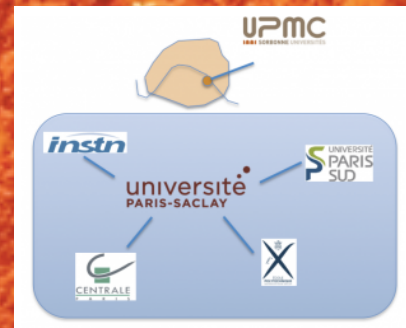


Francesco Califano

*Physics Department
University of Pisa, Italy*

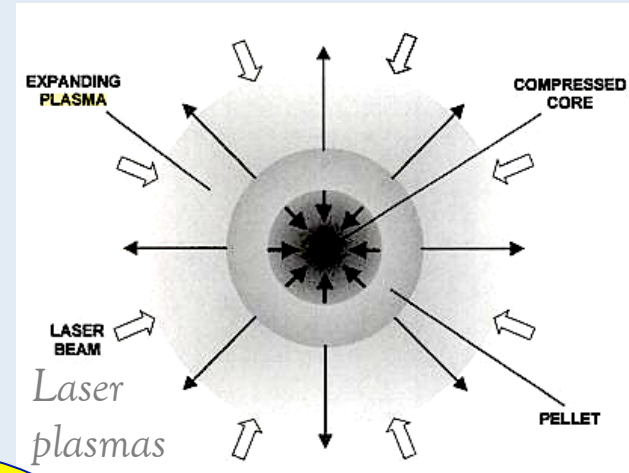
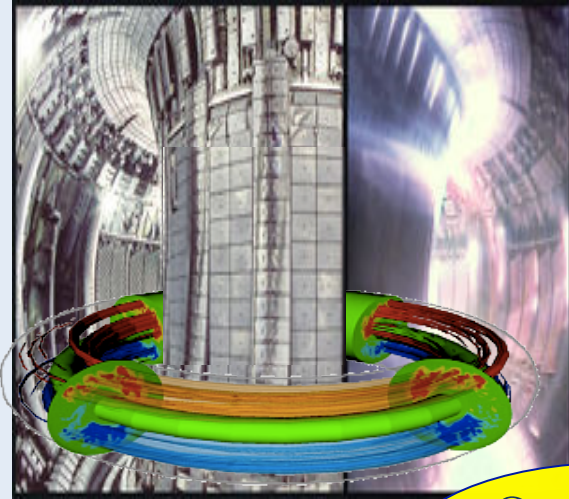
*I plasmi nello spazio e in laboratorio:
studio della dinamica di un sistema complesso*



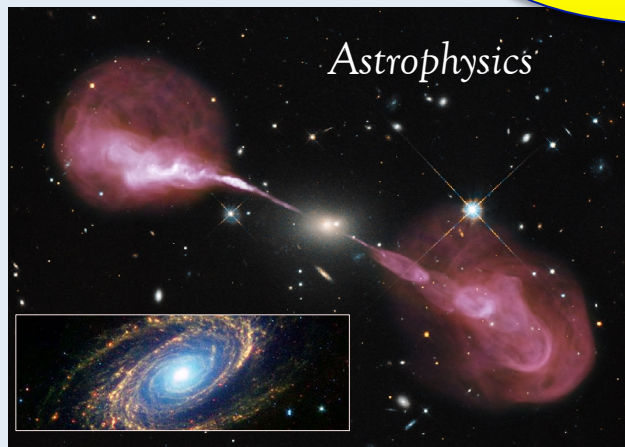
For many observed phenomenon *very similar physical mechanism*

Plasmas are produced in the laboratory mainly for fusion purpose

TOKAMAK fusion machine



Complex and
fascinating systems



Why space plasmas are so important for plasma physics ?

