

Share

Email destinataire :

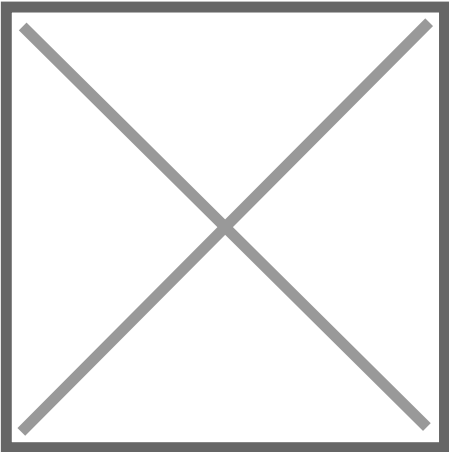
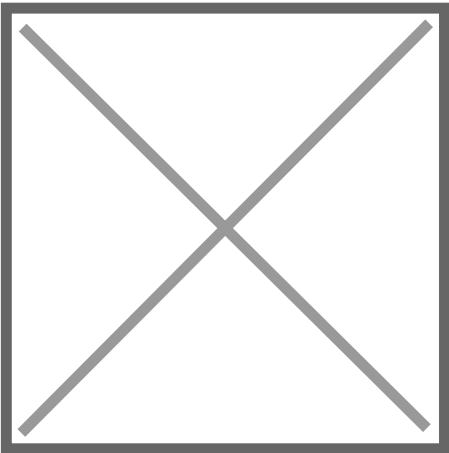
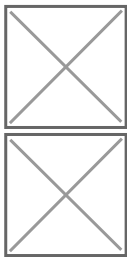
Vous devez renseigner un email valide

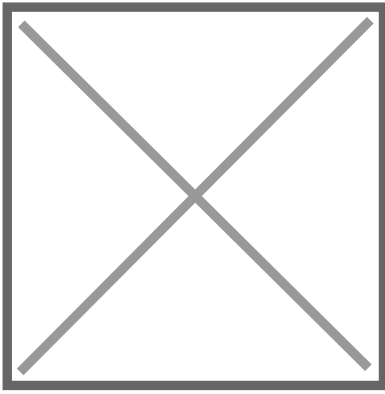
Envoyer

Une erreur est survenue. Merci de réessayer ultérieurement
Le mail de partage a bien été envoyé.

Add to Compare

M2 Complex systems





Master's degree

Specialisation Physique fondamentale et applications

Enrolment type

Full-time academic programmes Life-long learning

Language(s) of instruction

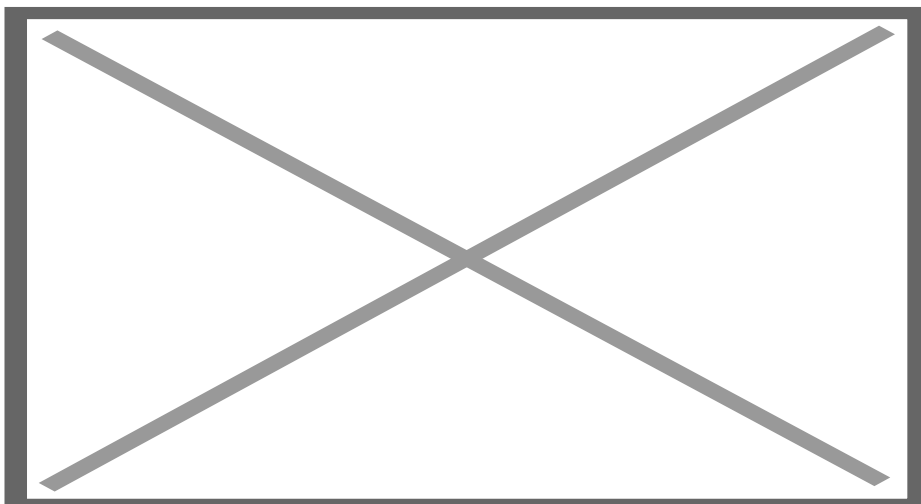
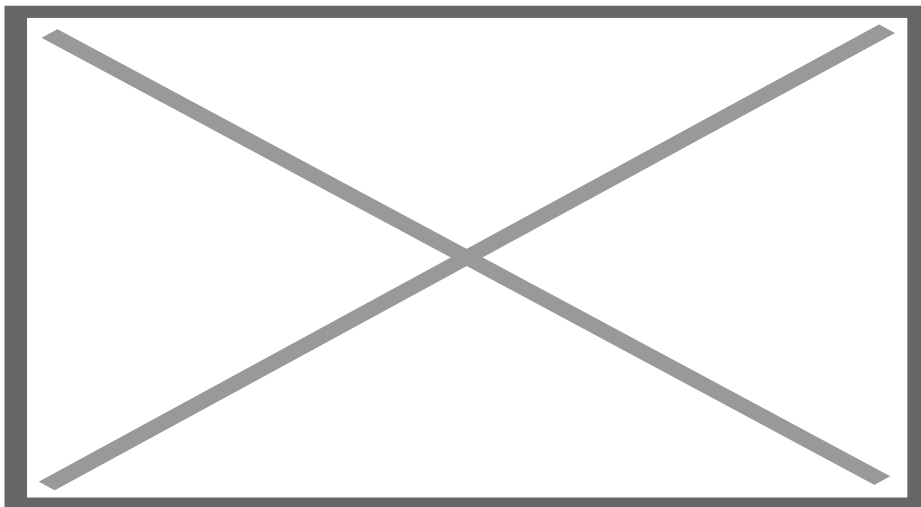
English

