



DECRETO RETTORALE N. 4401

Bando di concorso per l'ammissione a n. 4 posti per il corso di Dottorato internazionale in Science presso l'Università Cattolica del Sacro Cuore – ciclo XXXIV

IL RETTORE

- Visto lo Statuto dell'Università Cattolica del Sacro Cuore, emanato con decreto rettorale 24 ottobre 1996, e successive modifiche e integrazioni;
- visto il regolamento generale di Ateneo dell'Università Cattolica del Sacro Cuore, emanato con decreto rettorale 26 ottobre 1999, e successive modifiche e integrazioni;
- vista la legge 5 febbraio 1992, n. 104;
- visto il d.p.r. 9 maggio 1994, n. 487;
- visto il d.lgs. 30 giugno 2003, n. 196;
- visto il d.m. 22 ottobre 2004, n. 270;
- vista la legge 30 dicembre 2010, n. 240, in particolare l'art. 19;
- visto il decreto ministeriale n. 45 dell'8 febbraio 2013;
- vista la nota del Ministero dell'Istruzione, dell'Università e della Ricerca, prot. n. 11677 del 14 aprile 2017, avente ad oggetto le linee guida per l'accREDITAMENTO dei corsi di dottorato;
- viste le procedure per l'ingresso, il soggiorno e l'immatricolazione degli studenti stranieri/internazionali ai corsi di formazione superiore in Italia per l'anno accademico 2018-2019, dettate dalla Direzione generale per lo studente, lo sviluppo e l'internazionalizzazione della formazione superiore;
- visto il Regolamento UE 2016/679 in materia di protezione dei dati personali (*General Data Protection Regulation*), pubblicato sulla Gazzetta Ufficiale Europea del 4 maggio 2016;
- visto il proprio decreto n. 2778 del 13 settembre 2016, recante: «Modifiche al “Codice etico dell'Università Cattolica del Sacro Cuore”»;
- visto il proprio decreto n. 3627 del 12 luglio 2017, recante: «<<Modifiche al “Regolamento dei corsi di dottorato di ricerca e delle scuole di dottorato di ricerca dell'Università Cattolica del Sacro Cuore”>>»;
- visto l'accordo per il corso di Dottorato internazionale in *Science* tra l'Università Cattolica del Sacro Cuore, la Katholieke Universiteit Leuven (Belgium), la Pontificia Universidad Católica de Chile Santiago (Chile) e l'University of Notre Dame du Lac - Notre Dame, Indiana (USA), datato 12 maggio 2016;



- vista la relazione del Nucleo di Valutazione d'Ateneo del 26 marzo 2018 relativa alla "Verifica dei requisiti di idoneità per l'istituzione del XXXIV ciclo dei Corsi di Dottorato";
- vista la delibera adottata dal Senato accademico dell'Università Cattolica del Sacro Cuore, nell'adunanza del 9 aprile 2018;
- vista la delibera adottata dal Consiglio di amministrazione dell'Università Cattolica del Sacro Cuore, nell'adunanza del 18 aprile 2018;
- viste le note del Ministero dell'Istruzione, dell'Università e della Ricerca, rispettivamente del 5 febbraio 2018, n. 3419, del 23 febbraio 2018 n. 5845 e del 13 marzo 2018, n. 8295;
- preso atto delle indicazioni contenute nella banca dati ministeriale relativa ai Dottorati le quali precisano che: *"nel caso in cui non sia stata effettuato un cambiamento del coordinatore del corso o una variazione di più del 20% dei componenti del collegio nel suo complesso, non c'è necessità di un riaccreditamento del corso di dottorato"*,

DECRETA

Art. 1

L'attivazione del corso di Dottorato in *Science* – XXXIV ciclo, con sede amministrativa presso l'Università Cattolica del Sacro Cuore in accordo con la Katholieke Universiteit Leuven (Belgium), la Pontificia Universidad Católica de Chile Santiago (Chile) e l'University of Notre Dame du Lac - Notre Dame, Indiana (USA), secondo le disposizioni contenute nel documento allegato - in lingua inglese (*allegato 1*) – quale parte integrante del presente decreto.

Art. 2

La nomina dei membri del collegio dei docenti del corso di Dottorato di cui all'art. 1, i cui nominativi sono riportati in *allegato 2* quale parte integrante del presente decreto.

