



... a short description of the Training Programme  
(Study Plan), or *Percorso Formativo*, of LM-58  
Academic Year 2020-2021

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## Astronomy and Astrophysics

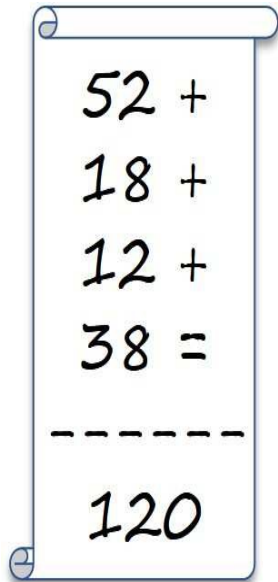
Masters

All information about LM-58  
in Sapienza web page

<h3>Degree Programme</h3> <ul style="list-style-type: none"> <li>• Programme Code: 30060</li> <li>• Test Code: 30060</li> <li>• Faculty: Scienze Matematiche, Fisiche e Naturali</li> <li>• Department: FISICA</li> <li>• Duration: 2 years</li> <li>• Degree Code: LM-58</li> <li>• Degree: Masters</li> <li>• Admission Procedure: Requirements and personal knowledge assessment</li> </ul> <p><a href="#">View more</a></p>	<h3>Study plan</h3> <p>The "Manifesto" study plan: fundamental, core and elective exams, credits and course language</p> <p><a href="#">View more</a></p>	<h3>Apply</h3> <p>How, where, when. Deadlines and procedures to enrol in the programme</p> <p>2020/2021 <a href="#">View more</a></p>	
<h3>Attendance</h3> <p>Syllabus and study material, lesson and exam schedules</p> <p><a href="#">View more</a></p>	<h3>Quality Assurance (AQ)</h3> <p>Organization and responsibility of the AQ for the Course</p> <p><a href="#">View more</a></p>	 <h3>Lectures in-person and online</h3>	
<h3>Contacts, services, facilities</h3>	<p>M. De Petris – PdS – LM-58 AA 2020-2021</p> <h3>Organization, contacts and</h3>	<h3>Learning Outcomes</h3>	<h3>Professional Opportunities</h3>

## LM-58 Generalities

The nominal duration of the Master's Degree Programme is **4 semesters\***, in total **two years**, during which students have to acquire **120 ECTS\*\***, equal to 3,000-hour overall workload.



- **Single curriculum**

- 8 mandatory courses out of 13 (52 CFU, *corsi obbligatori*)
- 3 optional courses (Group Course, 18 CFU, *corsi a scelta vincolata*) to choose one among each of the 3 groups (A, B and C) spanning several topics ranging from fundamental physics, mathematics, calculus, instrumental / observational / theoretical astrophysics, astroparticle, gravitation, cosmology, etc.
- 2 elective courses (Free Choice Course, 12 CFU, *corsi a scelta libera*) to choose from among all Sapienza courses (with approval of Programme Director)
- Final thesis (38 CFU)
- A few courses are delivered in English (3 mandatory and 4 elective courses)
















(\*) 1 semester = less than 4 months

(\*\*) ECTS = European Credit Transfer System  $\Leftrightarrow$  CFU = *Credito Formativo Universitario*

M. De Petris – PdS – LM-58 AA 2020-2021

## First year – First semester

ECTS

COURSE	SEMESTER	CFU	SSD	LANGUAGE
1012161 - ASTROPHYSICAL PROCESSES AND PLASMAS	First semester	6	FIS/05	
1012186 - GENERAL RELATIVITY	First semester	6	FIS/02	
1012178 - SUPERIOR PHYSICS	First semester	6	FIS/02	
1051847 - Astrophysics Laboratory  1/2	First semester	6		
1044601 - PHYSICAL COSMOLOGY	Second semester	6	FIS/05	
1012131 - STELLAR ASTROPHYSICS	Second semester	6	FIS/05	
1044553 - THEORETICAL ASTROPHYSICS	Second semester	6	FIS/05	
1051847 - Astrophysics Laboratory 	Second semester	6		
- A SCELTA DELLO STUDENTE	Second semester	6		
AAF1901 - English Language	Second semester	4		
GRUPPO A: AFFINI INTEGRATIVI	Go to group 		FIS/05	
GRUPPO B: ASTRONOMICCO OSSERVATIVO SPERIMENTALE	Go to group 			
GRUPPO C: CARATTERIZZANTE ASTRONOMICCO TECNOLOGICO	Go to group 			

