

POLITECNICO DI MILANO



**PhD School of the Politecnico di Milano**  
**Regulations of the PhD Programme in:**  
**PHYSICS**  
**Cycle XXX**

Location: Milano Leonardo

# 1. General Information

PhD School of Politecnico di Milano

PhD Programme: Physics

Location of the PhD Programme: Milano Leonardo

Subjects (SSD): FIS/01 Experimental physics; FIS/03 Physics of matter

PhD School Website: <http://www.polimi.it/phd>

PhD Programme Website: [http://www.fisi.polimi.it/en/teaching/teaching\\_offer/phd](http://www.fisi.polimi.it/en/teaching/teaching_offer/phd);  
<http://www.dottorato.polimi.it/en/phd-programmes/active-phd-programmes/physics/>

Areas:

- 1) Laser Physics, photonic devices and applications (FIS/01 Experimental physics; FIS/03 Physics of matter)
- 2) Solid state physics: advanced spectroscopy, scanning probe microscopy, nanostructure fabrication (FIS/01 Experimental physics; FIS/03 Physics of matter)

## 2. General presentation of the PhD Programme:

Translating scientific knowledge into new technology and transferring innovation to the production system represent a necessary step for many companies, also dictated by an increasingly global market. For this purpose, a figure with a broad cultural background is needed. In particular, many advanced sectors of industry and research require a good knowledge in topics such as condensed matter physics, optics, laser technology and instrumentation, and nanostructured materials.

The aim of the PhD in Physics at Politecnico di Milano is the training of personnel with strong research capacity, able to operate in basic and applied research and development facilities, and to manage and design high-tech and innovative products and processes in various industrial sectors. This application-oriented character clearly distinguishes the present PhD course in Physics from those at the School of Science.

The education contents are strictly related to the research activities carried out in the research laboratories at the Department of Physics. They can be divided into two main areas:

- 1) Laser Physics, Photonic Devices and Applications (optics and quantum electronics, including biomedical applications of lasers, laser applications in optical communications; diagnostics for works of art; time-resolved optical spectroscopy; ultrashort light pulse generation and applications; UV and X optical harmonic generation)

2) Solid State Physics: Advanced Spectroscopy, Scanning Probe Microscopy, Nanostructure Fabrication (photoemission; spin-resolved electronic spectroscopy; magneto-optics; X ray diffraction; magnetic nanostructures for spintronics; synchrotron radiation spectroscopy, positron spectroscopy, semiconductor nanostructures)

These research activities make use of advanced experimental laboratories located at Politecnico di Milano (Milano-Leonardo Campus and Como Campus), including:

Coherent vibrational spectroscopy

Spectroscopy with femtosecond time resolution

Attosecond generation

Coherent Raman spectroscopy and microscopy

Applications of lasers in telecommunications

Photonic and optofluidic devices

Ultrashort laser pulse micromachining

Solid state lasers

Biomedical applications of lasers

Time-domain diffuse optical spectroscopy

Imaging and spectroscopy for Cultural Heritage

Optical projection tomography

Electron spectroscopy with spin resolution

Magneto-Optics

Growth and characterization of magnetic nanostructures for spintronics

Scanning Auger Microscopy (SAM)

Scanning Near-field Optical Microscopy (SNOM)

Scanning Tunnelling Microscopy (STM)

Spectroscopy with synchrotron radiation

Spectroscopy with positrons

Epitaxial semiconductor nanostructures for electronics and optoelectronics

Optical and electron beam lithography

Moreover, many collaborations are on-going with high-level international institutions, such as: European Synchrotron Radiation Facility (ESRF) in Grenoble, Polytechnic University of Zurich (ETH) and Lausanne (EPFL), Ecole Polytechnique - Palaiseau (Paris), Paul Scherrer Institut (PSI), Institut de Ciència de Materials de Barcelona, Institut d'Electronique Fondamentale Université Paris-Sud, Argonne National Laboratory, Technical University of Denmark, Royal Institute of Technology (KTH, Stockholm), Max Planck Institute - Stuttgart, University College London, Interuniversitair Micro-Elektronica Centrum (IMEC) Leuven Belgium.