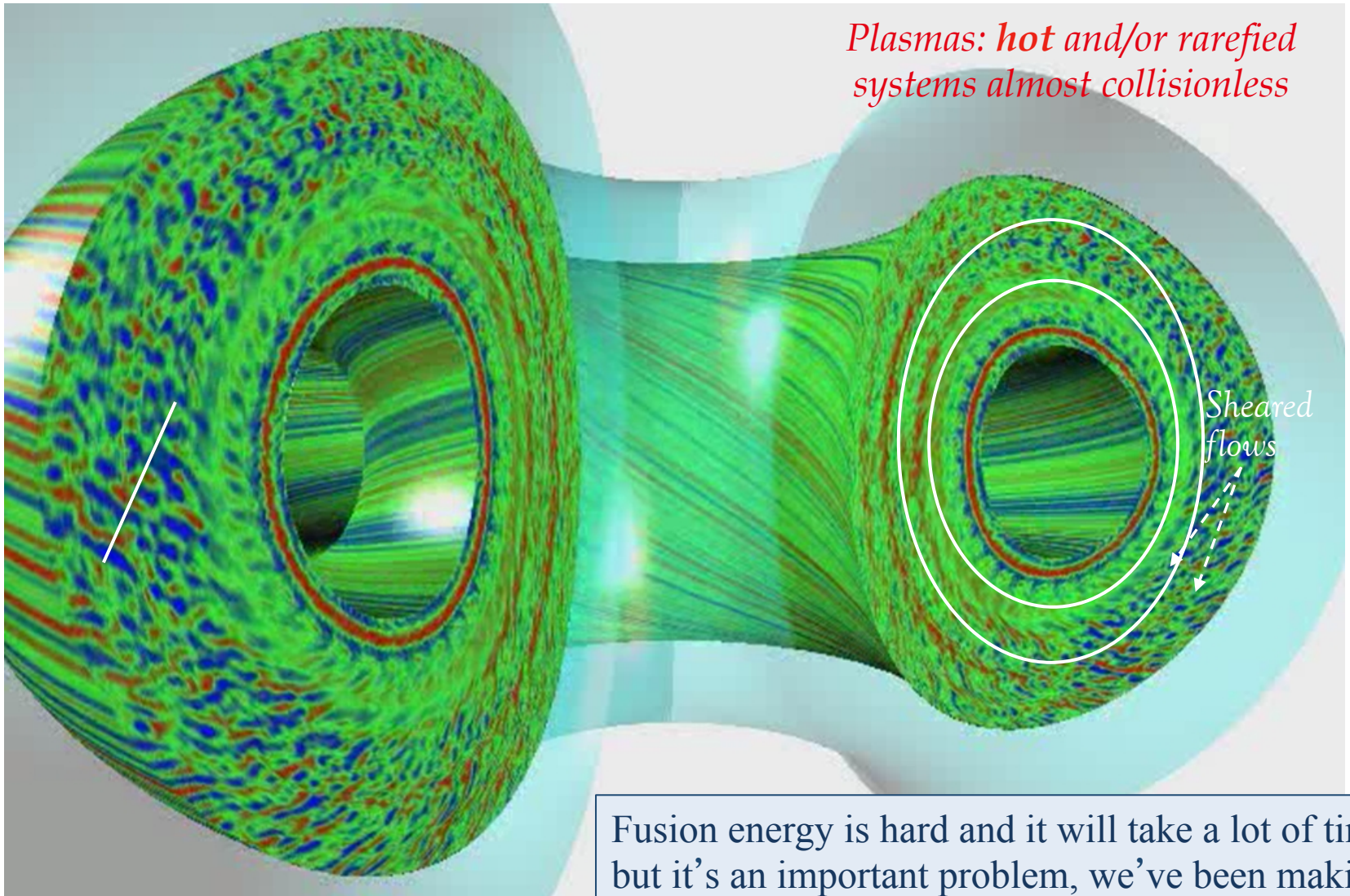
*Significant technical developments in space observations have offered the possibility to obtain **measurements of electric and magnetic fields**, density, etc...with a sufficient resolution (in space and time) to reach the **kinetic scales**, such as the Debye length and electron plasma frequency.*



*It is today possible to **investigate the dynamics and the fine structuring of space plasmas**.*

Space plasmas: a laboratory of excellence for collisionless plasma dynamics

Laboratory plasmas



Fusion energy is hard and it will take a lot of time, but it's an important problem, we've been making progress, and there are interesting ideas to pursue that could make it more practical