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

half of the second semester is devoted to a three months internship

[Télécharger la fiche détaillée](#)

[Apply Now](#)





■ ■

Information

- [Overview](#)
- [Application requirements](#)
- [Schedule](#)

Présentation

Skills

Understand the concept of complexity in physics and related disciplines, its issues and critical questions.

Objectives

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 questions raised in

the context of « big data » and « machine learning ». We prepare students to do their PhD in one of the many university or industrial laboratories that deal with the physics and modelling of complex systems. Some students enter the private sector right after receiving their master's degree. Details on the programme : cf. <https://physics-complex-systems.fr/>

Fees and scholarships

The amounts may vary depending on the programme and your personal circumstances.

- [More information on tuition fees](#)
- [More information on scholarships](#)

Admission

Capacity

Available Places

25

Target Audience and Entry Requirements

The programme is an extension of the fundamental physics course. The main prerequisite is a good standard in statistical physics, quantum physics and mathematics.

Période(s) de candidature

Inception Platform

From 15/03/2026 to 28/06/2026

Supporting documents

Compulsory supporting documents

Motivation letter.

All transcripts of the years / semesters validated since the high school diploma at the date of application.

Curriculum Vitae.

Additional supporting documents

VAP file (obligatory for all persons requesting a valuation of the assets to enter the diploma).

Document indicating the list of local M2 choices available here : <https://urlz.fr/i3Lo>.

Supporting documents :

- Residence permit stating the country of residence of the first country
- Or receipt of request stating the country of first asylum
- Or document from the UNHCR granting refugee status
- Or receipt of refugee status request delivered in France
- Or residence permit stating the refugee status delivered in France
- Or document stating subsidiary protection in France or abroad
- Or document stating temporary protection in France or abroad.

Programme

Compulsory courses "Physics of Complex Systems"

Subjects	ECTS	Semester	Lecture	directed study	practical class	Lecture/directed study	practical class	directed study/practical class
Nonlinear physics and dynamical systems	3	Semestre 1	26					
■								

Nonlinear physics and dynamical systems

ECTS : 3

Semester: Semestre 1

Detail

Lecture: 26

Language(s) of instruction

Français

Remote teaching

non

Type of assessment

Evaluation Continue non Intégrale

Computational science	6	Semestre 1	52
---------------------------------------	---	------------	----

Subjects	ECTS	Semester	Lecture	directed study	practical class	Lecture/directed study	Lecture/practical class	directed study/practical class	d
----------	------	----------	---------	----------------	-----------------	------------------------	-------------------------	--------------------------------	---

■

Computational science

ECTS : 6

Semester: Semestre 1

Detail

Lecture: 52

Language(s) of instruction

Français

Remote teaching

non

Bibliography

Statistical Mechanics: Algorithms and Computations, W. Krauth, Oxford University Press. The Elements of Statistical Learning, T. Hastie, R. Tibshirani & J. Friedman, Springer. All of statistics a concise course in statistical inference, L. Wasserman, Springer.

