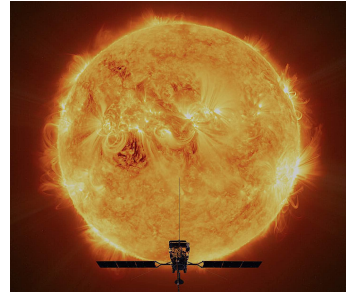




## Pisa-Paris CURRICULUM Plasma Physics



(Structure of Matter)

## UNIPI STUDENT

### FIRST YEAR AT UNIPI

#### CORSI OBBLIGATORI - MANDATORY COURSES

18/24 CFU

FONDAMENTI DI INTERAZIONE RADIAZIONE MATERIA  
(Fundamentals of matter radiation interaction)

9 CFU

FISICA DEI PLASMI  
(Plasma Physics)

9 CFU

FLUIDODINAMICA (se non già sostenuto nella Laurea Triennale)  
(Hydrodynamics, if not passed at Laurea Triennale)

6 CFU

#### CORSI DI CUI ALMENO UNO PER GRUPPO OBBLIGATORIO AT LEAST ONE BY GROUP MANDATORY COURSE

18 CFU

1a. ANALISI STATISTICA DEI DATI  
(Statistical analysis of data)

1b. LABORATORIO DI OTTICA QUANTISTICA A  
(Quantum optics laboratory)

9 CFU

1c. METODI NUMERICI PER LA FISICA  
(Numerical Methods for Physics)

2a. FISICA STATISTICA (Statistical Physics)	
2b. FISICA TEORICA 1 (Theoretical Physics)	9 CFU

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**CORSI OPZIONALI - COURSES ON OPTION** **24/18 CFU**

Fortemente suggeriti (almeno uno) - strongly suggested (at least one)

- PROCESSI ASTROFISICI (Astrophysics Processes)	9 CFU
- FISICA STELLARE A (Stellar Physics)	6 CFU
- ASTROFISICA EXTRAGALATTICA E COSMOLOGIA (Extragalactic Astrophysics and Cosmology)	6 CFU
- ASTROFISICA GENERALE (se non già sostenuto nella triennale) (General Astrophysics, if not passed at Laurea Triennale)	6 CFU

Fortemente suggeriti (almeno uno) - strongly suggested (at least one)

- SISTEMI COMPLESSI (Complex Systems)	9 CFU
- FLUIDODINAMICA COMPUTAZIONALE (ING. AEROSPAZIALE) (Computational Hydrodynamics – at Aerospace Engineering)	6 CFU

Altri - others

RELATIVITA` GENERALE (General Relativity)	9 CFU
FISICA DELLO STATO SOLIDO (Solid State Physics)	9 CFU
LASER A STATO SOLIDO (Solid State Laser)	3 CFU
ALGORITMI DI SPETTROSCOPIA (Spectroscopy Algorithms)	3 CFU
.....	CFU

**TOTAL** **60 CFU**

## II YEAR AT SU

### MANDATORY COURSES

18 ECTS

OUTILS POUR LES PLASMAS ET LA FUSION (tools for plasmas and fusion)	TC1	3 CFU
MAGNETOHYDRODYNAMIQUE (Magnetohydrodynamics)	TC2	3 CFU
THEORIE CINETIQUE (Kinetic Theory)	TC3	3 CFU
ONDES ET INSTABILITES (Waves and Instabilities)	TC4	3 CFU
INSTRUMENTATION, DIAGNOSTIC ET ANALYSE DES PLASMA (Instrumentation, Diagnostic and Plasma Analysis)	TC6	3 CFU
PHYSIQUE ATOMIQUE MOLÉCULAIRE ET RAYONNEMENT (Atomique and molecular physics and radiation)	TC7	3 CFU

### THESIS

42 ECTS

(COURSES PROPÉDEUTIQUE)  
(PROPAEDEUTIC COURSES)

PLASMAS SPATIAUX (Space Plasmas)	O3	3 CFU
PLASMAS ASTROPHYSIQUES A HAUTE DENSITÉ D'ÉNERGIE (high density Astrophysical Plasmas)	O4	3 CFU

PREPARATION AU STAGE  
(METHODES NUMERIQUES ET SIMULATIONS)