Milano, 9 maggio 2018

IL RETTORE
(Prof. Franco Anelli)
F.to: F. Anelli

IL DIRETTORE AMMINISTRATIVO
(Prof. Marco Elefanti)
F.to: M. Elefanti

Public Call for Admission to 4 positions in the International PhD in Science at Università Cattolica del Sacro Cuore - XXXIV Cycle

Art. 1

Opening

This Call indicates the Coordinator, the partner universities, the duration of the course, the number of positions available and the number of scholarships granted by the partner Universities of the International PhD in Science.

International PhD in Science

Coordinator: Prof. Prashant V. KAMAT - University of Notre Dame du Lac, Indiana (United States of America).

Duration: 4 years.

Studentship-based positions: 4.

Information: <http://dottorati.unicatt.it/science>

Details of scholarships:

There will be 4 scholarships positions financed by Università Cattolica del Sacro Cuore and IIT:

- 1 scholarship Istituto Italiano Tecnologia (IIT) - Genova (joint research project between Università Cattolica del Sacro Cuore, IIT and University of Notre Dame du Lac) “Advanced Optical Investigations of Halide Perovskites and their Chemical Transformations.”

Research topic: The project will tackle two novel aspects. The first centers on synthesizing chemically complex hybrid perovskite nanostructures and thin films using solution chemistries. This includes mixed cation and mixed anion hybrid perovskite quantum dots, nanowires and nanoplatelets.

Hybrid perovskites are important materials for the creation of next generation solar cells. Recent studies have shown that solution-processed hybrid perovskite solar cells can exhibit power conversion efficiencies exceeding 20%. There is similar interest in hybrid perovskite nanostructures where corresponding quantum dot solar cells have achieved power conversion efficiencies exceeding 13%. Despite widespread application of these materials for use in solar energy conversion, much is not understood about the basic photophysics of these materials.

Consequently, the second novel aspect of the proposed work will be to conduct detailed spatially-resolved optical measurements of hybrid perovskite photophysics. For mixed cation and anion materials this includes efforts to understand light-induced cation/anion phase segregation. For analogous nanostructures such as nanowires this entails measurements of single wire excited state progressions and absorption/emission Stokes shifts. Of note is that a debate exists regarding existence of a Stokes shift as it is not immediately predicted by certain theoretical models of the perovskite electronic structure.

The main goals of the project are:

- Accessing the photophysics of halide perovskites
- Optical properties of single nano-objects

IIT – Istituto Italiano di Tecnologia – Genova - tutor: Dott. Liberato Manna;
Università Cattolica del Sacro Cuore - tutor: Dr. Francesco Banfi;
University of Notre Dame du Lac - tutor: Prof. Masaru Kuno.

Important note: The amount of this scholarship financed by IIT Istituto Italiano di Tecnologia di Genova (Italy), paid in monthly instalments, is € 20.318,32 per year, before social security charges. Moreover, the IIT will also take charge of the annual tuition fees (€ 1500,00).

Workplace: IIT Istituto Italiano di Tecnologia, Genova (Italy), University of Notre Dame du Lac, Indiana (United States of America), Università Cattolica del Sacro Cuore (Italy).

Candidate Profile

- Diploma: Master's degree or comparable qualification in Physics, Materials Science, Chemistry or adjacent fields. The title must be obtained before October 31st, 2018.
- A strong interest for multidisciplinary research is required.
- A solid background in physics, materials science or materials chemistry is required.
- Experience in optical microscopy and solution phase chemical synthesis will be considered as an advantage.
- Good knowledge of the English language, both spoken and written, is essential.
- Strong commitment, ability to work in a team, and eager for international mobility is desired.

- 1 scholarship (joint research project between Università Cattolica del Sacro Cuore, KU Leuven and University of Notre Dame du Lac, Indiana (United States of America) “Time-Resolved Nanoscopy”.