Type of assessment

Evaluation Continue non Intégrale

[Statistical field theory](#) 6 Semestre 1 52

Subjects	ECTS	Semester	Lecture	directed study	practical class	Lecture/directed study	Lecture/practical class	directed study/practical class	d
----------	------	----------	---------	----------------	-----------------	------------------------	-------------------------	--------------------------------	---

■

Statistical field theory

ECTS : 6

Semester: Semestre 1

Detail

Lecture: 52

Language(s) of instruction

Français

Remote teaching

non

Prerequisites

Statistical physics, Quantum mechanics, mathematical tools, M1 level

Bibliography

Lecture on Phase Transitions and the Renormalization Group, N. Goldenfeld, Frontiers in Physics. Statistical Physics of Fields, M. Kardar, Cambridge University Press. Principles of Condensed Matter Physics, P. Chaikin and T. C. Lubensky, Cambridge University Press.

Type of assessment

Evaluation Continue non Intégrale

[Stochastic processes](#)

6

Semestre 1 52

Subjects	ECTS	Semester	Lecture	directed study	practical class	Lecture/directed study	Lecture/practical class	directed study/practical class	d
----------	------	----------	---------	----------------	-----------------	------------------------	-------------------------	--------------------------------	---

■

Stochastic processes

ECTS : 6

Semester: Semestre 1

Detail

Lecture: 52

Language(s) of instruction

Français

Remote teaching

non

Bibliography

Stochastic Methods a handbook for the natural and social sciences, C. W. Gardiner, Springer. The Fokker-Planck Equation: Methods of Solutions and Applications, H. Risken, Springer. Stochastic processes in physics and chemistry, N. G. van Kampen, Elsevier.

Type of assessment

Evaluation Continue non Intégrale

Elective courses "Physics of Complex Systems"

Subjects	ECTS	Semester	Lecture	directed study	practical class	Lecture/directed study	Lecture/practical class	directed study/practical class
----------	------	----------	---------	----------------	-----------------	------------------------	-------------------------	--------------------------------

[Introduction to quantum out of equilibrium dynamics](#)

3 Semestre 1 26

■

Introduction to quantum out of equilibrium dynamics

ECTS : 3

Semester: Semestre 1

Detail

Lecture: 26

Language(s) of instruction

Français

Remote teaching

non

Type of assessment

Evaluation Continue non Intégrale

[Advanced non-linear physics](#)

3 Semestre 1 26

Subjects	ECTS	Semester	Lecture	directed study	practical class	Lecture/directed study	Lecture/practical class	directed study/practical class
----------	------	----------	---------	----------------	-----------------	------------------------	-------------------------	--------------------------------

■

Advanced non-linear physics

ECTS : 3

Semester: Semestre 1

Detail

Lecture: 26

Language(s) of instruction

Français

Remote teaching

non

Bibliography

Linear and nonlinear waves, G. B. Whitham,
Wiley-Blackwell. Physique des solitons, M.
Peyrard & T. Dauxois, EDP sciences.

Type of assessment

Evaluation Continue non Intégrale

[Disordered systems](#) 3 Semestre 1 26

■

Disordered systems

ECTS : 3

Semester: Semestre 1

Detail

Lecture: 26

Language(s) of instruction

Français

Remote teaching

non

Type of assessment

Evaluation Continue non Intégrale

[Biophysics](#) 3 Semestre 1 26

Subjects	ECTS	Semester	Lecture	directed study	practical class	Lecture/directed study	Lecture/practical class	directed study/practical class
----------	------	----------	---------	----------------	-----------------	------------------------	-------------------------	--------------------------------

■

Biophysics

ECTS : 3

Semester: Semestre 1

Detail

Lecture: 26

Language(s) of instruction

Français

Remote teaching

non

Bibliography

C. P. Broedersz and F. C. MacKintosh. Modelling semiflexible polymer networks. Rev. Mod. Phys., 86, 995 (2014). J. Prost, F. Jülicher & J.-F. Joanny. Active gel physics. Nat. Phys., 11(2), 111 (2015).

