

# Paris Physics Master

*Welcome !*



# Historical Background...

~ 1200 :

Université de Paris



Faculté des Sciences de Paris

Campus Pierre et Marie Curie



~ 1968 :

Université Pierre et Marie Curie

Université Paris Diderot



Campus Pierre et Marie Curie



~ 2007:

Université Pierre et Marie Curie

Université Paris Diderot

Campus Pierre et Marie Curie

Campus Diderot



~ 2018:

Sorbonne Université

Physics @ Campus Pierre et Marie Curie

~ 2020:

Université de Paris

Physics @ Campus Diderot



~ 2022:

Université Paris Cité

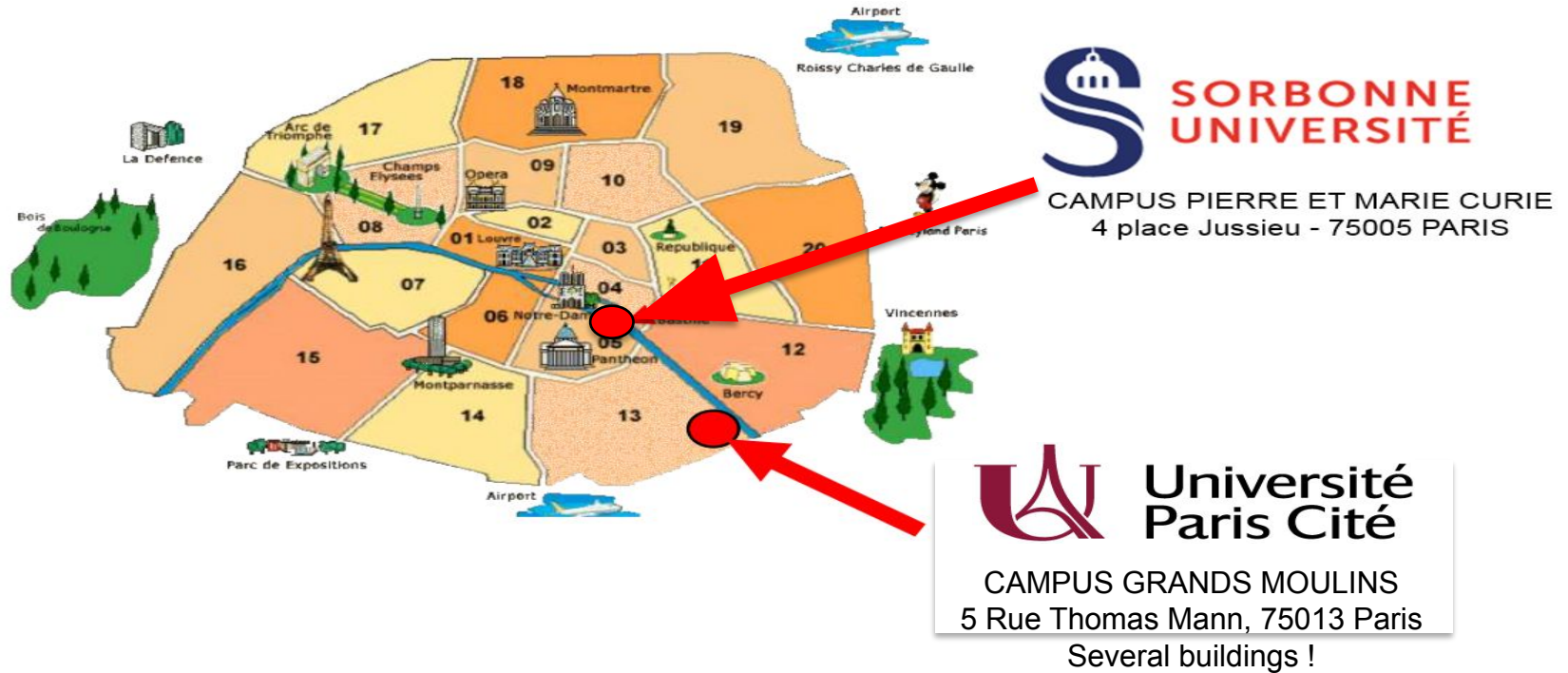
Physics @ Campus Grands Moulins



# Physics Departments: a strong interaction...and success

Most of Physics Labs in Paris  
are associated to one or both physics departments  
of Sorbonne Université and Université Paris Cité