6 CFU

STAGE

30 CFU

### TOTAL

60 ECTS

# FRENCH STUDENT

## FIRST YEAR AT SU

### MANDATORY COURSES (first semester)

AT LEAST ONE FOR EACH OF THE FOLLOWING 3 GROUPS

**18 CFU**

- mecanique quantique : des concepts à l'expérience 6 CFU
- mecanique quantique : bases et applications 6 CFU
  
- Physique statistique, des concepts à l'expérience 6 CFU
- Physique statistique, bases et applications 6 CFU
  
- physique numérique et informatiques 6 CFU
- Physique numérique (projet) 6 CFU

### COURSES ON OPTION

**12 CFU**

- Plasmas : bases physiques 3 CFU
- théorie classique des champs 3 CFU
- physique expérimentale I 3 CFU
- insertion professionnel 3 CFU

### MANDATORY COURSES (Seconde semestre)

**21 CFU**

- physique atomique et moléculaire 6 CFU
- physique expérimentale II 3 CFU
- cours d'anglais (english course) 3 CFU
- Stage 9 CFU

### COURSES ON OPTION

**9 CFU**

- Plasmas : applications 3 CFU
- Méthodes Numériques et Calculs Scientifiques 3 CFU
- Physique des Transports 3 CFU
- Astrophysique et cosmologie 3 CFU

## SECOND YEAR AT UNIPI

### MANDATORY COURSES

**9 CFU**

FISICA DEI PLASMI (FIS 05)  
(Plasma Physics)

9 CFU

### COURSES ON OPTION

**6 CFU**

#### AT LEAST ONE OF THE FOLLOWING

- PLASMI TEORIA CINETICA  
(Plasma Kinetic Theory)

6 CFU

- ELETTRODINAMICA DEI MEZZI CONTINUI  
(Electrodynamics of continuous media)

6 CFU

- OTTICA QUANTISTICA E PLASMI  
(Quantum optics and Plasma)

6 CFU

- FLUIDODINAMICA COMPUTAZIONALE (ING. AEROSPAZIALE)  
(Computational Hydrodynamics – at Aerospace Engineering)

6 CFU

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CFU

### MASTER THESIS/STAGE

**45 CFU**

### TOTAL

**120 CFU**

**Pisa-Paris CURRICULUM**  
**Fundamental Interactions**

**UNIPI STUDENT**

**FIRST YEAR AT UNIPI**

**MANDATORY COURSES** **27 CFU**

FISICA TEORICA 1 (FIS 02) (THEORETICAL PHYSICS - PART 1)	9 CFU
LABORATORIO DI INTERAZIONI FONDAMENTALI B/ Modulo A (FIS 01) (FUNDAMENTAL INTERACTIONS LABORATORY - part 1)	9 CFU
INTERAZIONI FONDAMENTALI (FIS 04) (FUNDAMENTAL INTERACTIONS)	9 CFU

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**OPTIONAL COURSES** **6 CFU**

**AT LEAST ONE OF THE FOLLOWING**

- ASTROFISICA GENERALE (FIS 05) (se non gia` seguito nel percorso triennale) (ASTROPHYSICS)	6 CFU
- ASTROPARTICELLE A (FIS 05) (ASTROPARTICLE - SHORT VERSION)	6 CFU

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**OPTIONAL COURSES** **27 CFU**

CORSI IN ALTERNATIVA, FRA QUELLI NON SCELTI SOPRA  
O NELLA LISTA SEGUENTE

COURSES TO BE CHOSEN IN THE FOLLOWING LIST OR AMONG  
THE ONES NOT CHOSEN ABOVE

RELATIVITA` GENERALE (FIS 02) (GENERAL RELATIVITY)	9 CFU
COSMOLOGIA DEL PRIMO UNIVERSO S (FIS 05) (EARLY UNIVERSE COSMOLOGY)	6 CFU
FISICA DELLE PARTICELLE S (FIS 04)	6 CFU