Students in our PhD Programme will therefore have a real opportunity to gain experience also in prestigious laboratories abroad.

### 3. Objectives:

The main purpose of the PhD Programme in Physics at Politecnico di Milano is the development of an

experimental approach in problem-solving techniques and the attainment of a high level of professional qualification. Scientific education and training to develop general research abilities in all areas of applied physics is increasingly needed by advanced technological companies in Italy, especially northern Italy, and abroad. The PhD aims at providing engineers and physicists, after a Bachelor of Science ("Laurea", 3 years) and a Master of Science ("Laurea Magistrale", 2 years), with a general education in the basic areas of applied physics and specific knowledge in condensed matter physics, optics, lasers and photonics.

## 4. Professional opportunities and job market

The PhD at Politecnico di Milano offers a wide range of opportunities in the fields of advanced technologies, such as photonics and optoelectronics (lasers, optofluidic devices), advanced physical instrumentation (electronic and atomic microscopy, nuclear magnetic resonance), biomedical optics (optical tomography, non-invasive diagnostic devices), vacuum technologies (thin film depositions), and material technologies (microelectronics and nanotechnologies).

Concerning Italy and similar Countries, the following professional profiles are well established:

- Manager of devices, equipment and systems (see above) to solve methodological and technological problems within large industries and companies.
- Designer of advanced optoelectronic devices and systems relying on a physical background and competencies in optics and laser technologies to promote, design and realize new components and devices in high-tech industries as well as small innovative enterprises.
- Researcher in industries, universities, research centres operating in the technological areas outlined above.

Interesting opportunities are found also at international level, where technological innovation is even more relevant than in the national scenario. In this frame, the PhD Programme in Physics at Politecnico provides excellent preparation for a highly competitive international arena.

## 5. Enrolment at the PhD Programme

### 5.1 Admission requirements

Italian and foreign citizens can apply. They are requested to have graduated in accordance with the pre-existing laws D.M. 3.11.1999 n. 509 or have a master of science degree in accordance with D.M. 3.11.1999 n. 509 or a master of science in accordance with D.M. 22.10.2004 n. 270 or similar academic degree obtained abroad, equivalent for duration and content to the Italian degree and for an overall duration of university studies of at least five years.

The certified knowledge of the English language is a requirement for admission. Please refer to the Ph.D. School web site for details.

The admission to the programmes will be decided according to the evaluation of the curricula of the studies, of the motivation letter, and of an illustrative paper about the development of a possible PhD research, which candidates will send contextually with their application to the admission announcement. *(If necessary to be extended for the specific PhD Programme)*

## 5.2 Admission deadlines and number of vacancies

The number of vacancies is indicated in the Call for admission to the 30° cycle of PhD Programmes:  
<http://www.polimi.it/phd>

Scholarships both on general and on specific themes are available, in accordance with what is specified in the call for admission.

## 6. Contents of PhD Programme

### 6.1 Requirements for the attainment of the title:

The attainment of the PhD title in Physics requires at least three years full time of study, research and development of the PhD thesis.

The PhD programme in Physics requires **30 credits** from PhD level courses to be acquired as indicated in the following paragraph 6.3

### 6.2 Development of the research and of the PhD thesis

The aim of the PhD programmes of Politecnico di Milano is the development in the candidates of a research-oriented mind-set, with expertise and skills in a specific research topic.

These skills provide the PhD candidates with major opportunities of improving their scientific capabilities in view of a personal commitment both in the academic field and in public and private organisations.

The main objective is the development of an original personal research track. The PhD thesis must contribute to increasing knowledge in the research field of the candidate and has to be coherent with the research topics developed at the Department of Physics, where the PhD Programme is carried out. The PhD thesis shall contain and discuss the original contribution of the candidate, with respect to the state of the art in the relevant research field.

The PhD research will be developed according to the guidelines of a supervisor, who supports the candidate in the setting-out and in everyday activities regarding the development of the thesis.

The supervisor does not have to be a member of the Academic Board and can also belong to an institution other than Politecnico di Milano. The supervisor can be supported by one or more co-supervisors.

To develop the capability of carrying out research activities, the candidate must attend courses according to the PhD Programme, defined for his/her study plan, and pass them with a positive evaluation.