# 2 Universities, 2 Campuses



# Université Paris Cité

~ 61.000 students (Sciences and Engineering, Humanities, and Medical School)

~ 4.500 professors (+ ~2000 researchers) and

~ 3.000 administrative and technical staff



université  
PARIS  
DIDEROT



UNIVERSITÉ  
PARIS  
DESCARTES



# Sorbonne Université



- ~ 56.000 students (Sciences and Engineering, Humanities, and Medical School)
- ~ 6.400 professors and researchers
- ~ 2.400 administrative and technical staff

# Université Paris Cité: Physics Department

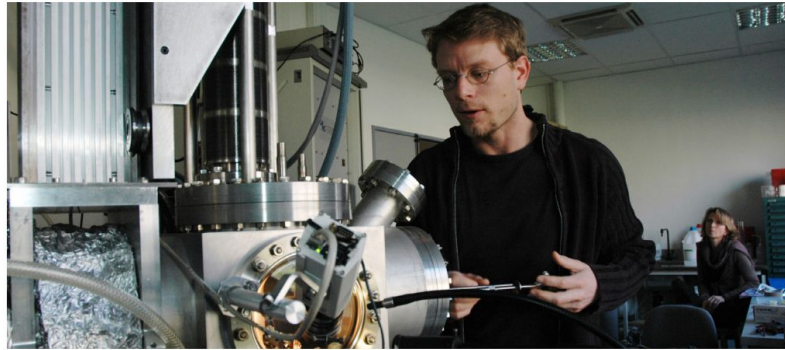
Director: Atef Asnacios



**15 laboratories**  
**~ 400 researchers**  
**50 tech. and adm. staff**  
**250 PhD students**  
**650 B/M students**

# Sorbonne Université: physics department

Director: Edouard Kierlyk



~ 2.500 students

~ 700 professors and researchers

~ 450 administrative and technical staff

22 laboratories



# Research domains in physics at Université Paris Cité

*Covers all the main domains of physics, from universe to particle scale, from quantum physics to macroscopic physics.*

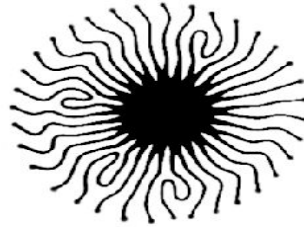
## **3 + 1 main research axes**

- « **Two infinities** » : cosmology, astrophysics, particle physics
- **Quantum physics and nanophysics** : nano-electronics and photonics, new quantum materials
- **Macroscopic physics and biophysics** : soft matter, non-linear physics, physics of biological systems
- **Energetic transition**, new energy sources

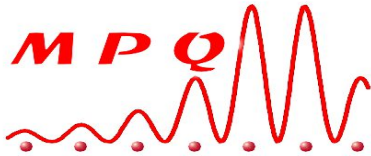
# Université Paris Cité: physics department, laboratories



AstroParticle  
and Cosmology  
(APC)



Complex Matter  
and Systems (MSC)



Quantum Materials  
and Phenomena  
(MPQ)



LIED

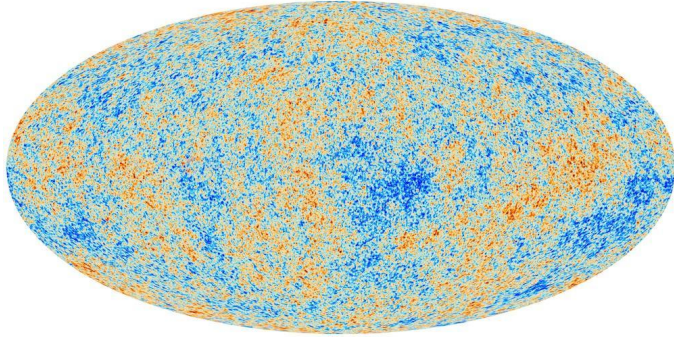
**LDAR** Education Research  
in Physics

+ 10 other laboratories in the best institutions  
around Paris are supported by the Physics department