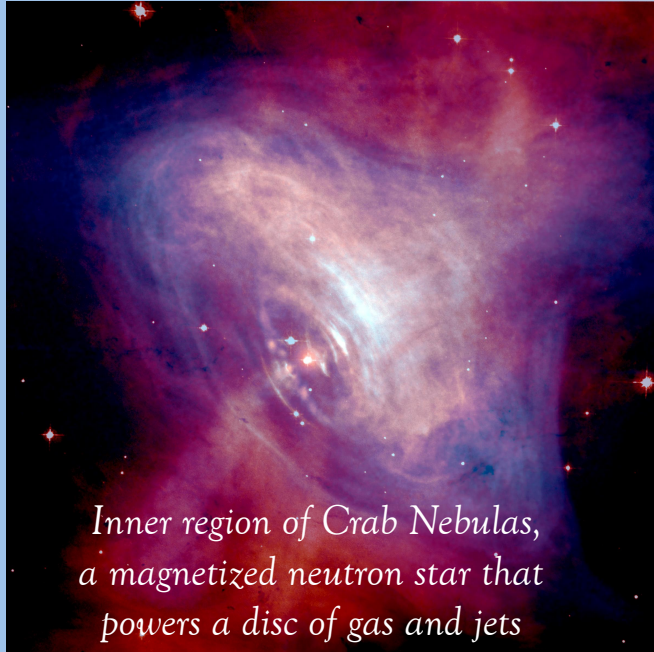
*Astrophysics, very spectacular objects:
accretion disk, stars, black-holes, jets, ...*



*Elliptical galaxy emitting
a relativistic jet [M87]*



*Lagoon Nebula: a giant interstellar
cloud in the constellation Sagittarius*



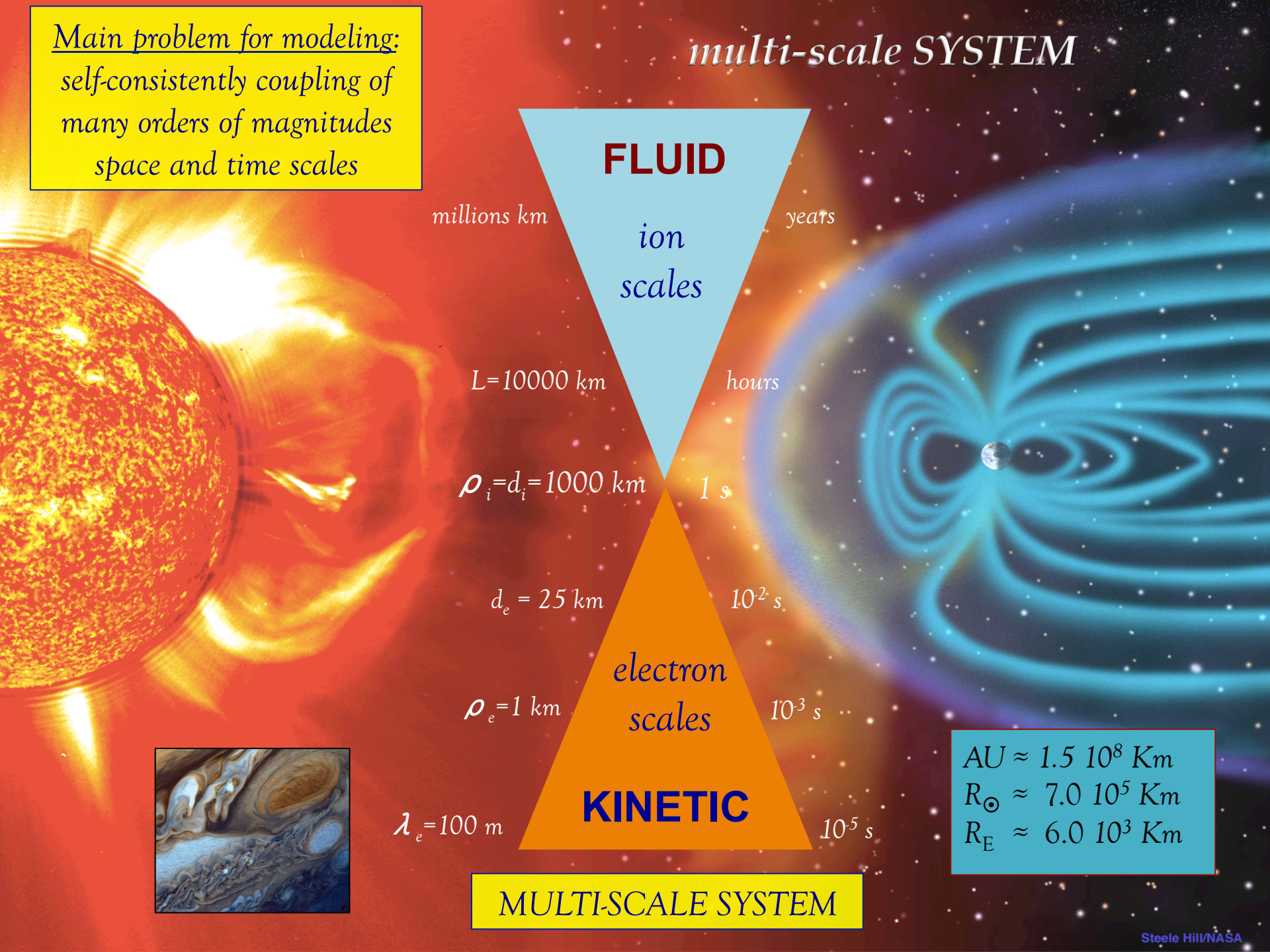
*Inner region of Crab Nebulas,
a magnetized neutron star that
powers a disc of gas and jets*