For each candidate admitted to the Programme, a tutor, belonging to the Academic Board, is appointed. The tutor supervises and supports the candidate in his/her overall training path. The same person can act as both supervisor and tutor.

The choice of the courses will be overseen by the tutor and will be formalized in a study plan to be approved by the Coordinator of the PhD Programme.

Other activities for the development of personal skills and research expertise are encouraged during the PhD Programme.

The candidates must acquire the capability to present and discuss their work in the research community. Consequently, both attendance at international conferences and publication of research results in reviewed international journals are encouraged.

The candidates are also encouraged to carry out part of their research activities (up to six months) in contact with other research groups in their field of interest, possibly abroad, to acquire further skills for the development of their research work and thesis.

The duration of the Programme is normally three years.

### 6.3 Objectives and general framework of the teaching activities

The PhD Programme and the PhD School may activate various types of training activities (courses, seminars, project workshops, laboratories). All will aim at:

- creating common starting knowledge for the PhD Programme;
- examining the basic research issues (problems, theories, research methods) which represent the cornerstone of the PhD Programme and clearly identify its position in the cultural landscape;
- developing selected research topics and issues related to the thesis work.

Courses are offered in English, unless otherwise specified for individual courses.

The PhD Programme warrants the availability of a teaching path provided entirely in English.

Certain teaching activities (Structured teaching activities) entitle the student with ECTS credits; other activities (typically the more specialised ones), for which it is difficult to make an assessment and quantification of learning, fall within the scientific activities which the Academic Board will take into account in the overall evaluation, but whose value is not individually quantified in ECTS.

The tables here below show the foreseen path for the candidates and they refer only to coursework activities. At the same time, the Programme foresees that the candidate is devoted to the research activity in a continuous way, following the lead of his/her supervisor and of the Board of Professors.

#### *First/Second Year*

<b>Course type</b>	<b>Number of ECTS (min-max)</b>	<b>Notes</b>
PhD School Courses	5 – 15	Chosen from the list available at: <a href="http://www.dottorato.polimi.it/en/during-your-phd/phd-school-courses">http://www.dottorato.polimi.it/en/during-your-phd/phd-school-courses</a>
Courses characterising the PhD Programme	15 – 25	Chosen among the 25 ECTS offered by the Department of Physics (see Table A)
Other PhD Programmes	0 – 10	<a href="http://www.dottorato.polimi.it/en/phd-programmes/active-phd-programmes/">http://www.dottorato.polimi.it/en/phd-programmes/active-phd-programmes/</a>

#### *Third year*

In the third year the candidate should be devoted entirely to the research and to the development of the PhD thesis.

## PHD PROGRAMMES

**A)** The PhD Programme in Physics organises the following **Characterising Courses** (see table A)

For the admission to the final exam the acquisition of at least **30 credits** is **mandatory**. These credits have to be acquired through the “**characterising**” **PhD courses** offered by the PhD Programme.

**B)** The PhD School organises every year **General and Interdoctoral courses** and courses with foreign professors. The acquisition of **at least 5 credits** is **mandatory** among the courses of B type. The list of PhD courses organized by the PhD School is available at the following page: <http://www.dottorato.polimi.it/en/during-your-phd/phd-school-courses/>

### **C) Other PhD courses**

Up to 10 of the mandatory credits (as shown in the previous table) can be obtained choosing among the PhD course of A or B type, or among other courses provided by other PhD programmes of Politecnico.

## PREPARATORY COURSES

If the supervisor and the tutor find useful or necessary that the candidate attends preparatory courses (chosen among the activated courses at the Politecnico di Milano) the Board of Professors of the PhD Programme can assign some extra-credits to be acquired to complete the training path. The credits acquired in this way will be considered as additional, in relation to the mandatory credits to be acquired with the PhD courses.

## SPECIALISTIC COURSES, LONG-TRAINING SEMINARS

The attendance of Specialist Courses, Workshops, Schools, Seminars cycles is encouraged. These courses and workshops can be inserted in the study plan, even if they are not evaluated (and therefore not qualified as credits), as optional “additional teaching”.

In the following, the scheduled planning is reported for the academic year 2014-15 and 2015-16. It is possible that other courses are activated at the PhD School even afterwards; in this case the candidates will be promptly informed. The candidates will be able to insert these new courses in their study plan.