# AstroParticle and Cosmology (APC)

<https://apc.u-paris.fr/>

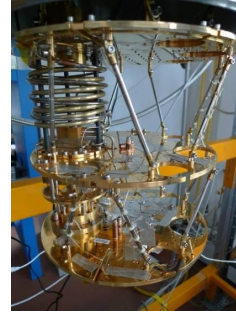
European satellite PLANCK :



*Map of the Cosmological Microwave Background*



*Study of the early Universe  
Instrumentation on microwaves detection*



*Superconducting bolometer  
arrays with SQUIDs readout*



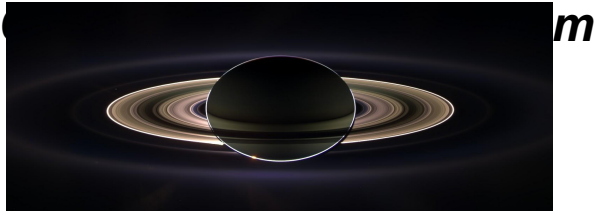
Paris Centre for Cosmological Physics :

*George Smoot, 2006 Nobel Prize in Physics, professor at Université Paris Cité*

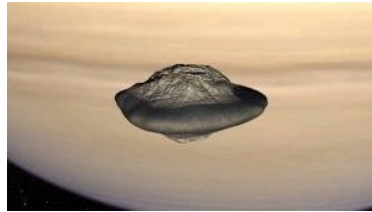


# Astrophysics, Instrumentation and Modelization (AIM)

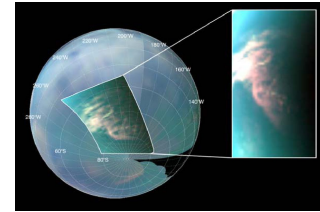
## Astrophysics and Planetology



*Saturne*



*Small satellite*



*Titan*

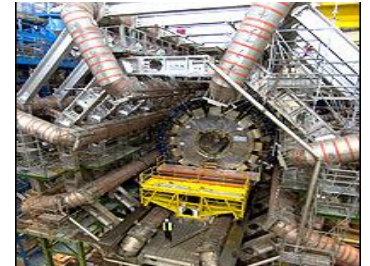
Support to other groups at **Observatoire de Paris** :  
**LESIA, LUTh, GEPI**

**Particles, Nuclei and High Energy Lab  
(LPNHE)**

**High energy particles physics (CERN) :**

*Discovery of the Higgs boson*

*ATLAS detector*

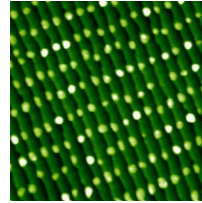


# Quantum Materials and Phenomena (MPQ)

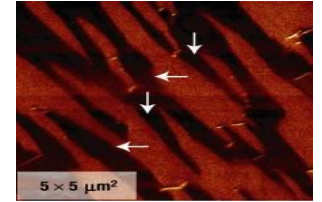
<https://mpq.u-paris.fr/>



Magnetic nanoparticles and materials :

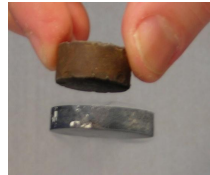


*Self-organized Co nanoparticles*

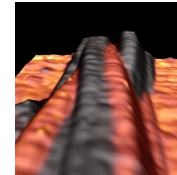


*Multiferroic*

Quantum materials :

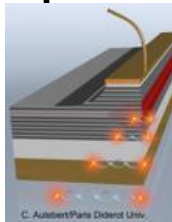


*High  $T_c$  superconductor*

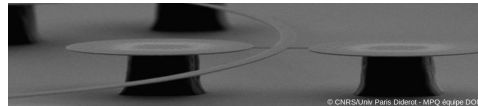


*Carbon nanotubes*

Photonic quantum devices :



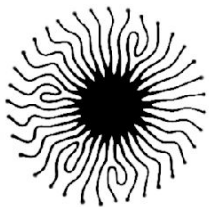
*Quantum optics with semiconductors*



*Optomechanics, nonlinear optics*



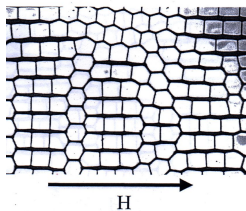
*Ions micro-traps*



# Complex Matter and Systems (MSC)

<http://www.msc.univ-paris-diderot.fr/?lang=en>

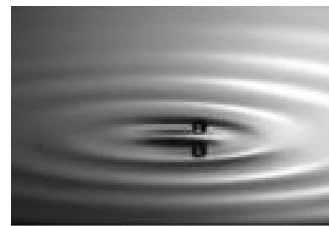
Soft matter,  
hydrodynamics:



