



UNIVERSITÀ DI PISA



DUAL MASTER DIPLOMA DEGREE AGREEMENT

UNIFI – SORBONNE

Pisa-Paris CURRICULUM - Plasmas

UNIFI STUDENT

PRIMO ANNO A UNIFI FIRST YEAR AT UNIFI

CORSI OBBLIGATORI MANDATORY COURSES

18/24 CFU

FONDAMENTI DI INTERAZIONE RADIAZIONE MATERIA (Fundamentals of matter radiation interaction)	FIS/03	9 CFU
FISICA DEI PLASMI (Plasma Physics)	FIS/05	9 CFU
FLUIDODINAMICA (se non già sostenuto nella Laurea Triennale) (Hydrodynamics, if not passed at Laurea Triennale)	FIS/03	6 CFU

OBBLIGATORIO ALMENO UNO PER OGNUNO DEI DUE GRUPPI SEGUENTI MANDATORY AT LEAST ONE FOR EACH OF THE FOLLOWING TWO GROUPS

18 CFU

- ANALISI STATISTICA DEI DATI (Statistical analysis of data)	FIS/01	
- LABORATORIO DI OTTICA QUANTISTICA A (Quantum optics laboratory)	FIS/01	9 CFU
- METODI NUMERICI PER LA FISICA (Numerical Methods for Physics)	FIS/01	
- FISICA STATISTICA (Statistical Physics)	FIS/02	
- FISICA TEORICA 1 (Theoretical Physics)	FIS/01	9 CFU

CORSI OPZIONALI COURSES ON OPTION

24/18 CFU

Fortemente suggeriti
strongly suggested

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

suggerito almeno uno
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

altri
others

.....	CFU
TOTAL	60 CFU

II YEAR AT SU

COURS OBLIGATOIRES MANDATORY COURSES **18 CFU**

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 CFU**

(COURS PREPARATOIRES) (PROPAEDEUTIC COURSES)		
PLASMAS SPATIAUX (SPACE PLASMAS)	O3	3 CFU
PLASMAS ASTROPHYSIQUES DE HAUTE DENSITÉ (HIGH DENSITY ASTROPHYSICAL PLASMAS)	O4	3 CFU
PREPARATION AU STAGE (MASTER THESIS INTRODUCTION)		6 CFU
STAGE (STAGE)		30 CFU

TOTAL **60 CFU**

TOTAL MASTER **120 CFU**

SU STUDENT

PREMIERE ANNEE A SU FIRST YEAR AT SU

COURS OBLIGATOIRES (PREMIER SEMESTRE) MANDATORY COURSES (FIRST SEMESTER) 18 CFU

AU MOINS UN COURS DANS CHACUN DES 3 GROUPES
AT LEAST ONE FOR EACH OF THE FOLLOWING 3 GROUPS

- MECANIQUE QUANTIQUE : DES CONCEPTS À L'EXPÉRIENCE (QUANTUM MECHANICS : FROM CONCEPTS TO EXPERIMENT) (FIS 02)	6 CFU
- MECANIQUE QUANTIQUE : BASES ET APPLICATIONS (QUANTUM MECHANICS : FUNDAMENTALS AND APPLICATIONS) (FIS 02)	6 CFU
- PHYSIQUE STATISTIQUE : DES CONCEPTS À L'EXPÉRIENCE (STATISTICAL PHYSICS : FROM CONCEPTS TO EXPERIMENT) (FIS 02)	6 CFU
- PHYSIQUE STATISTIQUE : BASES ET APPLICATIONS (STATISTICAL PHYSICS : FUNDAMENTALS AND APPLICATIONS) (FIS 02)	6 CFU
- PHYSIQUE NUMÉRIQUE ET INFORMATIQUE (NUMERICAL PHYSICS AND COMPUTING) (FIS 01)	6 CFU
- PHYSIQUE NUMÉRIQUE (PROJET) (PROJECT IN NUMERICAL PHYSICS) (FIS 01)	6 CFU

COURS OPTIONNELS COURSES ON OPTION 12 CFU

- PLASMAS : BASES PHYSIQUES (PLASMAS : PHYSICAL BASES) (FIS 05)	3 CFU
- THÉORIE CLASSIQUE DES CHAMPS (CLASSICAL FIELD THEORY) (FIS 02)	3 CFU
- PHYSIQUE EXPÉRIMENTALE I (EXPERIMENTAL PHYSICS I) (FIS 01)	3 CFU
- INSERTION PROFESSIONNELLE (PROFESSIONAL TRAINING)	3 CFU

COURS OBLIGATOIRES (SECOND SEMESTRE) MANDATORY COURSES (SECOND SEMESTER) 21 CFU

PHYSIQUE ATOMIQUE ET MOLÉCULAIRE (ATOMIC AND MOLECULAR PHYSICS) (FIS 03)	6 CFU
PHYSIQUE EXPÉRIMENTALE II (EXPERIMENTAL PHYSICS II)	3 CFU
COURS D'ANGLAIS (ENGLISH COURSE)	3 CFU
STAGE (STAGE)	9 CFU