*Plasmas: hot and/or
rarefied systems almost
collisionless*

Main problem for modeling:
self-consistently coupling of
many orders of magnitudes
space and time scales

multi-scale SYSTEM



FLUID

ion
scales

millions km

years

$L = 10000 \text{ km}$

hours

$\rho_i = d_i = 1000 \text{ km}$

1 s

$d_e = 25 \text{ km}$

10^{-2} s

$\rho_e = 1 \text{ km}$

10^3 s

electron
scales

$\lambda_e = 100 \text{ m}$

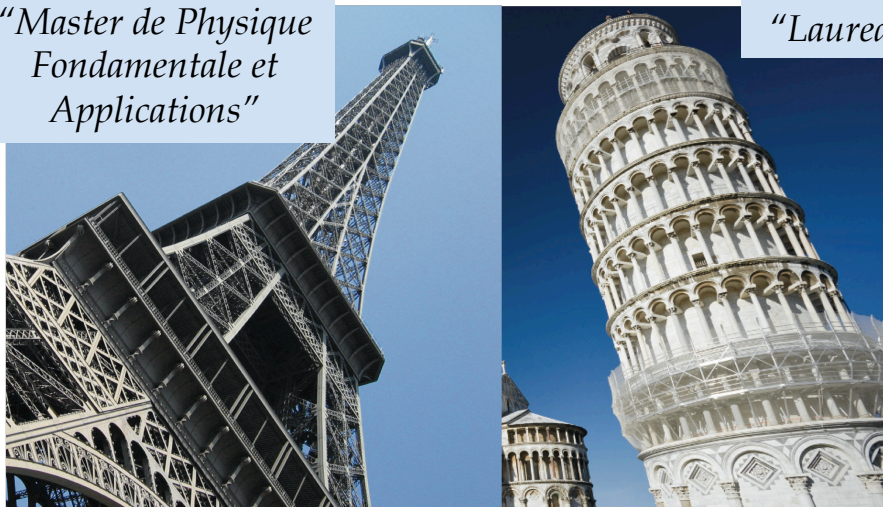
10^5 s

KINETIC

$\text{AU} \approx 1.5 \cdot 10^8 \text{ Km}$
 $R_{\odot} \approx 7.0 \cdot 10^5 \text{ Km}$
 $R_E \approx 6.0 \cdot 10^3 \text{ Km}$

MULTI-SCALE SYSTEM

*“Master de Physique
Fondamentale et
Applications”*



“Laurea Magistrale in Fisica”

MASTER ITALO - FRANCESE DI FISICA INDIRIZZO PLASMI

Un doppio diploma e un'esperienza internazionale

Université Pierre et Marie Curie

Università di Pisa

L'UPMC e l'università di Pisa cooperano per offrire un'opportunità unica d'integrazione, a livello di Master, nel contesto internazionale della ricerca di domani nell'ambito della fisica dei plasmi

Questa formazione permette:

- > di studiare per un anno in ciascuna delle due Università nell'ambito del Master Physique et Applications (UPMC) e della Laurea Magistrale in Fisica (UNIFI)
- > di confrontarsi con due diverse culture accademiche
- > di inserirsi nella rete di collaborazioni scientifiche italo - francesi

Importante!