*Magnetic foam*



*Meandering  
instability*



*Walking droplet*

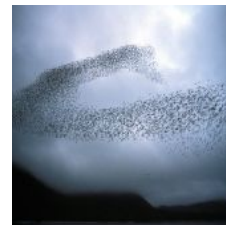
Morphogenesis :



*Sand dunes*

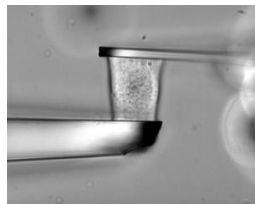


*Sunflower*

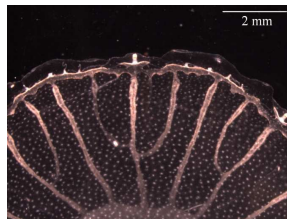


*Birds flying*

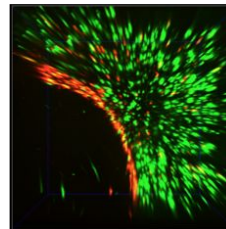
Biophysics and  
bioengineering :



*Single cell mechanics*



*Angiogenesis in jellyfish*



*Tissue engineering*

# Interdisciplinary Laboratory for New Energies (LIED)

- Development of low-carbon energy sources
- Energy efficiency
- Interdisciplinary methodology
- Forecasting, social and economic analysis, and public policy studies



*Other research groups in condensed matter physics :*

**At ESPCI :** - **Institut Langevin** (acoustics, imaging for material science and biomedicine),  
- **PMMH** (fluid mechanics, non-linear physics)

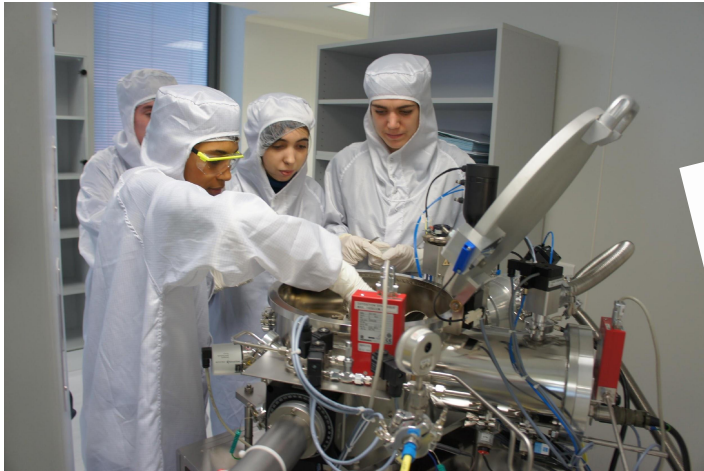
**At Ecole Normale Supérieure :** - **LPA** (quantum physics)  
- **LPS** (statistical physics)

**At Paris-Sud Campus :** - **IMNC** (Institut de Modélisation en Neurobiologie et Cancérologie)  
- **C2N** (Center for Nanosciences and Nanotechnologies)

# Université Paris Cité: experimental training platforms

a formation through and for research

- Subatomic physics
- Hydrodynamics and complex systems
- Nanosciences and quantum physics



**Master's Student Initiation to Scanning Probes and Electronic  
Microscopes via Research Projects in Nanosciences**  
M.L. Della Rocca<sup>1,2</sup>, V. Repain<sup>1,2</sup>, Y. Gallais<sup>1,2</sup>, L. Doyennette<sup>1,3</sup>, F. Raineri<sup>1,4</sup> and A. Anthore<sup>1,4</sup>  
<sup>1</sup> Université Paris Diderot, Sorbonne Paris Cité, Département de physique, 4 rue Elsa Morante, 75013 PARIS, France  
<sup>2</sup> Université Paris Diderot-CNRS, Laboratoire Matériaux et Phénomènes Quantiques, UMR 7162, 75013 PARIS, France  
<sup>3</sup> Université Montpellier 2-CNRS, Laboratoire Charles Coulomb, UMR 5221, F-34095 MONTPELLIER, France  
<sup>4</sup> CNRS, Laboratoire de Photonique et Nanostructures, UPRI 20, 91460 MARCOUSSIS, France