Type of assessment

Evaluation Continue non Intégrale

[Nonequilibrium](#)

[and active](#)

[systems](#)

3

Semestre

1

26

■

Nonequilibrium and active systems

ECTS : 3

Semester: Semestre 1

Detail

Lecture: 26

Language(s) of instruction

Français

Remote teaching

non

Type of assessment

Evaluation Continue non Intégrale

[Quantum](#)

[information](#)

3

Semestre

1

26



Quantum information

ECTS : 3
 Semester: Semestre 1
 Detail
 Lecture: 26
 Language(s) of instruction
 Français
 Remote teaching
 non
 Type of assessment
 Evaluation Continue non Intégrale
[Statistical field theory and Soft matter](#) 3 Semestre 1 26



Statistical field theory and Soft matter

ECTS : 3
 Semester: Semestre 1
 Detail
 Lecture: 26
 Language(s) of instruction
 Français
 Remote teaching
 non
 Bibliography

 Basic Concepts for Simple and Complex Liquids, J.-L. Barrat & J.-P. Hansen Capillarity and wetting phenomena : drops, bubbles, pearls, waves, P. G. de Gennes, F. Brochard-Wyart & D. Quéré, Springer.
 Theory of Simple Liquids, J.-P. Hansen & I. R. McDonald, Elsevier. Liquides: solutions, dispersions, emulsions, gels, B. Cabane & S. Henon, Belin.

 Type of assessment
 Evaluation Continue non Intégrale

UE "microfluidique"

[Introduction à la biologie](#) 3 Semestre 1 25
■

Introduction à la biologie

ECTS : 3

Semester: Semestre 1

Detail

Lecture: 25

Language(s) of instruction

Français

Remote teaching

non

Type of assessment

Evaluation Continue non Intégrale

[Laboratoires sur puce](#) 6 Semestre 1 50
■

Laboratoires sur puce

ECTS : 6

Semester: Semestre 1

Detail

Lecture: 50

Language(s) of instruction

Français

Remote teaching

non

Type of assessment

Evaluation Continue non Intégrale

[Microfluidique](#) 3 Semestre 1 30
■

Microfluidique

ECTS : 3

Semester: Semestre 1

Detail

Lecture: 30

Language(s) of instruction

Français

Remote teaching

non

Type of assessment

Evaluation Continue non Intégrale

[Techniques de microfabrication](#) 3 Semestre 1 30



Techniques de microfabrication

ECTS : 3

Semester: Semestre 1

Detail

Lecture: 30

Language(s) of instruction

Français

Remote teaching

non

Type of assessment

Evaluation Continue non Intégrale

[Tutorat bibliographique](#) 3 Semestre 1



Tutorat bibliographique

ECTS : 3

Semester: Semestre 1

Language(s) of instruction

Français

Remote teaching

non

Type of assessment

Evaluation Continue non Intégrale

[UE d'orientation thématique Mécanique des fluides](#) 12 Semestre 1 100



UE d'orientation thématique Mécanique des fluides

ECTS : 12

Semester: Semestre 1

Detail

Lecture: 100

Language(s) of instruction

Français

Remote teaching

non

Type of assessment

Evaluation Continue non Intégrale

UE obligatoires "fluides complexes et milieux divisés"

Subjects	ECTS	Semester	Lecture	directed study	practical class	Lecture/directed study	Lecture/practical class	directed study/practical class
Microfluidique et microfabrication	6	Semestre 1	46		15			
■								

Microfluidique et microfabrication

ECTS : 6

Semester: Semestre 1

Detail

Lecture: 46

Practical study : 15

Language(s) of instruction

Français

Remote teaching

non

Type of assessment

Evaluation Continue non Intégrale

[Interfaces et](#)

[dispersions,](#)

[applications](#)

[industrielles](#)



3 Semestre 1 45

Interfaces et dispersions, applications industrielles

ECTS : 3

Semester: Semestre 1

Detail

Lecture: 45

Language(s) of instruction

Français

Remote teaching

non

Type of assessment

Evaluation Continue non Intégrale

[Rhéologie des](#)

[fluides](#)

[complexes](#)

6 Semestre 1 22 5 30

Subjects	ECTS	Semester	Lecture	directed study	practical class	Lecture/directed study	Lecture/practical class	directed study/practical class
----------	------	----------	---------	----------------	-----------------	------------------------	-------------------------	--------------------------------

Rhéologie des fluides complexes

ECTS : 6

Semester: Semestre 1

Detail

Lecture: 22

Practical study : 30

Directed study: 5

Language(s) of instruction

Français

Remote teaching

non

Type of assessment

Evaluation Continue non Intégrale

Anglais	3	Semestre 1	33
-------------------------	---	------------	----

Anglais

ECTS : 3

Semester: Semestre 1

Detail

Lecture: 33

Language(s) of instruction

Anglais

Remote teaching

non

Type of assessment

Evaluation Continue non Intégrale

Elasticité et ses applications industrielles	6	Semestre 1	21	21
--	---	------------	----	----