- Possibilità di borse di studio per il soggiorno nel paese straniero
- Selezione su dossier

Per maggiori informazioni
califano@df.unipi.it



UPMC
SORBONNE UNIVERSITÉS



Borse di studio ~ 1250 euro/mese

M2 International Scholarships

PLAS@PAR is offering a one-year scholarship to study plasma physics at the Master 2 (M2) level, in the master program “Physique des plasmas et de la Fusion (PPF)”

More details about the teaching program here

PLAS@PAR will provide:

- a monthly scholarship of 1000€
- 500€ for installation expenses

The students are required to have good writing and oral skills in French (B2) as well as in English (B2)

Registration from now to May 26, 2017

Contact: xavier.fresquet@obspm.fr



Dual Master Diploma Students of the University of Pisa

**First year in Pisa
mandatory courses**

CURRICULUM Structure of Matter - Plasmas [ITALY to FRANCE]				
ITALIAN STUDENT <i>First year (PISA) 60 ECTS. At least 51 before departure (60 before February)</i>				
Number	Name	CODE	ECTS	CFU TOTALI
COURSES (mandatory)				
1	Fondamenti di interazione radiazione materia	232BB	9	9
1	Laboratorio di Ottica Quantistica	106BB	12	12
1 at choice	Fisica Teorica 1	213BB	9	9
	Fisica Statistica	207BB	9	
4	TOTAL ECTS			30
COURSES to be chosen in the following exams list for a total of 30 ECTS				
	Fluidodinamica (se non già sostenuto alla LI) Fondamenti di Fisica dei Plasmi e Fluidi; Relatività generale; Sistemi Complessi; Fisica dello Stato Solido; Problemi Astrofisici; Teoria quantistica dei solidi			
	TOTAL ECTS			30
TOTAL First year ECTS				60