**Clean room formation  
Experimental projects in nanosciences**



# Sorbonne Université: physics department, laboratories

## Condensed matter, nanosciences:

Institut de minéralogie, de  
physique des matériaux et de  
cosmochimie (IMPMC)



Laboratoire de Physique de  
l'ENS (LPENS)



Institut des nanosciences de  
Paris (INSP)



Laboratoire de physique et d'  
étude des matériaux (LPEM)



# Sorbonne Université: physics department, laboratories

## Macroscopic physics, biophysics:

Laboratoire Jean Perrin (LJP)



Physico-chimie Curie (PC-Curie)



Physique et mécanique des  
milieux hétérogènes (PMMH)



# Sorbonne Université: physics department, laboratories

Theoretical and statistical physics, particle physics:

Laboratoire de physique nucléaire  
et hautes énergies (LPNHE)



Laboratoire de physique  
théorique et hautes énergies  
(LPTHE)



Laboratoire de Physique de  
l'ENS (LPENS)



Laboratoire de physique théorique  
de la matière condensée (LPTMC)



# Sorbonne Université: physics department, laboratories

Waves, quantum optics, atomic and molecular physics:

Institut Langevin ondes et images



Laboratoire Kastler-Brossel



# Sorbonne Université: physics department, laboratories

## Astronomy, astrophysics and plasma physics:

Institut d'astronomie de Paris (IAP)



Institut de Mécanique Céleste et  
Calcul des Ephémérides (IMCCE)



Laboratoire d'études du rayonnement et  
de la matière en astrophysique et  
atmosphères (LERMA)



Laboratoire d'études spatiales et  
instrumentation en astrophysique (LESIA)



Laboratoire de physique des plasmas (LPP)



Laboratoire pour l'utilisation des  
lasers intenses



Systèmes de référence temps-espace (SYRTE)



PPM...

# 1st Semester

Location:	MONDAY		TUESDAY	WEDNESDAY	THURSDAY		FRIDAY
	SU	SU	SU	SU	until Oct 19 UPCité morning / SU afternoon	after Oct 26 UPCité	SU
08:30							
08:45							
09:00	Complex systems	Complex systems	Complex systems	Quantum Mechanics (M. Joyce)	Quantum mechanics (E. Boulat) UP. Cité	Quantum mechanics (E. Boulat)	Numerical Methods
09:15							
09:30							
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Semester 1	
Courses:	Professors:
Advanced Quantum Mechanics	SU : Michael Joyce UPCité : Edouard Boulat
Statistical Physics	SU : Fabio Pietrucci UPCité : Jihad Mourad
Numerical methods	SU : Andrea Ciardi UPCité : Sébastien Charnoz
Complex Systems	SU : Maria Barbi UPCité : Anke Lindner

+

Laboratories

+

French foreign language

/

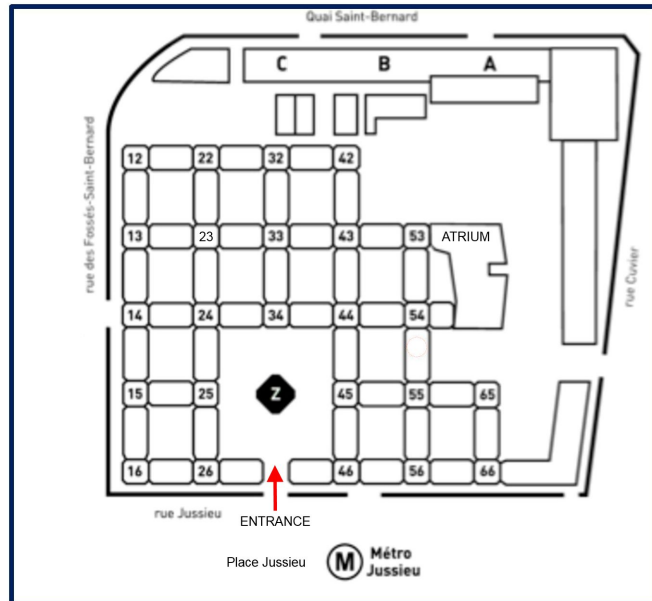
International Physicists Tournament

# Lecture rooms at Sorbonne Université

Pierre et Marie Curie Campus:

