UNIVERSITÀ DI PISA

SORBONNE UNIVERSITÉ

DUAL MASTER DIPLOMA DEGREE AGREEMENT

ANNEX A

Versione 1.0

Pisa-Paris CURRICULUM - Plasmas

UNIPI STUDENT

PRIMO ANNO A UNIPI
FIRST YEAR AT UNIPI

CORSI OBBLIGATORI — **18/24 CFU**
MANDATORY COURSES

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 gia` sostenuto nella Laurea Triennale) (Hydrodynamics, if not passed at Laurea Triennale)	FIS/03	6 CFU

OBBLIGATORIO ALMENO UNO PER OGNUNO DEI DUE GRUPPI SEGUENTI — **18 CFU**
MANDATORY AT LEAST ONE FOR EACH OF THE FOLLOWING TWO GROUPS

- 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 — **24/18 CFU**
COURSES ON OPTION

Fortemente suggeriti
strongly suggested

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

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

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) — 18 CFU
MANDATORY COURSES (FIRST SEMESTER)

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 MECANICS : FROM CONCEPTS TO EXPERIMENT)	(FIS 02)	**6 CFU**
- MECANIQUE QUANTIQUE : BASES ET APPLICATIONS (QUANTUM MECANICS : 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 — 12 CFU
COURSES ON OPTION

- 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) — 21 CFU
MANDATORY COURSES (SECOND SEMESTER)

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

COURS OPTIONNELS — 9 CFU
COURSES ON OPTION

PLASMAS : APPLICATIONS (PLASMAS : APPLICATIONS) (FIS 03/05)	**3 CFU**
MÉTHODES NUMÉRIQUES ET CALCULS SCIENTIFIQUES (NUMERICAL METHODS ANS 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**

Versione 1.0

DEUXIEME ANNE A UNIPI
SECOND YEAR AT UNIPI

MANDATORY COURSES		**9 CFU**
FISICA DEI PLASMI (Plasma Physics)	FIS/05	9 CFU
COURSES ON OPTION AT LEAST ONE OF THE FOLLOWING		**6 CFU**
- 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
OTHERS…		
MASTER THESIS/STAGE		**45 CFU**
TOTAL		**60 CFU**
TOTAL MASTER		**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

OPTIONAL COURSES **AT LEAST ONE OF THE FOLLOWING**	**6 CFU**
- 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**
CLASSICAL FIELD THEORY	3 CFU
TIME AND RELATIVITY	3 CFU
AT LEAST ONE OF THE FOLLOWING GROUP	**6 CFU**
ATOM AND MOLECULAR PHYSICS	6 CFU
CONDENSED MATTER	6 CFU
TOTAL 1ST YEAR	**60 CFU**

SECOND YEAR AT UNIPI

COURSES ON OPTION	**15/18 CFU**
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)	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**