Subjects	ECTS	Semester	Lecture	directed study	practical class	Lecture/directed study	Lecture/practical class	directed study/practical class
----------	------	----------	---------	----------------	-----------------	------------------------	-------------------------	--------------------------------

Elasticité et ses applications industrielles

ECTS : 6

Semester: Semestre 1

Detail

Lecture: 21

Directed study: 21

Language(s) of instruction

Français

Remote teaching

non

Type of assessment

Evaluation Continue non Intégrale

Milieux granulaires	3	Semestre 1	20	20	15
-------------------------------------	---	------------	----	----	----

Milieux granulaires

ECTS : 3

Semester: Semestre 1

Detail

Lecture: 20

Practical study : 15

Directed study: 20

Language(s) of instruction

Français

Remote teaching

non

Type of assessment

Evaluation Continue non Intégrale

Systemes Colloïdaux : applications biologiques et industrielles	3	Semestre 1	15
---	---	------------	----

Subjects	ECTS	Semester	Lecture	directed study	practical class	Lecture/directed study	Lecture/practical class	directed study/practical class
----------	------	----------	---------	----------------	-----------------	------------------------	-------------------------	--------------------------------

■

Systemes Colloidaux : applications biologiques et industrielles

ECTS : 3

Semester: Semestre 1

Detail

Lecture: 15

Language(s) of instruction

Français

Remote teaching

non

Type of assessment

Evaluation Continue non Intégrale

UE optionnelles "fluides complexes et milieux divisés"

Subjects	ECTS	Semester	Lecture	directed study	practical class	Lecture/directed study	Lecture/practical class	directed study/practical class
----------	------	----------	---------	----------------	-----------------	------------------------	-------------------------	--------------------------------

[Insertion Professionnelle](#) 3 Semestre 1 25

■

Insertion Professionnelle

ECTS : 3

Semester: Semestre 1

Detail

Lecture: 25

Language(s) of instruction

Français

Remote teaching

non

Type of assessment

Evaluation Continue non Intégrale

[Milieux Poreux et écoulement dans les roches](#) 3 Semestre 1 22.5

Subjects	ECTS	Semester	Lecture	directed study	practical class	Lecture/directed study	Lecture/practical class	directed study/practical class	di
----------	------	----------	---------	----------------	-----------------	------------------------	-------------------------	--------------------------------	----

■

Milieux Poreux et écoulement dans les roches

ECTS : 3

Semester: Semestre 1

Detail

Lecture: 22.5

Language(s) of instruction

Français

Remote teaching

non

Type of assessment

Evaluation Continue non Intégrale

Elective courses "Physics of Complex Systems"

Subjects	ECTS	Semester	Lecture	directed study	practical class	Lecture/directed study	Lecture/practical class	directed study/practical class	di
----------	------	----------	---------	----------------	-----------------	------------------------	-------------------------	--------------------------------	----

[Machine Learning](#) 3 Semestre 28

■

Machine Learning

ECTS : 3

Semester: Semestre 2

Detail

Lecture: 28

Language(s) of instruction

Français

Remote teaching

non

Bibliography

Pattern Recognition And Machine Learning, C.

Bishop, Springer-Verlag New York Inc

Information, Physics, and Computation, M.

Mézard and A. Montanari, OUP Oxford

Type of assessment

Evaluation Continue non Intégrale

[Theoretical](#)

[Physics](#)

[Spring School of](#) 12 Semestre 2 112

[Complex](#)

[Systems](#)



Theoretical Physics Spring School of Complex Systems

ECTS : 12
 Semester: Semestre 2
 Detail
 Lecture: 112
 Language(s) of instruction
 Français
 Remote teaching
 non
 Type of assessment
 Evaluation Continue non Intégrale
[Traffic modelling : jams, crowds and molecular pedestrians](#) 3 Semestre 28
 2

Traffic modelling : jams, crowds and molecular pedestrians

ECTS : 3

Semester: Semestre 2

Detail

Lecture: 28

Language(s) of instruction

Anglais

Remote teaching

non

Programme/contents

As soon as space is organized, there is a need for transport. This is the case in systems as different as cities or cell interior.