**Table A: PHD COURSES CHARACTERISING THE PHD PROGRAMME**

<b>Name of the Course</b>	<b>Professor</b>	<b>Academic Year</b>	<b>Language</b>	<b>Credits</b>
Plasmonics	P. Biagioni – G. Della Valle	2014-15	English	5
Optical Properties of low-dimensional materials	F. Scotognella	2014-15	English	5

Spectroscopy of Solids	G. Ghiringhelli	2015-16	English	5
Nano and nanobio-particles and structures	P. Taroni	2015-16	English	5
Photon migration and wave diffusion in random media	A. Torricelli	2015-16	English	5

#### **Table B SUGGESTED CROSS –SECTORAL COURSES OR WITH A FOREIGN PROFESSOR**

The following table shows the courses offered by the Department of Physics as Interdoctoral courses PhD School in 2014-15.

<b>Name of the Course</b>	<b>Professor</b>	<b>Academic Year</b>	<b>Language</b>	<b>ECTS</b>
Symmetry Applications in Classical and Quantum Physics	M. Finazzi	2014-15	English	5
Physical methods for Cultural Heritage	G. Valentini	2014-15	English	5

A complete list of the PhD School courses (both Interdoctoral and General courses) can be found at: <http://www.dottorato.polimi.it/en/during-your-phd/phd-school-courses>

### **6.4 Presentation of the study plan**

Each PhD candidate will have to submit his/her study plan. The candidate will have the opportunity to review it periodically (every three months) in order to adapt it to possible changes of the training offer or to needs motivated by the development of his/her study plan. The study plan is approved by the Coordinator of the PhD programme, according to the modalities established by the Board of Professors of the PhD Programme itself.

### **6.5 Instructions for the annual exams**

Every year the candidates present their work to the Academic Board and are evaluated for admission to the next year.

After each annual evaluation, the candidates admitted to the next year will receive an evaluation (A/B/C/D). If the candidate does not pass the exam, he/she will qualify as a “Repeating candidate”(Er) or “not able to continue with the PhD (Ei)”.

At the end of the third year, the Academic Board evaluates the admission of the candidates to the final exam (held by the external Committee).

At the end of the third year, candidates may obtain an extension of 6 to 12 months to complete their thesis.

### **6.6 Instruction for the preparation of the PhD thesis**

The PhD study and research work will be carried out full-time during the three years of the PhD course. The possibility of internships or study periods in Italian or foreign companies or external entities and universities is foreseen.

The main objective is the development of an original research contribution.

The PhD thesis must contribute to increasing knowledge in the research field of the candidate and



must be coherent with the research issues developed in the Department of Physics.

The candidate must present an original thesis, discussing its contribution to the state of the art in the relevant research field.

The PhD research will be developed following the guidelines of a Supervisor who supports the candidate in setting-out and everyday activities regarding the development of the thesis.

The admission of the candidate to the final exam will be evaluated by the Academic Board. Upon positive evaluation of the Academic Board, a final exam (thesis defence) is taken in order to attain the qualification, in which the research work carried out and the thesis will be evaluated by an Examination Committee composed of three members, including at least two external examiners.

## 7. Laboratories, PhD Secretary Services

### 7.1 Laboratories

The PhD students will join advanced research laboratories of the Department of Physics, learning about experimental techniques, contributing to research activity, and attending meetings and internal seminars aimed at providing more in-depth knowledge on research topics. A non-comprehensive list of the experimental laboratories is provided here below:

1 - Ultrashort light pulse generation and applications to the study of ultrafast phenomena in the matter

- Attosecond Reaction Microscope

- Femtosecond laser laboratory

- High-energy attosecond pulse laboratory

- Laboratory for coherent Raman spectroscopy and microscopy

- Laboratory for IR-VIS ultrafast spectroscopy

- Laboratory for XUV ultrafast spectroscopy

- Positron laboratory

- Terawatt laser laboratory

2 - Solid state lasers and photonic devices for integrated systems

- Characterization of photonic and optofluidic devices

- Frequency comb laboratory - Campus Point (Lecco)