## First year – Second semester

min 0 courses/max 2 courses

COURSE	SEMESTER	CFU	SSD	LANGUAGE
1012161 - ASTROPHYSICAL PROCESSES AND PLASMAS	First semester	6	FIS/05	
1012186 - GENERAL RELATIVITY	First semester	6	FIS/02	
1012178 - SUPERIOR PHYSICS	First semester	6	FIS/02	
1051847 - Astrophysics Laboratory	First semester	6		
1044601 - PHYSICAL COSMOLOGY	Second semester	6	FIS/05	
1012131 - STELLAR ASTROPHYSICS	Second semester	6	FIS/05	
1044553 - THEORETICAL ASTROPHYSICS	Second semester	6	FIS/05	
1051847 - Astrophysics Laboratory	Second semester	6		
- A SCELTA DELLO STUDENTE	Second semester	6		
AAF1901 - English Language	Second semester	4		

GRUPPO A-AFFINI INTEGRATIVI

Go to group ↓

FIS/05

GRUPPO B-ASTRONOMICO OSSERVATIVO SPERIM

In the AA20-21 webpage the full list of optional courses is shown, without Groups separation

GRUPPO C-CARATTERIZZANTE ASTRONOMICO TECNOLOGICO

Go to group ↓



## Second year – First semester

min 1 courses/max 3 courses

COURSE	SEMESTER	CFU	SSD	LANGUAGE
- A SCELTA DELLO STUDENTE	First semester	6		
AAF1036 - FINAL EXAM	Second semester	38		
GRUPPO A AFFINI INTEGRATIVI	Go to group <a href="#">↕</a>		FIS/05	
GRUPPO B ASTRONOMICO OSSERVATIVO SPERIMENTALE	Go to group <a href="#">↕</a>			
GRUPPO C CARATTERIZZANTE ASTRONOMICO TECNOLOGICO	Go to group <a href="#">↕</a>			

## Second year – Second semester

full semester devoted to Thesis

COURSE	SEMESTER	CFU	SSD	LANGUAGE
- A SCELTA DELLO STUDENTE	First semester	6		
AAF1036 - FINAL EXAM	Second semester	38		
GRUPPO A AFFINI INTEGRATIVI	Go to group <a href="#">↕</a>		FIS/05	
GRUPPO B ASTRONOMICO OSSERVATIVO SPERIMENTALE	Go to group <a href="#">↕</a>			
GRUPPO C CARATTERIZZANTE ASTRONOMICO TECNOLOGICO	Go to group <a href="#">↕</a>			

## 2 Elective Courses

Ideally to be allocated at  
1<sup>st</sup> year/2<sup>nd</sup> sem and 2<sup>nd</sup> year/1<sup>st</sup> sem

You can choose them from **ALL** Sapienza courses (except the ones delivered at *Laurea Triennale in Fisica*) compatible with your Study Plan [NB 12 CFU, max allowed 15 CFU] However, they need to be approved by the Programme Area Council (*Responsabile dei Piani di Studio*)

### REMEMBER !

- ✓ Differently from Master's Degree in Physics (LM-17), LM-58 Study Plans **have not to include at least 12 non-FIS\* ECTS**, that is, other disciplinary sectors such as INF\*, MAT\*, CHIM\*, BIO\*.
- ✓ If the course is delivered in another Master, **choose it in the same year of the presentation of the Study Plan**. The course could be no more activated in other years.

Possible choices (just a few examples):

- 2 of the 4 courses required to be admitted to public competitions for secondary school teaching (24 CFU \* for *Abilitazione all'insegnamento*) among 4 topics: *antro/psico/pedagogico/metodologico*.
- Courses in other Masters, among the several, Earth Observation Data Analysis (Master in Data Science) or Telerilevamento e GIS (Master in Ecobiologia)

(\*) Art. 42 - ESAMI DI PROFITTO EXTRACURRICULARI EX ART. 6 DEL R.D. N. 1269/38- students may enrol, in each academic year, up to maximum two courses of other Sapienza University degree programmes

See <https://www.uniroma1.it/it/content/esami-di-profitto-extracurriculari-ex-art-6-del-rd-n-126938>

## Optional Courses: 3 Groups

N.B. All courses delivered at  
1<sup>st</sup> year/2<sup>nd</sup> sem or 2<sup>nd</sup> year/1<sup>st</sup> sem