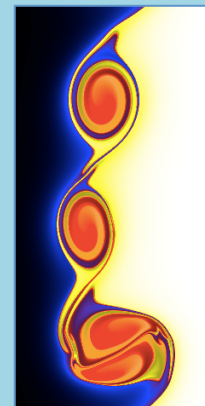
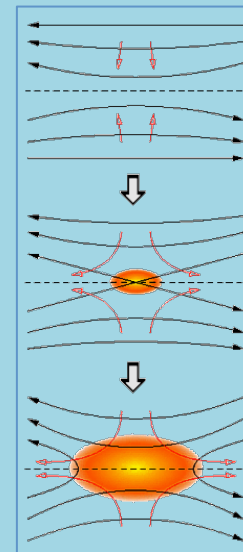
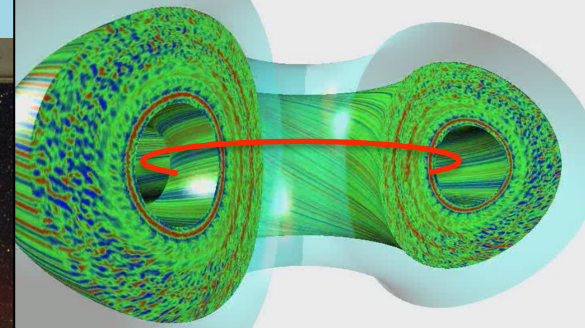
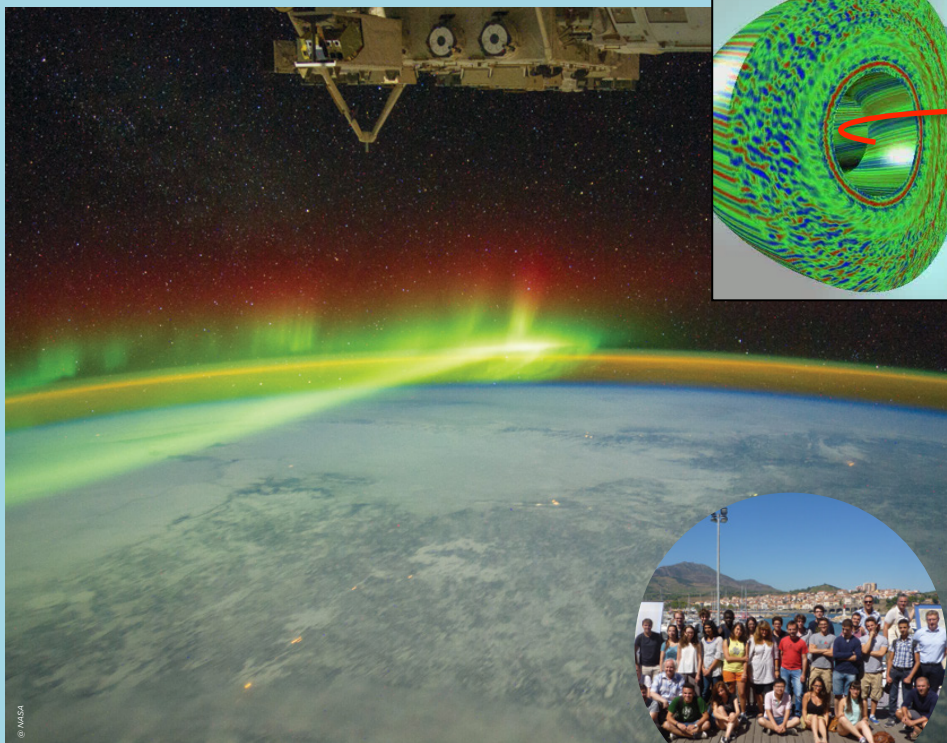
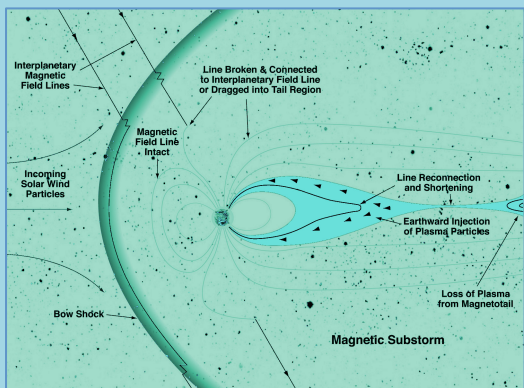
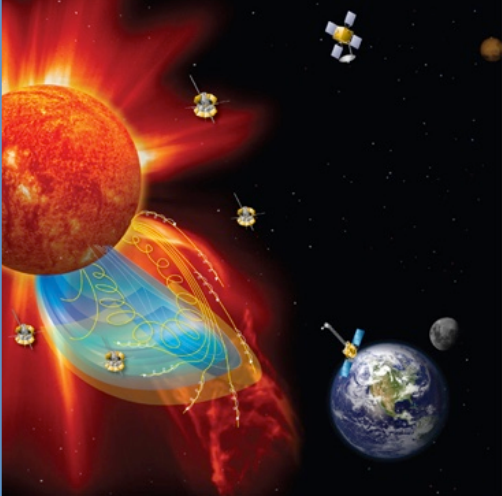
I ANNO STUDENTE UNIPIS (60 credits)

Second year in Paris (Master Thesis in plasma physics)

mandatory courses				
1	Outils pour les Plasmas et la Fusion	TC1	3	
1	Magnétohydrodynamique	TC2	3	
1	Théorie Cinétique	TC3	3	
1	Ondes et Instabilités	TC4	3	
1	Méthodes numériques et simulations	TC5	3	
1	Diagnostic et instrumentation, acquisition, traitement et	TC6	3	
1	Physique atomique, moléculaire et rayonnement	TC7	3	
1	Plasmas spatiaux	O3	3	
1	Préparation stage UNIP		6	
	TC5 and TC6 : 6 ECTS will be counted as Stage/Thesis		-6	
	ECTS		24	
	Stage (Master Thesis)		36	36
	6 ECTS counted as Stage/Thesis			6
	Totale Thesis ECTS			42
	TOTAL ECTS		60	

A Tutor from UNIP
will follow the student
career at UPMC

II ANNO STUDENTE UNIP (60 crediti)



SUMMER SCHOOL 2017

From the laboratory to the distant universe, the world of plasmas

To discover the plasmas diversity and their applications during a 5-day summer school in Banyuls (French coastal city).
Lectures, accommodation and transfer Paris - Banyuls are free of charge.

August 20-26, 2017

Registration from now to May 26, 2017

Program director: P. Savoini

Contact: xavier.fresquet@obsppm.fr

www.plasaparc.com



GRAZIE!