- High-resolution and high-precision laser spectroscopy

- Laboratorio virtuale di elettromagnetismo computazionale

- Laboratory of coherent vibrational spectroscopy

- Solid state lasers

- Two-photon polymerization by femtosecond lasers

- Ultrashort laser pulse micromachining

- Wet etching in hydrofluoric acid for microfluidic circuits

3 - Photonics for health, food and cultural heritage

- Diffuse Optical Spectroscopy

- Diffusive Optical Phantoms

- Fast Fluorescence Molecular Tomography

- Fluorescence Spectroscopy

Functional Near Infrared Spectroscopy  
Gated Photon Counting  
Imaging Spectroscopy for Cultural Heritage  
Near Infrared Spectroscopy for Food  
Optical Mammography  
Optical Projection Tomography

#### 4 - Epitaxial growth and nanostructure fabrication

Electron Beam Lithography  
Materials and devices for Spin Electronics  
Nanobio  
Scanning Tunnelling Microscope  
Semiconductor growth  
Versatile Electron Spectroscopy Instrumentation

#### 5 - Electronic, optical and magnetic properties of low-dimensional systems

Magneto-Optical Kerr  
Scanning Auger Microscope  
Scanning probe microscopy  
Scanning near-field optical microscopy  
Synchrotron radiation facilities  
Ultrafast Photoemission and Optical Spectroscopy  
Variable energy positron annihilation spectroscopy

## 7.2 PhD Secretary Services

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## 8. Internationalisation and other activities

The carrying-out of study and research activities at other laboratories is strongly recommended. The university proposes also the opportunity of PhD joint paths with foreign universities and of joint and double PhD programmes. Further information is available on the PhD School Website and on the PhD programme Website.

## Attachment A1 – PhD Board of Professors – Collegio dei Docenti

The Board of Professors is composed of 7 full professors, 5 associate professors, and 3 researchers of Politecnico di Milano. The director of the CNR Institute of Photonics and Nanotechnology is also part of the Board, as strong long-lasting collaboration and integrated research is on-going between the CNR Institute and the Department of Physics.

<b>Name</b>	<b>Affiliation</b>	<b>SSD / Title of SSD</b>
Paola TARONI (coordinator)	Politecnico di Milano	FIS/01 Experimental Physics
Alberto BRAMBILLA	Politecnico di Milano	FIS/01 Experimental Physics
Franco CICCACCI	Politecnico di Milano	FIS/01 Experimental Physics
Rinaldo CUBEDDU	Politecnico di Milano	FIS/01 Experimental Physics
Cosimo D'ANDREA	Politecnico di Milano	FIS/01 Experimental Physics
Sandro DE SILVESTRI	Politecnico di Milano	FIS/01 Experimental Physics
Lamberto DUO'	Politecnico di Milano	FIS/01 Experimental Physics
Marco FINAZZI	Politecnico di Milano	FIS/01 Experimental Physics
Giacomo GHIRINGHELLI	Politecnico di Milano	FIS/01 Experimental Physics
Giovanni ISELLA	Politecnico di Milano	FIS/01 Experimental Physics
Guglielmo LANZANI	Politecnico di Milano	FIS/01 Experimental Physics
Marco MARANGONI	Politecnico di Milano	FIS/01 Experimental Physics
Mauro NISOLI	Politecnico di Milano	FIS/03 Physics of Matter
Roberta RAMPONI	Consiglio Nazionale delle Ricerche	FIS/01 Experimental Physics
Salvatore STAGIRA	Politecnico di Milano	FIS/01 Experimental Physics
Alessandro TORRICELLI	Politecnico di Milano	FIS/01 Experimental Physics

## Attachment A2 – PhD Advisory Board

The composition of the Advisory Board has been recently changed. It is now composed of five distinguished researchers/managers representative of different applied research environments: two of them belong to important international technical universities (ETH and EPFL), and the other three to leading hi-tech companies in the field lasers, microelectronics, and chemistry (for photovoltaic applications), as specified in the following table:

<b>Name</b>	<b>Affiliation</b>
Fabio DONATI	EPFL - Lausanne
Giovanni MASOTTI	El.En. S.p.A
Luciano MIOZZO	Solvay Specialty Polymers
Agostino PIROVANO	Micron Semiconductor Italia s.r.l.
Hans von KÄNEL	ETH - Zuerich

The Committee composition was substantially modified with the aim of offering the PhD students new contacts with external academia and job market, as well as collecting fresh suggestions for the improvement of the PhD Programme.