**GRUPPO A AFFINI INTEGRATIVI: The student must acquire 6 CFU from the exams below** [^](#)

COURSE	YEAR	SEMESTER	CFU	SSD	LANGUAGE
1044551 - OBSERVATIONAL COSMOLOGY	First year	Second semester	6	FIS/05	
1012184 - ASTRONOMICAL OPTICS	First year	Second semester	6	FIS/05	
1012137 - DYNAMICS OF STAR SYSTEMS	First year	Second semester	6	FIS/05	
1012136 - TEORICAL COSMOLOGY	Second year	First semester	6	FIS/05	
1012165 - SELF-GRAVITATING SYSTEMS	Second year	First semester	6	FIS/05	
1056018 - Chemical Evolution of the Universe	Second year	First semester	6	FIS/05	



## Optional Courses: 3 Groups

N.B. All courses delivered at  
1<sup>st</sup> year/2<sup>nd</sup> sem or 2<sup>nd</sup> year/1<sup>st</sup> sem

**GRUPPO B** ASTRONOMICICO OSSERVATIVO SPERIMENTALE: The student must acquire 6 CFU from the exams below ^

COURSE	YEAR	SEMESTER	CFU	SSD	LANGUAGE
1012129 - HIGH ENERGIES ASTROPHYSICS	First year	Second semester	6	FIS/05	
1012130 - EXTRAGALACTIC ASTROPHYSICS	First year	Second semester	6	FIS/05	
1044551 - OBSERVATIONAL COSMOLOGY	First year	Second semester	6	FIS/05	
1012184 - ASTRONOMICAL OPTICS	First year	Second semester	6	FIS/05	
10589158 - PLANETS AND EXOPLANETS	First year	Second semester	6	FIS/05	
1012136 - TEORICAL COSMOLOGY	Second year	First semester	6	FIS/05	
1055885 - PARTICLE AND ASTROPARTICLE PHYSICS	Second year	First semester	6	FIS/01	
1055363 - EXPERIMENTAL GRAVITATION	Second year	First semester	6	FIS/01	
1044550 - METHODS OF SPACE ASTROPHYSICS	Second year	First semester	6	FIS/01	
1012165 - SELF-GRAVITATING SYSTEMS	Second year	First semester	6	FIS/05	
1056018 - Chemical Evolution of the Universe	Second year	First semester	6	FIS/05	

## Optional Courses: 3 Groups

N.B. All courses delivered at  
1<sup>st</sup> year/2<sup>nd</sup> sem or 2<sup>nd</sup> year/1<sup>st</sup> sem

**GRUPPO C CARATTERIZZANTE ASTRONOMICAMENTE TECNOLOGICO: The student must acquire 6 CFU from the exams below** [^](#)

COURSE	YEAR	SEMESTER	CFU	SSD	LANGUAGE
1012184 - ASTRONOMICAL OPTICS	First year	Second semester	6	FIS/05	
1012137 - DYNAMICS OF STAR SYSTEMS	First year	Second semester	6	FIS/05	
1012152 - ADVANCED LABORATORY OF COMPUTING	Second year	First semester	6	INF/01	
1044550 - METHODS OF SPACE ASTROPHYSICS	Second year	First semester	6	FIS/01	

A few optional courses are present in more than one Group:  
.... try to optimize the distribution of the courses among the two AYs in the Study Plan.

An unbalanced distribution of courses, *i.e.* CFU, during the two years is not acceptable.



1<sup>st</sup> year:  $58 < \text{CFU} < 70$   
2<sup>nd</sup> year:  $50 < \text{CFU} < 62$

## 7 mandatory courses

PROCESSI E PLASMI ASTROFISICI  
RELATIVITA' GENERALE  
FISICA SUPERIORE  
ASTROPHYSICS LABORATORY (les+lab)  
PHYSICAL COSMOLOGY  
ASTROFISICA STELLARE  
THEORETICAL ASTROPHYSICS