COURS OPTIONNELS COURSES ON OPTION 9 CFU

PLASMAS : APPLICATIONS (PLASMAS : APPLICATIONS) (FIS 03/05)	3 CFU
MÉTHODES NUMÉRIQUES ET CALCULS SCIENTIFIQUES (NUMERICAL METHODS AND SCIENTIFIC COMPUTATION) (FIS 01)	3 CFU
PHYSIQUE DES TRANSPORTS (TRANSPORT PHYSICS) (FIS 03)	3 CFU
ASTROPHYSIQUE ET COSMOLOGIE (ASTROPARTICLE AND COSMOLOGY) (FIS 05)	3 CFU

TOTAL 60 CFU DEUXIEME ANNEE A UNIP

SECOND YEAR AT UNIFI

MANDATORY COURSES

9 CFU

FISICA DEI PLASMI
(Plasma Physics)

FIS/05

9 CFU

COURSES ON OPTION

6 CFU

AT LEAST ONE OF THE FOLLOWING

- PLASMI TEORIA CINETICA

6 CFU

(Plasma Kinetic Theory)

- ELETTRODINAMICA DEI MEZZI CONTINUI

6 CFU

(ELECTRODYNAMICS OF CONTINUOUS MEDIA)

- OTTICA QUANTISTICA E PLASMI

6 CFU

(Quantum optics and Plasma)

- FLUIDODINAMICA COMPUTAZIONALE (ING. AEROSPAZIALE)

6 CFU

(Computational Hydrodynamics – at Aerospace Engineering)

OTHERS...

MASTER THESIS/STAGE

45 CFU

TOTAL

60 CFU

TOTAL MASTER

120 CFU

UNIFI STUDENT

FIRST YEAR AT UNIFI

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

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

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) (PARTICLE PHYSICS - SHORT VERSION)	6 CFU
FISICA DELLE PARTICELLE S (FIS 04) (PARTICLE PHYSICS – FULL VERSION)	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 04) (HADRONIC COLLIDER PHYSICS)	9 CFU
FISICA AI COLLISIONATORI ADRONICI S (FIS 04) (HADRONIC COLLIDER PHYSICS - SHORT VERSION)	6 CFU
FONDAMENTI DI INTERAZIONE RADIAZIONE MATERIA (FIS 03) (FUNDAMENTALS OF PHOTON-MATTER INTERACTION)	9 CFU
FISICA DELLO STATO SOLIDO (FIS 03) (SOLID STATE PHYSICS)	9 CFU

TOTAL 1ST YEAR **60 CFU**

II YEAR AT SU

MANDATORY COURSES **9 CFU**

EXPERIMENTAL PROJECT (COUNTS AS STAGE/THESIS PREPARATION – THESIS PART 1)	6 CFU
LA PHYSIQUE DU DETECTORS (DETECTOR PHYSICS)	3 CFU

COURSES ON OPTION **21 CFU**

**AT LEAST THREE OF THE FOLLOWING GROUP
(ONE OF THESE IS COUNTED AS THESIS PREPARATION - PART 2)**

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

AT LEAST ONE OF THE FOLLOWING GROUP

RELATIVITE GENERALE (GENERAL RELATIVITY)	3 CFU
PHYSIQUE DES ACCELERATEURS (ACCELERATOR PHYSICS)	3 CFU

THESIS – PART 3 **30 CFU**

(NOTE: The total number of CFU assigned to the Master Thesis is 42 and is given by the sum of Thesis Part 1 (6 CFU), Thesis Part 2 (6 CFU) and Thesis Part 3 (30 CFU)).

(PROPAEDEUTIC COURSES)	
NUMERICAL PROJECT	3 CFU
ADVANCED LECTURES	3 CFU

PREPARATION AU STAGE/MASTER THESIS	24 CFU
TOTAL 2ND YEAR	60 CFU
TOTAL MASTER	120 CFU

SU STUDENT

FIRST YEAR AT SU

MANDATORY COURSES	51 CFU
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

AT LEAST ONE OF THE FOLLOWING GROUP	3 CFU
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CLASSICAL FIELD THEORY	3 CFU
TIME AND RELATIVITY	3 CFU

AT LEAST ONE OF THE FOLLOWING GROUP	6 CFU
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ATOM AND MOLECULAR PHYSICS	6 CFU
CONDENSED MATTER	6 CFU

TOTAL 1ST YEAR	60 CFU
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SECOND YEAR AT UNIPI

COURSES ON OPTION	15/18 CFU
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COURSES TO BE CHOSEN IN THE FOLLOWING LIST	15/18 CFU
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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)	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 01)	6/9 CFU
(HADRONIC COLLIDER PHYSICS)	
FONDAMENTI DI INTERAZIONE RADIAZIONE MATERIA (FIS 03)	9 CFU
(FUNDAMENTS OF PHOTON INTERACTION WITH MATTERS)	
FISICA DELLO STATO SOLIDO (FIS 03)	9 CFU
(SOLID STATE PHYSICS)	
MASTER THESIS/STAGE	45/42 CFU
TOTAL 2ND YEAR	60 CFU
TOTAL MASTER	120 CFU