(PARTICLE PHYSICS - SHORT VERSION) FISICA DELLE PARTICELLE S (FIS 04)	9 CFU
(PARTICLE PHYSICS – FULL VERSION) FISICA DELLE ONDE GRAVITAZIONALI A (FIS 01)	6 CFU
(GRAVITATIONAL WAVES PHYSICS - SHORT VERSION) REAZIONI NUCLEARI DI INTERESSE ASTROFISICO S (FIS 04)	6 CFU
(LOW ENERGY NUCLEAR REACTIONS - SHORT VERSION) INSTRUMENTATION FOR FUNDAMENTAL INTERACTIONS PHYSICS (FIS 01)	9 CFU
ANALISI STATISTICA DEI DATI (FIS 01)	9 CFU
(STATISTICS ANALYSIS OF EXP DATA) MACCHINE ACCELERATRICI (FIS 04)	9 CFU
(ACCELERATORS) COMPUTING METHODS FOR EXPERIMENTAL PHYSICS AND DATA ANALYSIS (FIS 01)	9 CFU
RECENT HIGHLIGHTS IN FUNDAMENTAL INTERACTIONS (FIS 01)	3 CFU
SIMMETRIE DISCRETE (FIS/04)	6 CFU
(DISCRETE SIMMETRIES) FISICA DELLE ONDE GRAVITAZIONALI (FIS 01)	9 CFU
(GRAVITATIONAL WAVES PHYSICS - FULL VERSION) FISICA TEORICA 2 (FIS 02)	9 CFU
(THEORETICAL PHYSICS - PART 2) FISICA AI COLLISIONATORI ADRONICI (FIS 04)	9 CFU
(HADRONIC COLLIDER PHYSICS) FISICA AI COLLISIONATORI ADRONICI S (FIS 04)	6 CFU
(HADRONIC COLLIDER PHYSICS - SHORT VERSION) FONDAMENTI DI INTERAZIONE RADIAZIONE MATERIA (FIS 03)	9 CFU
(FUNDAMENTALS OF PHOTON-MATTER INTERACTION) FISICA DELLO STATO SOLIDO (FIS 03)	9 CFU
(SOLID STATE PHYSICS) LABORATORIO DI INTERAZIONI FONDAMENTALI B/ Modulo B (FIS 01)	6 CFU
Completion of ASTROPARTICELLE A (FIS 05)	3 CFU
(ASTROPARTICLE - LONG VERSION) CROMODINAMICA QUANTISTICA (FIS 02)	9 CFU
(QUANTUM CHROMODYNAMICS)	

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**TOTAL 1<sup>st</sup> YEAR**

**60 CFU**

## II YEAR AT SU

<b>MANDATORY COURSES</b>	<b>9 CFU</b>
EXPERIMENTAL PROJECT (COUNTS AS STAGE/THESIS PREPARATION – THESIS PART 1)	6 CFU
LA PHYSIQUE DU DETECTORS (DETECTOR PHYSICS)	3 CFU
<b>COURSES ON OPTION</b>	<b>21 CFU</b>
<b>AT LEAST THREE OF THE FOLLOWING GROUP (ONE OF THESE IS COUNTED AS THESIS PREPARATION - PART 2)</b>	
THEORIE QUANTIQUE DE CHAMPS (QUANTUM FIELD THEORY)	6 CFU
PARTICULES ET SYMETRIES (PARTICLES AND SYMMETRIES)	6 CFU
COSMOLOGIE ET ASTROPARTICULES (COSMOLOGY AND ASTROPARTICLES)	6 CFU
DES NOYAUX AUX ETOILES (FROM NUCLEUS TO STARS)	6 CFU
<b>AT LEAST ONE OF THE FOLLOWING GROUP</b>	
RELATIVITE GENERALE (GENERAL RELATIVITY)	3 CFU
PHYSIQUE DES ACCELERATEURS (ACCELERATOR PHYSICS)	3 CFU
<b>THESIS – PART 3</b>	<b>30 CFU</b>
(PROPAEDEUTIC COURSES)	
NUMERICAL PROJECT	3 CFU
ADVANCED LECTURES	3 CFU