In spite of these differences, transport can be described by the same families of models, inspired from those developped for fluids, and corresponding to different description levels: microscopic, mesoscopic, or macroscopic.

In this course, we shall study the properties of the different types of models, see how conservation laws constrain the form of model equations, and discuss which models are more appropriate for given applications. We shall also see how the competition for space that can be described through game theory.

Type of assessment

Evaluation Continue non Intégrale

[Econophysics](#) 3 Semestre 28
2



Econophysics

ECTS : 3
Semester: Semestre 2
Detail
Lecture: 28
Language(s) of instruction
Français
Remote teaching
non
Bibliography

An Introduction to Econophysics: Correlations and Complexity in Finance, R.N. Mantegna and H.E. Stanley, Cambridge University Press
The statistical Mechanics of Financial Markets, J. Voit, Springer.
The Mathematics of Financial Derivatives: A student introduction, P. Wilmott, S. Howison and J. Dewynne, Cambridge University Press.

Type of assessment
Evaluation Continue non Intégrale

[Statistical physics of ecosystems](#) 3 Semestre 28
2

Statistical physics of ecosystems

ECTS : 3

Semester: Semestre 2

Detail

Lecture: 28

Language(s) of instruction

Français

Remote teaching

non

Programme/contents

Many natural ecosystems are home to a staggering diversity of species. How do so many species coexist? What principles underly the organization of ecosystems? How do they evolve over time or respond to perturbations? The aim of this course is to show how tools coming from the statistical physics of nonequilibrium and disordered systems can be used to approach such questions.

Type of assessment

Evaluation Continue non Intégrale

[Random](#)

[matrix theory](#)

[and](#)

[applications](#)

3 Semestre 28
2



Random matrix theory and applications

ECTS : 3
Semester: Semestre 2
Detail
Lecture: 28
Language(s) of instruction
Français
Remote teaching
non
Bibliography

Lecture on macroeconomics, O. Jean Blanchard & S. Fischer, MIT Press. Game Theory, M. Maschler, E. Solan & S. Zamir, Cambridge University Press.

Type of assessment
Evaluation Continue non Intégrale

[Out of equilibrium statistical physics](#) 3 Semestre 2 28



Out of equilibrium statistical physics

ECTS : 3
Semester: Semestre 2
Detail
Lecture: 28
Language(s) of instruction
Français
Remote teaching
non
Bibliography

Stochastic processes in physics and chemistry, N. van Kampen, Elsevier. Critical dynamics, U. C. Täuber, Cambridge University Press.

Type of assessment
Evaluation Continue non Intégrale

Stage "Physics of Complex Systems"

Subjects	ECTS	Semester	Lecture	directed study	practical class	Lecture/directed study	Lecture/practical class	directed study/practical class	distance learning courses
Stage PCS	18	Semestre 2							
■									

Stage PCS

ECTS : 18

Semester: Semestre 2

Language(s) of instruction

Français

Remote teaching

non

Type of assessment

Evaluation Continue non Intégrale

Stage "microfluidique"

Subjects	ECTS	Semester	Lecture	directed study	practical class	Lecture/directed study	Lecture/practical class	directed study/practical class	distance learning courses
Stage MF	30	Semestre 2							
■									

Stage MF

ECTS : 30

Semester: Semestre 2

Language(s) of instruction

Français

Remote teaching

non

Type of assessment

Evaluation Continue non Intégrale

Stage "fluides complexes et milieux divisés"

Subjects	ECTS	Semester	Lecture	directed study	practical class	Lecture/directed study	Lecture/practical class	directed study/practical class	distance learning courses
Stage FCMD	30	Semestre 2							

Subjects	ECTS	Semester	Lecture	directed study	practical class	Lecture/directed study	Lecture/practical class	directed study/practical class	distance learning courses
----------	------	----------	---------	----------------	-----------------	------------------------	-------------------------	--------------------------------	---------------------------

■

Stage FCMD

ECTS : 30

Semester: Semestre 2

Language(s) of instruction

Français

Remote teaching

non

Type of assessment

Evaluation Continue non Intégrale

Teaching Location(s)

ORSAY

PARIS 05

PARIS 13

Contact

- **Christophe TEXIER**

<http://www.universite-paris-saclay.fr/formation/master/physique-fondamentale-et-applications/m2-systemes-complexes>