how to build solid *astro*-knowledge



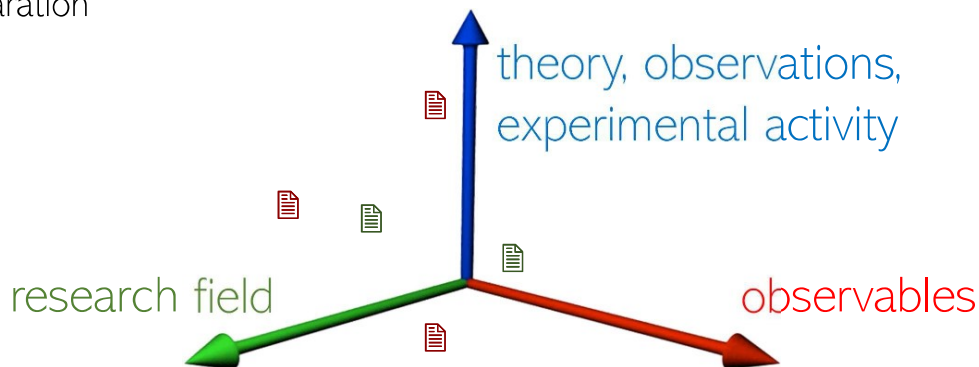
Courses in English

- ✓ Regular attendance to all courses is highly recommended.
- ✓ Attendance to lab activities provided for the Astrophysics Laboratory course is mandatory.

+ English language (4 CFU) to be independent users of the language, fluent knowledge of both written and oral English, equivalent to **B2 English Level**

## + 5 elective courses (3 in Groups + 2 free choice)

to make the Study Plan more theoretical/observational/experimental oriented or focused on a preferred research field (*e.g.* gravitation) or an observational target (*e.g.* CMB) or general preparation



### OBSERVATIONAL COSMOLOGY

OTTICA ASTRONOMICA  
DINAMICA DEI SISTEMI STELLARI  
ASTROFISICA DELLE ALTE ENERGIE  
ASTROFISICA EXTRAGALATTICA  
PLANETS AND EXOPLANETS  
COSMOLOGIA TEORICA

### SISTEMI AUTOGRAVITANTI

EVOLUZIONE CHIMICA DELL'UNIVERSO  
PARTICLE AND ASTROPARTICLE PHYSICS  
EXPERIMENTAL GRAVITATION  
METHODS OF SPACE ASTROPHYSICS  
LABORATORIO DI CALCOLO AVANZATO



## When?

The Master's Degree students submit their Study Plan at the beginning of the first year (in one of 2 available periods), by choosing the 3 optional exams in a provided group and the 2 elective exams.

2020 October 19th – December 11th  
2021 February 1st – February 20th



N.B. Only **one** Study Plan can be approved per Academic Year.

The exams already registered cannot be changed in a new proposal of Study Plan.

## Curricular or Individual Study Plans?

- 1) Curricular study plans are established every year by the Programme Area Council.
- 2) Individual study plans have to be assessed by the Programme Area Council for approval.

## Thesis

Do you remember the Dissertation for the *Laurea Triennale*?  
.... Forget it!



The second semester of the second AY is fully dedicated to Thesis work (38 CFU).

An **original research work**, the students go deeply on a project agreed with a tutor (*Relatore*), one of the faculty members in the Dept, and possibly an external tutor (*Secondo Relatore*), one of our colleagues in external institutions (Italian or abroad). The well known “problem solving” capability is applied to enter in the world of research. It is common to write the Thesis in English for an easy distribution in the market. Sometimes the Thesis work is worthy of being published in a scientific paper or it is the first step for that.

For all the information about Thesis and Final Exam:  
<https://www.phys.uniroma1.it/fisica/en/node/10212>



## Take-home messages

During the Master Degree Programme do not forget the following opportunities:

### 1 Honours Programmes (*Percorsi di Eccellenza*)

EXCELLENCE



The Programme Area Council in Sciences of the Universe has established an Honours Programme aimed at enhancing the skills of the most deserving students.

They will be assigned to a tutor who will support and will cooperate with them in the organisation of the agreed upon activities.

Requisites: ... in good standing with the exams, *i.e.* all the 1st year CFU by **31st October** + average mark > **27/30!**

(NB the new Call could be changed in this way: **58 CFU by 30<sup>th</sup> November**)

Official acknowledgement by the Faculty president and 2<sup>nd</sup> year tax refunded!

See <https://www.phys.uniroma1.it/fisica/corsilauree/percorsi-di-eccellenza>

## Take-home messages

During the Master Degree Programme do not forget the following opportunities:

**2** ERASMUS+ Programme



It is a European funding programme offering university students a possibility of studying or doing an internship abroad in another country for a period of at least 3 months and maximum 12 months per cycle of studies.

Erasmus+ now offers the possibility to go way beyond the European borders as well.

