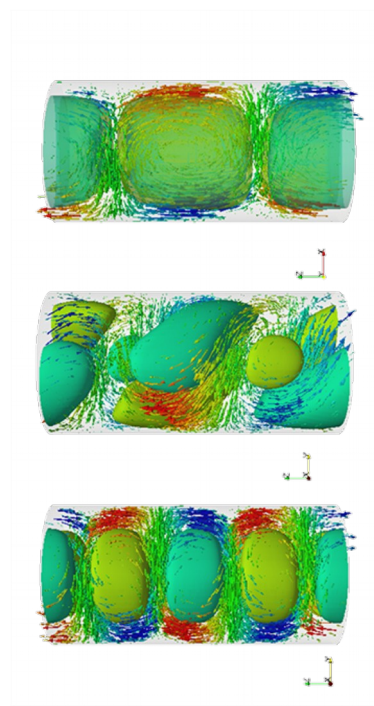
+ 4 elective courses, choose among 8 → 70 possibilities



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)



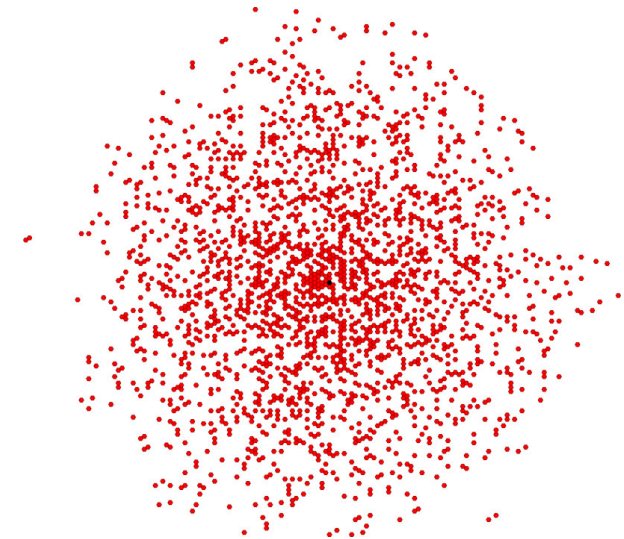
D. Mouhanna

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 \rightarrow formal notions
and their universal character

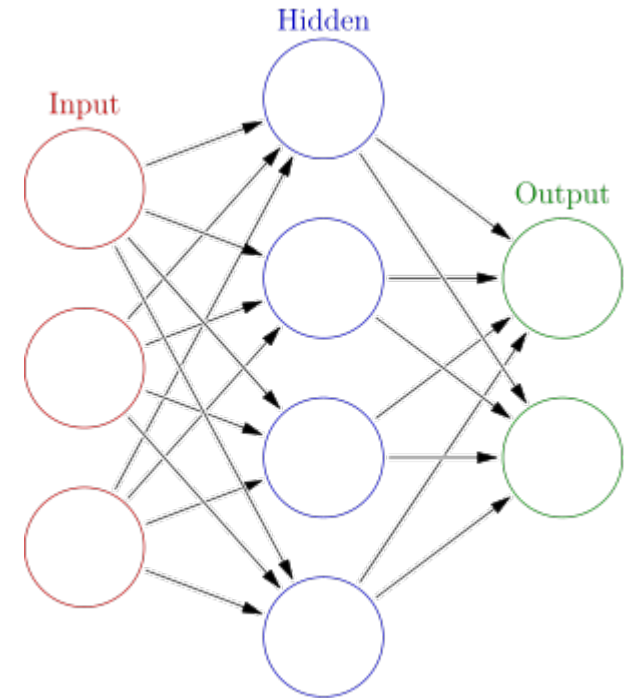




Computational science

F. Krzakala

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

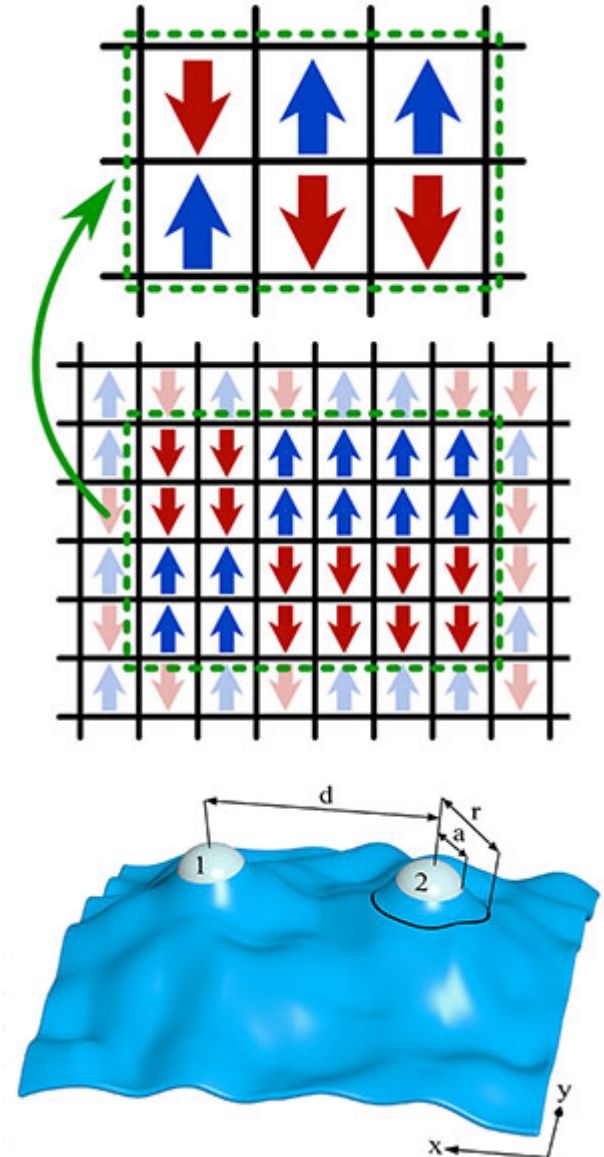




Statistical field theory

J.B. Fournier

- 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