PREPARATION AU STAGE/MASTER THESIS	24 CFU
<b>TOTAL 2nd YEAR</b>	<b>60 CFU</b>
<b>TOTAL MASTER</b>	<b>120 CFU</b>

## **FRENCH STUDENT**

### **FIRST YEAR AT SU**

<b>MANDATORY COURSES</b>	<b>51 CFU</b>
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ADVANCED QUANTUM MECHANICS (FIS 02)	9 CFU
STATISTICAL PHYSICS (FIS 02)	9 CFU
NUCLEAR AND PARTICLE PHYSICS (FIS 04)	6 CFU
NUMERICAL METHODS FOR PHYSICS (FIS 01)	6 CFU
ASTROPHYSICS AND COSMOLOGY (FIS 05)	6 CFU
FRENCH FOREIGN LANGUAGE (ENGLISH)	3 CFU
LABORATORY (FIS 01)	3 CFU
INTERNSHIP (3 MONTHS)	9 CFU

### **COURSES ON OPTION**

<b>AT LEAST ONE OF THE FOLLOWING GROUP</b>	<b>3 CFU</b>
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CLASSICAL FIELD THEORY	3 CFU
TIME AND RELATIVITY	3 CFU
INTRODUCTION TO PLASMA PHYSICS	3 CFU

<b>AT LEAST ONE OF THE FOLLOWING GROUP</b>	<b>6 CFU</b>
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ATOM AND MOLECULAR PHYSICS	6 CFU
CONDENSED MATTER	6 CFU

<b>TOTAL 1<sup>st</sup> YEAR</b>	<b>60 CFU</b>
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### **SECOND YEAR AT UNIPI**

<b>COURSES ON OPTION</b>	<b>15/18 CFU</b>
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COURSES TO BE CHOSEN IN THE FOLLOWING LIST	15/18 CFU
RELATIVITA` GENERALE (FIS 02) (GENERAL RELATIVITY)	9 CFU
COSMOLOGIA DEL PRIMO UNIVERSO S (FIS 05) (EARLY UNIVERSE COSMOLOGY)	6 CFU
FISICA DELLE PARTICELLE S (FIS 04) (PARTICLE PHYSICS - SHORT VERSION)	6 CFU
FISICA DELLE PARTICELLE S (FIS 04) (PARTICLE PHYSICS - FULL VERSION)	9 CFU
INTERAZIONI FONDAMENTALI (FIS 04) (FUNDAMENTAL INTERACTIONS)	9 CFU
FISICA DELLE ONDE GRAVITAZIONALI A (FIS 01) (GRAVITATIONAL WAVES PHYSICS - SHORT VERSION)	6 CFU
REAZIONI NUCLEARI DI INTERESSE ASTROFISICO S (FIS 04) (LOW ENERGY NUCLEAR REACTIONS - SHORT VERSION)	6 CFU
INSTRUMENTATION FOR FUNDAMENTAL INTERACTIONS PHYSICS (FIS 01)	9 CFU
ANALISI STATISTICA DEI DATI (FIS 01) (STATISTICS ANALYSIS OF EXP DATA)	9 CFU
MACCHINE ACCELERATRICI (FIS 04) (ACCELERATORS)	9 CFU
COMPUTING METHODS FOR EXPERIMENTAL PHYSICS AND DATA ANALYSIS (FIS 01)	9 CFU
RECENT HIGHLIGHTS IN FUNDAMENTAL INTERACTIONS (FIS 01)	3 CFU
SIMMETRIE DISCRETE (FIS/04) (DISCRETE SIMMETRIES)	6 CFU
FISICA DELLE ONDE GRAVITAZIONALI (FIS 01) (GRAVITATIONAL WAVES PHYSICS - FULL VERSION)	9 CFU
FISICA TEORICA 2 (FIS 02) (THEORETICAL PHYSICS - PART 2)	9 CFU
FISICA AI COLLISIONATORI ADRONICI (FIS 01) (HADRONIC COLLIDER PHYSICS)	6/9 CFU
FONDAMENTI DI INTERAZIONE RADIAZIONE MATERIA (FIS 03) (FUNDAMENTS OF PHOTON INTERACTION WITH MATTERS)	9 CFU
FISICA DELLO STATO SOLIDO (FIS 03) (SOLID STATE PHYSICS)	9 CFU
<b>MASTER THESIS/STAGE</b>	<b>45/42 CFU</b>
<b>TOTAL 2nd YEAR</b>	<b>60 CFU</b>

**TOTAL MASTER**

**120 CFU**