**Important!** To identify the courses you wish to attend at the partner university contacting the professor promoter of the Agreement. **This choice could impact the SP!**

Choose the international Institution and courses and apply! Call around every Jan/Feb  
Info at <https://www.uniroma1.it/it/pagina/erasmus-studenti-sapienza-studio>  
<https://www.phys.uniroma1.it/fisica/en-erasmus>

On your toes! ...

a meeting with the students will be organized around January/February.



## Take-home messages

During the Master Degree Programme do not forget the following opportunities:

### 3 Thesis work abroad (*Borse di studio per Tesi all'estero*)

If you are working on a Thesis topic, formally shared with an international co-tutor (*secondo relatore*), you could apply to fellowships devoted to financially support your staying at the foreign institution for a period longer than 2 months.

SMFN Faculty fellowships (the Call around every June) at:

[https://web.uniroma1.it/fac\\_smfn/bandi\\_categoria\\_tendina/borsa-tesi-estero](https://web.uniroma1.it/fac_smfn/bandi_categoria_tendina/borsa-tesi-estero)

as an alternative, Fondazione Sapienza fellowships at:

<https://www.fondazione-sapienza.uniroma1.it/bandi/>

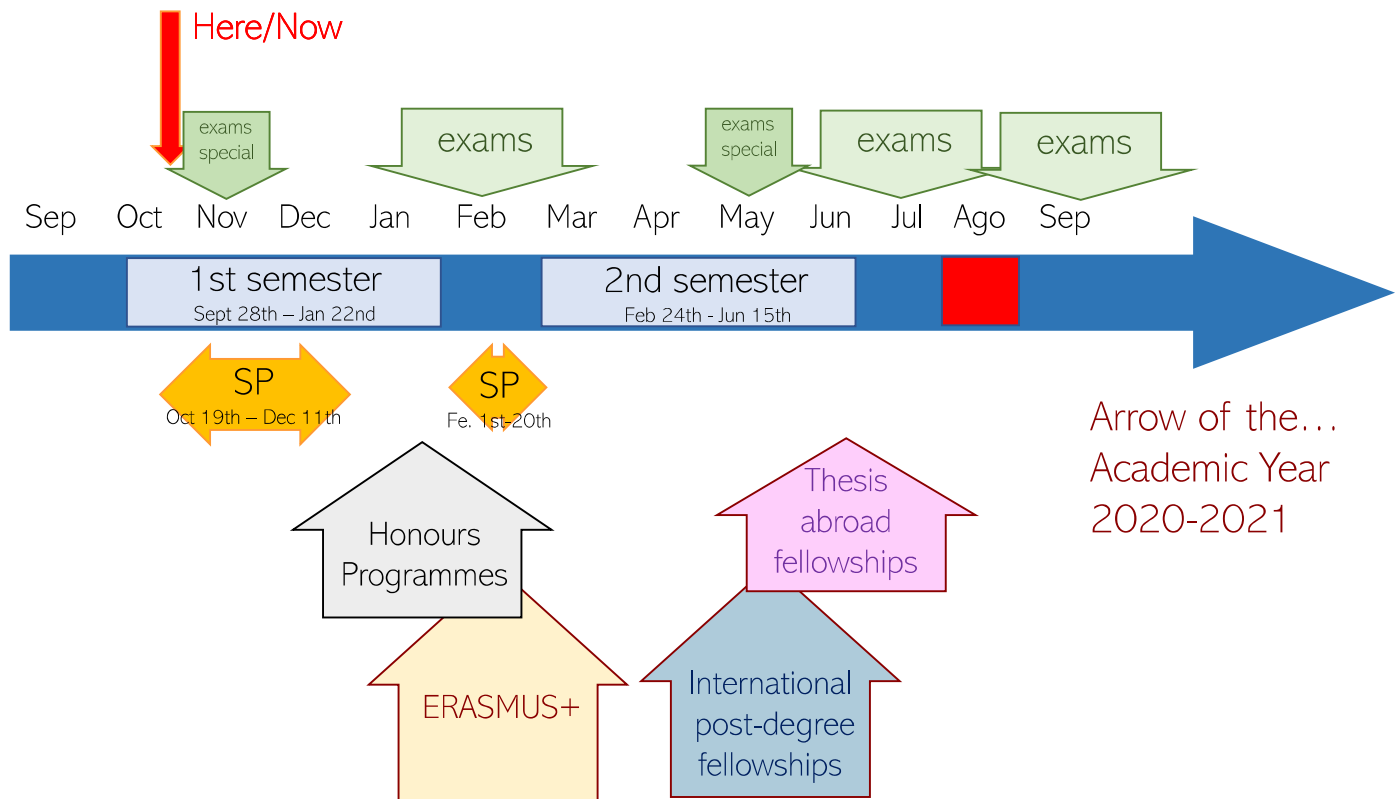
### 4 International Post-degree Scholarship (*Borse perfezionamento all'estero*)

.... and after graduating? Apply to scholarships to attend courses and traineeships at foreign and international university organizations, see:

<https://www.uniroma1.it/it/pagina/borse-di-perfezionamento-allestero>



Mark it on your calendar!



