MASTER - Physique

Astrophysique

Langue du parcours			Anglais
ECTS			120 ECTS
Volume horaire			
TP : 82h	TD : 44h	CI : 0h	CM : 153h
Formation initiale			Oui
Formation continue			Non
Apprentissage			Non
Contrat de professionnalisation			Non
Stage : (durée en semaines)			15

Pré-requis obligatoires

- Written and spoken english.
- Practical knowledge of at least one programming language.

Objectifs du parcours

This program intends to build a broad knowledge of the field of astrophysics and its associated methodology to prepare the students to pursue a PhD training in astrophysics or associated domains. It offers during the first semester a set of compulsory courses covering most of the requirements in modern astrophysics as well as courses focused on data science (databases, statistical modeling, etc) with the aim to give the students a strong knowledge base. These courses are complemented by optional courses giving in-depth knowledge on specific topics and permitting students to start building an area of expertise. The second term is devoted to projects and contains observational projects on the in-house telescope, a 5 nights project at a professional observing site (OHP) and a 15 weeks internship. **All the teaching is conducted in English to prepare the students to work in a highly international environment.**

Compétences à acquérir

English version:

- Theoretical knowledge of physics and astrophysics
- Mastery of Scientific English (written and oral)
- Mastery of data analysis tools
- Mastery of observation tools
- Mastery of statistical analysis tools
- Modeling/solving complex problems
- Observation of natural systems.

French version:

- Connaissance théorique de la physique et de l'astrophysique
- Maîtrise de l'anglais scientifique (écrit et oral)
- Maîtrise des outils de l'analyse de données
- Maîtrise des outils d'observation
- Maîtrise des outils statistiques
- Modélisation/résolution de problèmes complexes
- Observation des systèmes naturels
- Travail en mode projet
- Avoir une connaissance du monde du travail.

Poursuite d'études

- Poursuite d'études en Doctorat.

Stage et projet tutoré

- 15 weeks internshipin S4
- Observing project on 2T36
- 5 nights observing session at OHP
- 1 project on numerical methods
- 1 programming project in python
- 1 project on databases (SQL) and virtual observatories

Contact

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Master 1 Physique - Tronc commun (TC)

Semestre 1 - Master Physique (tronc commun)

	ECTS	CM	CI	TD	TP	TE	Stage
UE 1 - Semestre 1 - Quantum mechanics and statistical mechanics	9 ECTS	56 h		56 h			
Quantum mechanics		28 h		28 h			
Statistical mechanics		28 h		28 h			
UE 2 - Semestre 1 - Computer programming and Current research in physics	6 ECTS	40 h			18 h		
Computer programming and numerical simulations		28 h					
Current research in physics		12 h					
UE 3 - Semestre 1 - Experimental physics I	6 ECTS				60 h		
Experimental physics I					60 h		
UE 4 - Semestre 1 - Elective course (2 to choose among)	6 ECTS	56 h					
Mécanique des milieux continus		28 h					
Astrophysical objects and their observations		28 h					
Group theory		28 h					
Ionizing radiation and detection methods		28 h					
General relativity		28 h					
Physique statistique avancée & Introduction à l'analyse complexe		28 h					
Variational principles and analytical mechanics		28 h					
Advanced quantum mechanics		28 h					
Project		28 h					
Photonics for quantum science and technology		28 h					
Soft condensed matter		28 h					
UE 5 - Semestre 1 - Free course	3 ECTS						
UE facultative (au-delà de 30 ECTS validés) - Bases de mécanique quantique et physique statistique	3 ECTS	32 h					
Bases de mécanique quantique							
Bases de physique statistique							

Semestre 2 - Master Physique (tronc commun)

	ECTS	CM	CI	TD	TP	TE	Stage
UE 1 - Semestre 2 - Nuclear physics and elementary particles - Solid state physics	9 ECTS	52 h		52 h			
Nuclear physics and elementary particles		26 h		26 h			
Solid state physics		26 h		26 h			
UE 2 - Semestre 2 - Computer programming and Numerical simulations	3 ECTS	12 h			10 h		
Computer programming and Numerical simulations		12 h			10 h		
UE 3 – Semestre 2 - Laboratory physics	12 ECTS	4 h					4 sem
Laboratory internship							4 sem
Experimental physics II: nano fabrication in clean room							
UE 4 - Semestre 2 - Elective course (1 to choose among)	3 ECTS	28 h					
Particles and astroparticles		28 h					
Stellar physics		28 h					
Atomic and molecular physics		28 h					
Introduction to physics of living systems		28 h					
Relativistic quantum mechanics		28 h					
Numerical methods in physics		28 h					
Project		28 h					
Electronics for quantum science and technology		28 h					
Phénomènes critiques et physique statistique hors-équilibre		28 h					
UE 5 - Semestre 2 - Free course	3 ECTS						
UE 7 - Semestre 2 - Optional	3 ECTS						8 sem
Voluntary internship							8 sem

Master 2 - Astrophysique

Semestre 3 - Astrophysique

	ECTS	CM	CI	TD	TP	TE	Stage
UE 1 - Semestre 3 - Astrophysical objects and theories	12 ECTS	70 h		4 h	2 h	168 h	
Astrophysical objects and theories		70 h		4 h	2 h	168 h	
UE 2 - Semestre 3 - Data analysis	6 ECTS	28 h			12 h	90 h	
Data analysis		28 h			12 h	90 h	
UE 3 - Semestre 3 - Numerical physics and astrophysical medium modeling	6 ECTS	22 h		28 h	26 h	110 h	
Numerical physics and astrophysical medium modeling		22 h		28 h	26 h	110 h	
UE 4 - Semestre 3 - Option (1 to choose among)	3 ECTS	20 h				40 h	
Inverse problem theory and advanced data analysis		20 h				40 h	
Compact objects		20 h				40 h	
Galaxy evolution		20 h				40 h	
External (planetary science, telescope and instrumentation, solar physics)		20 h				40 h	
UE 5 - Semestre 3 - Option (1 to choose among)	3 ECTS	20 h				40 h	
Inverse problem theory and advanced data analysis		20 h				40 h	
Compact objects		20 h				40 h	
Galaxy evolution		20 h				40 h	
External (planetary science, telescope and instrumentation, solar physics)		20 h				40 h	
UE 6 - Semestre 3 - Option (1 to choose among)	3 ECTS	20 h				40 h	
Inverse problem theory and advanced data analysis		20 h				40 h	
Compact objects		20 h				40 h	
Galaxy evolution		20 h				40 h	
External (planetary science, telescope and instrumentation, solar physics)		20 h				40 h	

Semestre 4 - Astrophysique

	ECTS	CM	CI	TD	TP	TE	Stage
UE 1 - Semestre 4 - Bibliographical and observationnal projects	9 ECTS	5 h		12 h	42 h	40 h	
Bibliographical and observationnal projects		5 h		12 h	42 h	40 h	
UE 2 - Semestre 4 - Internship	21 ECTS						15 sem
Internship							15 sem
Optional							8 sem
Voluntary internship							8 sem