Main entrance: 4 place Jussieu, 75005 PARIS

Metro Station : Jussieu, metro lines 7 and 10



Example:

Room 23-33, 202

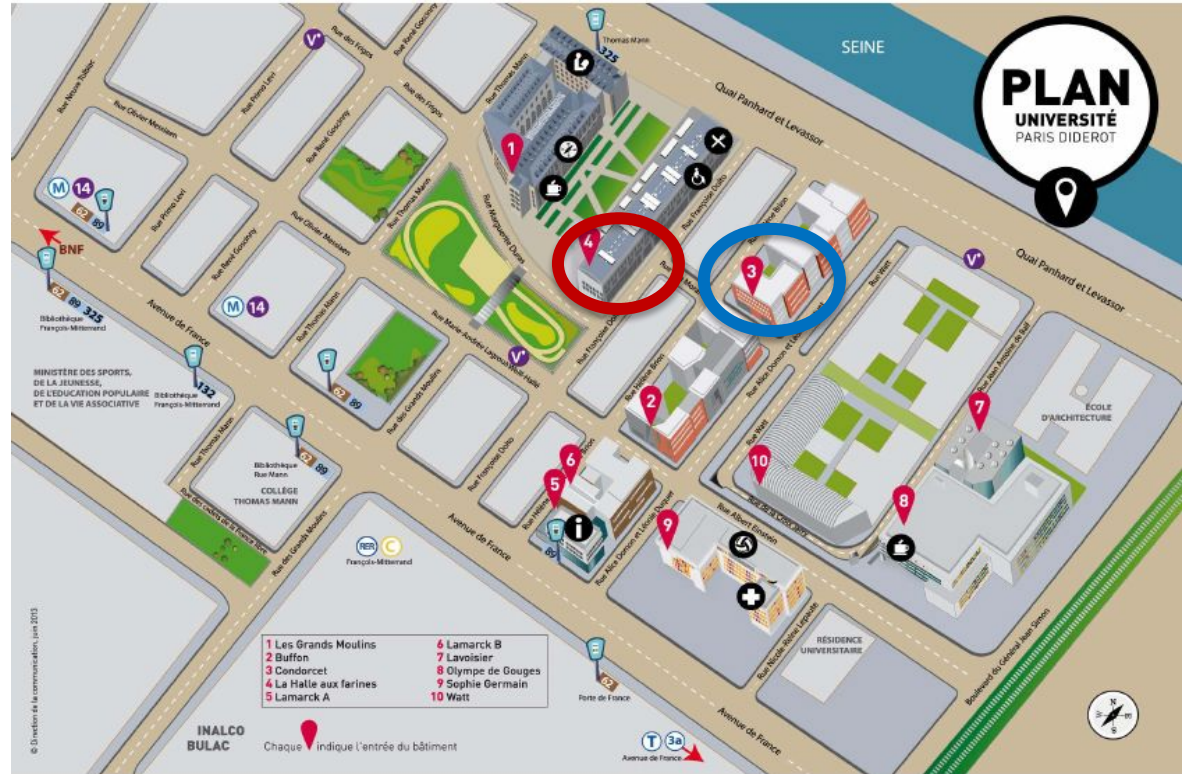
- Go to tower 23 or 33
- **202** means go to 2d floor
- Enter the 23-33 corridor



# Université Paris Cité: Paris Diderot/Grands Moulins campus

**234C Halle aux farines  
building**

**356A Condorcet building**



# 2nd Semester

Choose 3 among the 4 courses:

- Atomic and Molecular Physics
- Condensed Matter: from fundamentals to nanosciences
- Astrophysics and Cosmology
- Nuclear and Particle Physics

Choose 1 among the 3 courses:

Project / Plasma Physics / Advanced Quantum Mechanics 2

+ Internship (>7 weeks)