Periodic meetings of the Advisory Board with the PhD Faculty, open to all PhD students and other researchers of the Department, are foreseen to discuss the PhD Programme organisation and possible professional opportunities. In particular, a meeting has already been called for the afternoon of May 16, 2014, connected to the Diploma Ceremony of the XXVI cycle.



POLITECNICO DI MILANO  
DIPARTIMENTO DI FISICA

piazza Leonardo da Vinci 32  
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### Verbale della riunione del Comitato di Riferimento del 19-10-2012

Il Comitato di Riferimento del Dottorato in Fisica del Politecnico di Milano si è riunito il giorno 19.12.2012 al Politecnico di Milano presso l'aula Natta alla presenza del Collegio dei Docenti del Dottorato, appositamente convocato.

Le seguenti componenti del Comitato sono intervenute alla Riunione o in presenza o rappresentate da un delegato ufficiale:

<b>Componente del Comitato</b>	<b>Istituzione</b>
Roberto Bez (rappresentato da Agostino Pirovano)	Micron
Emilio Parisini	CNST - Fondazione Istituto Italiano di Tecnologia (IIT)
Stefano De Rossi	Oerlikon Balzers Coatings
Hans von Känel	ETH (Zürich)
Marco Grioni	EPFL (Lausanne)

Sono inoltre presenti numerosi dottorandi del XXV ciclo e dei successivi due cicli, docenti e ricercatori del Dipartimento di Fisica.

La riunione ha inizio alle ore 14:30.

Il Coordinatore, Prof. Ciccacci, presenta i membri del Comitato, che è stato parzialmente rinnovato, descrive brevemente la struttura del Dottorato in Fisica ed illustra in particolare le modifiche che verranno introdotte al piano di studi per la formazione dei dottorandi rispetto ai cicli precedenti.

Grioni chiede un chiarimento sulla corrispondenza tra ore di frequenza/studio e crediti, per meglio valutare il carico didattico previsto nei primi due anni di Dottorato. Ciccacci chiarisce la situazione e aggiunge che il numero di crediti attualmente richiesto è il minimo (30 cfu) previsto dalla Scuola di Dottorato.

Si apre poi la discussione.

- Lanzani chiede agli studenti cosa pensano della differenza tra la situazione italiana, con il Dottorato che dura sempre 3 anni (con solo una possibile estensione di 1 anno), e quella in molti paesi stranieri, in cui il Dottorato si conclude quando il lavoro di tesi è concluso, tipicamente in 4-6 anni.
- Alcuni studenti rispondono che sarebbe interessante adottare lo stesso modello in Italia solo se avere un Dottorato facesse una differenza sostanziale nelle successive possibilità di impiego.
- Lanzani ribatte che in Italia un Dottore entra nel mondo del lavoro come un laureato, ma la carriera può essere molto più rapida, non tanto per il titolo, ma perchè di fatto un Dottore può/dovrebbe essere più preparato.