## Astrophysics faculty members

E.S. Battistelli, A. Capone, R. Capuzzo-Dolcetta, G. D'Alessandro, P. de Bernardis, M. De Petris, L. Lamagna, P. Leaci, R. Maoli, S. Masi, A. Melchiorri, M. Merafina, P. Pani, E. Pascale, F. Piacentini, G. Pisano, F. Ricci, R. Schneider

## INAF, INFN and ENEA members

C. Bianco, A. Cruciani, F. Fiore, A. Fontana, M. Limongi, E. Majorana, G. Montani, L. Pentericci, P. Puppò, R. Scaramella, L. Stella, O. Straniero, ...

you find their coordinates on:

<https://www.phys.uniroma1.it/fisica/node/6843>

## Research activities @ Dept. of Physics

THEORY – OBSERVATIONS – INSTRUMENTATION – DATA ANALYSIS

<https://www.phys.uniroma1.it/fisica/ricerca/aree-tematiche-e-gruppi-di-ricerca/astrofisica-astrofisica-e-geofisica>

- Planetary Astrophysics including exoplanets
- Stellar Astronomy and Astrophysics
- Galaxy Astronomy and Astrophysics
- Fundamental Physics
- General Relativity
- Large Scale Structures
- Experimental and observational cosmology
- Advanced technology
- Detectors
- Data analysis techniques
- Image reconstruction
- Numerical simulations
- Data analysis and interpretations
- Astronomical Observations
- Experimental and theoretical gravitation

All the activities reported in  
three-year SCIENTIFIC REPORTs



2017-2019 Edition

<https://www.phys.uniroma1.it/fisica/ricerca/scientific-report>

## The Nobel Prize in Physics 2020

6 October 2020

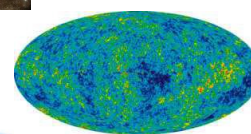
The Nobel Prize in Physics 2020 was divided, one half awarded to Roger Penrose *"for the discovery that black hole formation is a robust prediction of the general theory of relativity"*, the other half jointly to Reinhard Genzel and Andrea Ghez *"for the discovery of a supermassive compact object at the centre of our galaxy"*



©Johan Jarnestad/The Royal Swedish Academy of Sciences"

.... but do not forget **The Nobel Prize in Physics 2019**

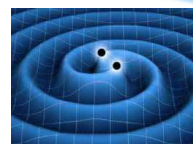
was divided, one half to James Peebles, *"for theoretical discoveries in physical cosmology"* and the other half jointly to Michel Mayor, and Didier Queloz *"for the discovery of an exoplanet orbiting a solar-type star"*.



and **The Nobel Prize in Physics 2017**

was divided, one half awarded to Rainer Weiss, the other half jointly to Barry C. Barish and Kip S. Thorne *"for decisive contributions to the LIGO detector and the observation of gravitational waves."*

All of them are research topics deeply investigated, theoretically and experimentally, in our Department!!



## What next?

Continue the educational training and/or  
look for a job in public institutions and/or private companies

Here, PhD in Astrophysics, Astronomy and Space Science (Sapienza+Torvegata Universities) or PhDs in Physics or Accelerator Physics.

In Italy, PhD in Astrophysics in Bologna, in Astronomy in Padua, in Physics and Astronomy in Milan (Bicocca)

abroad with several PhDs in Astrophysics/Astronomy.

Take a look also at the Master in Scienza e Tecnologia Spaziale a TorVergata



Several astrophysics institutions, *e.g.* Italian Space Agency (ASI), National Institute for AstroPhysics (INAF), European Space Agency (ESA) and European Space Research Institute (ESRIN)



Aerospace Companies, electronics, IT or optics industries  
High school teachers



Do you need more information?



Contact: Marco De Petris

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... do not forget to join the Astroseminars mailing list!

<https://lists2.roma1.infn.it/mailman/listinfo/astroseminar>

Grazie!