SEMESTER 2	
COURSES:	Professors:
Atomic and molecular physics	SU: Jean Hugues Fillion UPCité: Luca Guidoni/Julien Serreau
Condensed matter	SU: Nathalie Jedrecy UPCité: Yann Gallais
Nuclear and particle physics	SU: Eli Ben Haim UPCité: José Ocariz
Astrophysics and cosmology	SU: Irina Dvorkin UPCité: Sylvain Chaty
Plasma Physics	SU: Andrea Ciardi
Advanced Quantum Mechanics 2	UPCité: Edouard Boulat
Scientific Project	SU: Nicolas Rodriguez/Andrea Ciardi UPCité: Florent Baboux
Internship	SU: Nicolas Rodriguez/Andrea Ciardi UPCité: Florent Baboux

## For Sorbonne University students : The IPIASMUS Program

The possibility to make your **M1** internship  
in a foreign country with a grant  
of the Initiative Physique des Infinis

- ✓ For internships in the fields of : *Plasma, Fusion, Astrophysics, Cosmology, Particle Physics...*
- ✓ 5 to 10 grants opened for the spring 2022
- ✓ Amount : between 2000 and 4000 € for transport, housing and meals
- ✓ Applications : 1<sup>st</sup> of September – 31<sup>st</sup> of December 2021
- ✓ More information on :  
<https://ipi-sorbonne-universite.fr/ipiasmus/>
- ✓ Contact : Sophie Trincaz-Duvoid ([trincaz@lpnhe.in2p3.fr](mailto:trincaz@lpnhe.in2p3.fr))



En 2022, financez votre stage à l'étranger

Bourses de mobilité en M1

Programme **IPIASMUS** de l'Initiative Physique des Infinis

Physique des Plasmas et Physique de l'Univers et des hautes énergies

M1 Mobility grants on plasma physics or physics of the Universe and high energies from Initiative Physique des Infinis. Interested ? Details on <http://ipi-sorbonne-universite.fr>

Plus d'informations ? Aller sur <http://ipi-sorbonne-universite.fr>



# Université Paris Cité: the master department

Director (of all M1+M2 programs): Francesco Nitti  
French Master 1 coordinator: Francesca Carosella  
Paris Physics master UP coordinator: Florent Baboux  
Administrative secretary: Evelyne Authier

Contact: [firstname.surname@u-paris.fr](mailto:firstname.surname@u-paris.fr)

(Or [firstname.surname@univ-paris-diderot.fr](mailto:firstname.surname@univ-paris-diderot.fr) if you encounter any problem with the previous address)



# Sorbonne Université : the master in physics department

Director: Frédéric DECREMPS

Vice director: Nicolas SATOR

Master 1 director: Pauline IZOMBARD

Pedagogical and administrative head: Corinne SALLANDRE

Paris Physics master SU coordinator: Nicolas RODRIGUEZ

Contact: [firstname.surname@sorbonne-universite.fr](mailto:firstname.surname@sorbonne-universite.fr)



# Quantum Devices

[\(https://www.ip-paris.fr/master-2-quantum-devices/\)](https://www.ip-paris.fr/master-2-quantum-devices/)

2<sup>nd</sup> year track



## Master 2 Quantum Devices

APPLY >

### Overview

The 'Quantum Devices' program provides its students with a high level theoretical and experimental training on different kinds of quantum phenomena with particular emphasis on quantum devices and nanotechnologies. Students receive state of the art training in nanofabrication and nanocharacterizing, with access to cleanroom facilities and a dedicated nanoscience teaching platform.

The training courses are given by high-level scientists from Ile de France laboratories working in the domain of quantum devices. Thanks to this well established network, students find many opportunities after graduation both in academics as well as in the industrial sector.

**Language of instruction:** English

**ECTS:** 60

**Oriented:** academic research or industrial sector

**Duration:** 1 year

**Courses Location:** Université Paris-Diderot, Ecole Polytechnique

# Physics of Complex Systems

(<https://physics-complex-systems.fr/en/>)



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.