- Pirovano concorda e aggiunge che i dottori dovrebbero cercare lavoro in quelle compagnie che valutano il Dottorato.
- Grioni nota che molto dipende dalle motivazioni che spingono un laureato ad affrontare un Dottorato. In Italia c'è spesso l'idea che il Dottorato sia il trampolino di lancio per la carriera accademica e questo non è necessariamente corretto.
- Per Lanzani, in paesi come gli USA, dopo il PhD spesso i Dottori aprono piccole aziende ad elevato contenuto innovativo. Da noi non accade.
- Von Kaenel chiede quanti stanno pensando di aprire un'azienda. Risposta: nessuno.
- Per Valentini, molti non hanno le competenze per aprire e gestire un'azienda. Il Politecnico offre un supporto, ma non può essere sufficiente. I neo-dottori devono essere i primi giudici di se stessi e capire se hanno "idee" sufficienti per sostenere un'azienda.
- Alcocer (XXVII ciclo) sostiene che forse, dovendo concludere il Dottorato (corsi e tesi) in soli 3 anni, i Dottorandi non hanno il tempo per poter valutare concretamente l'idea di aprire un'azienda.
- Cubeddu dice che però la situazione è diversa rispetto ad altri Paesi, come gli USA, perchè negli USA il dottorando segue, sostanzialmente da solo, un tema di ricerca e quindi aprire start-up o spin-off sull'argomento di Dottorato è, in qualche modo, una naturale evoluzione. Qui, tipicamente, il dottorando è inserito in un lavoro di un più ampio gruppo di ricerca e quindi, al termine del Dottorato, non è così comune che il neo-Dottore sia l'unico coinvolto nella ricerca sulla quale basare una start-up.
- Cubeddu chiede poi quale sarebbe il vantaggio di un Dottorato di 4 anni anziché 3 e Lanzani risponde che sarebbe solo un modo da per fare un migliore lavoro di tesi e che comunque la soluzione migliore sarebbe la flessibilità: 3 o 4 anni a seconda dei casi.
- Ciccacci invita i membri del Comitato che provengono da aziende a presentare la loro posizione.
- Pirovano dice che per un Dottore in Italia la possibilità migliore è quella di creare una piccola azienda. Trovare lavoro in grandi aziende ora non è facile in Italia. Per lavorare in una grande azienda, dovrebbero pensare di cercare lavoro all'estero.
- De Rossi interviene spiegando che lavora in una multinazionale presente anche in Italia (Oerlikon Balzers Coatings) e che la sua impressione è diversa da quelle appena espresse e chiede quanti dottorandi hanno iniziato il Dottorato pensando che poi avrebbero cercato un lavoro in una grande azienda. Risposta dalla platea: Nessuno. De Rossi spiega che questa risposta negativa non lo stupisce, perchè ha recentemente fatto colloqui per offrire un posto a un Dottore e non ha trovato candidati. Critica quindi le aspettative dei dottorandi, che vedono il Dottorato come trampolino per la carriera accademica.
- Grioni chiede se Ciccacci sa quanti dei Dottori lavorano in grandi compagnie e se pensano che il Dottorato sia utile. Ciccacci risponde che abbiamo informazioni per 2 anni dopo il Dottorato e il 70% fa ancora ricerca. Però 2 anni sono un intervallo di tempo troppo corto.
- Parisini dice che i Dottori vorrebbero fare un post-doc di 1 o 2 anni all'estero, ma temono di non riuscire più a re-inserirsi in Italia. E hanno ragione. Grioni aggiunge che un post-doc è un'ottima scelta per chi vuole rimanere nel mondo accademico, ma non per andare poi nell'industria.

- Parisini dice che su un Dottorato di 3 anni non è frequente stare all'estero 1 anno, ma un tempo minore non è veramente utile dal punto di vista della ricerca. Se il Dottorato durasse 4 anni, 1 anno all'estero sarebbe più facile da gestire.
- Alcocer (XXVII ciclo) chiede cosa significa che l'insegnamento per il Dottorato non è riconosciuto come didattica. Cubeddu spiega che è sempre stato visto come parte della formazione alla ricerca e non della didattica.
- Pirovano spiega che il lavoro offerto dalle aziende non sembra prevedere molta "ricerca" e non attrae i Dottori, ma la situazione reale è diversa, soprattutto a mano a mano che l'attività progredisce, perchè spesso vengo richieste ed utilizzate molte delle competenze dei Dottori.
- Duò sostiene che spesso i giovani vengono criticati, perchè iniziano un Dottorato con il sogno di restare nel mondo accademico, anche se sanno che le possibilità sono molto ridotte. Però in fondo molti che ora sono docenti hanno fatto lo stesso e hanno realizzato il loro sogno.
- Cubeddu invita a non essere interessati solo a quelli che sembrano gli argomenti più "nobili" della ricerca pura, ma a valutare anche la ricerca applicata, che può avere molti risvolti interessanti e offrire migliori possibilità di impiego.

Non essendoci ulteriori interventi, la riunione si conclude alle ore 16:30.

Il Coordinatore del Dottorato in Fisica  
Prof. Franco Ciccacci