The goal is to provide a state-of-the-art research-oriented education in fundamental physics. Complex systems are thereby studied with the tools of statistical physics at or out-of equilibrium, field theory, stochastic processes, dynamical systems, non-linear physics, inference techniques and computational approaches. These systems encompass complex networks, active matter, the interface between social sciences and physics, soft matter, biological systems, complexity in the quantum realm, or

Calendar of the year



# Nuclei, Particles, Astroparticles, Cosmology

(<https://npac.lal.in2p3.fr/m2-presentation/>)



## M2 PRESENTATION

*All the lectures are given in English*

The NPAC Master's degree (or "M2") is designed to provide training for students wishing to enter research in nuclear physics, particle physics, astroparticles and cosmology. More specifically it prepares students for either an experimental or a theoretical PhD in these fields in laboratories attached to the universities or other major research institutions (CNRS, CEA).

*(\*)In the French system, the master program is divided into two years: M1 (first-year of Master) and M2 (second-year of Master).*

The content of the program has a dual objective. On the one hand, it provides an introduction to the physics of the "infinitely small" – the physics of the fundamental particles and interactions in Nature, and the physics of nuclei built from these elementary building blocks. On the other hand, it introduces the physics of the "infinitely large" – modern cosmological theory and its description of the geometry and contents of the Universe (including notably dark matter and dark energy). The students are also taught about astroparticle physics, which concerns another important class of "cosmic messengers" which open windows on many unanswered questions.

### CONNECTIONS ZOOM (DISTANCE EDUCATION)

All the courses will be available via zoom (until October 22 for the moment) for those will not be able to present in the classrooms due to the COVID-19 (if you are not yet in France, in quarantine or having a health problem which makes you very sensitive to COVID-19).

#### Morning courses (9:00-12:00):

Participate to the ZOOM courses:  
<https://jclab.zoom.us/j/94989833665?pwd=a3FzTkold3pZWUpLVW5mVDJhN2grQT09>

ID de réunion : 949 8983 3665  
Code secret : .....

#### Afternoon courses (14:00-17:00):

Participate to the ZOOM courses:



# SMNO-Nanomat

(<http://master.physique.sorbonne-universite.fr/fr/m2/smno/smno.html>)

Material sciences and nano-objects-nanomat



[French version here.](#)

SMNO-nanomat is a research-type M2 program (*M2: Master 2<sup>nd</sup> year*) that offers a complete high-level training on the structural and electronic properties of condensed matter and nanostructures. The objective is two-fold: (i) to acquire the theoretical bases allowing a thorough understanding of the materials properties, (ii) to be trained in advanced experimental and numerical investigation methods. The program includes numerous tutorials, laboratories and numerical projects in relation with current scientific topics that can answer to societal challenges (renewable energies, ecology, health, heritage, ...). The addressed topics concern optics, electronics, spintronics, superconductivity, correlated systems, physical chemistry of solids and high-density liquids, exploration of planetary interiors, interaction with the environment, etc. They cover a large variety of materials and their applications, such as nanostructured materials, 2D materials, thin films, materials for energy, materials under extreme conditions, glasses, minerals and cultural heritage materials, with a systematic focus on the microscopic phenomena at the origin of their macroscopic properties.

SMNO-nanomat welcomes students enrolled at Sorbonne University, with the support of l'École Polytechnique (l'X), ESPCI and Chimie Paris-Tech. Strong international ties are maintained by the collaboration "Nanomat international master" with the Universities of Uppsala, Antwerp, Bologna and Khatam, allowing the awarding of double diplomas.

# Physics of plasmas and fusion

(<http://www.master-plasmas-fusion.fr/ppf-en/?lang=en>)

## Master's programme Physics of Plasmas and Fusion (PPF)

Home » Master's programme Physics of Plasmas and Fusion (PPF)

### Description



The Master "Physics of Plasmas and Fusion" (PPF) is the **only generalist** Master in France which offers fundamental basis in plasma physics and whose objective is to train **high level** scientists and engineers, capable of invest in research programs on plasmas, whether natural or artificial, cold or hot, diluted or dense.

### Courses



This Master offers students **wide possibilities of choice and orientation** among many themes of plasma physics, allowing them to build step by step their professional project throughout the academic year. It is common to various establishments

### Application for M2 PPF



including the **Paris-Saclay University** (UPSAY), the University **Sorbonne Université** (SU) and the **Polytechnic Institute of Paris** (IPP).