Research topic: The aim of the PhD project is to develop a microscopy-oriented research platform combined with time-resolved optical spectroscopy to study single nanostructures and surface inhomogeneities with a spatial resolution below 100 nm and a temporal resolution of the order of 100 fs. One of the goal of this projects will be to harness the capability of super-resolution imaging methods that now can provide spatial resolution that is well below the diffraction limit (nanoscopy), approaching virtually molecular resolution. In particular we will concentrate on label-free and white light super-resolution microscopy based on the detection of evanescent waves. Atomic force microscopy techniques will complement the optical microscopy platform to characterize the mechanical/chemical aspects of the investigated physics. Since these microscopy/nanoscopy techniques comes with novel requirements for the time-resolved optical spectroscopy, new schemes to adapt the standard pump and probe techniques to the microscopy environment will be implemented. Finally, it will be important to pay attention to the data interpretation strategies, also in view of the data storage and management needed in experiments where a great deal of spectroscopic information is potentially available in each pixel of an image.

Università Cattolica del Sacro Cuore - tutor: Prof. Gabriele Ferrini;
KU Leuven - tutor: Dr. Eduard Fron;
Notre Dame du Lac, Indiana - tutor: Prof. Gregory Hartland.

- Diploma: Master's degree or comparable qualification in Physics, Materials Science, Electronic engineering or adjacent fields. The title must be obtained before October 31st, 2018.

Workplace: Università Cattolica del Sacro Cuore (Italy), University of Notre Dame du Lac, Indiana (United States of America)

Candidate Profile

- A strong interest for multidisciplinary research is required.
 - Candidates should have a solid background in optics.
 - Previous experience in microscopy and/or ultrafast optics will be an asset.
 - Good knowledge of the English language, both spoken and written, is essential.
 - Strong commitment, ability to work in a team, and eagerness for international mobility is desired.
- 1 scholarship (joint research project between Università Cattolica del Sacro Cuore and KU Leuven): “Quantum Field Theory, Holography and Ads/Cft”.

Research topic: Anti de Sitter / Conformal Field Theory (AdS/CFT) correspondence gives us a unique opportunity both to study strongly coupled field theory systems in a controlled setting and to address fundamental questions in quantum gravity with quantum field theory tools. Candidates are expected to carry out a PhD in Theoretical Physics in Quantum Field Theory and Gauge/Gravity duality.

The main goals of the project are to acquire a solid knowledge in theoretical physics in order to conduct independent research in the following topics:

- Renormalization group flows in quantum field theory and holography,
- Non-relativistic field theories and their holographic duals,
- Supersymmetric theories at strong coupling,
- Black Holes and gravity duals of quantum information concepts such as entropy and complexity,
- Conformal field theories and anomalies.

The candidate is also expected to proactively carry out the research project, interacting with the theory staff of Università Cattolica del Sacro Cuore, KU Leuven and other Universities (e.g. University of Milano-Bicocca, University of Pisa, and possibly others).

Università Cattolica del Sacro Cuore - tutor: Prof. Giuseppe Nardelli and Dr. Roberto Auzzi.

KU Leuven - tutor: Prof. Nikolay Bobev

Workplace: Università Cattolica del Sacro Cuore (Italy), KU Leuven (Belgium)

Candidate Profile

- Diploma: Master's degree or comparable qualification in Physics, Mathematical Physics and adjacent fields. The title must be obtained before October 31st, 2018.
- A strong interest for multidisciplinary research is required.
- A solid background in Quantum Mechanics and Quantum Field Theory is required.
- Experience in AdS/CFT, Black Holes, will be considered as an advantage.
- Good knowledge of the English language, both spoken and written, is essential.
- Strong commitment, ability to work in a team, and eager for international mobility is desired.

- 1 scholarship (joint research project between Università Cattolica del Sacro Cuore and KU Leuven): “Size-resolved aerosol particle deposition to European broadleaved forests”.

Research topic: Airborne particulate matter (PM) is a subject of major concern in Europe because it has been attributed to the most severe health effects. Vegetation is likely to play an important role in mitigating this source of air pollution because of the large surface area offered by leaves to filter PM out of the air. Many studies aimed at quantifying the dry deposition of PM to vegetation, particularly in forests. However, the characterization of the exchange processes are still incomplete. PM deposited on leaves, for example, can be re-suspended in air, while the only process that represents the ultimate removal of PM from the atmosphere is the washing off by precipitation dripping from leaves to the soil. Up to now only a couple of models attempted to include the above-mentioned processes in their formulation, but their description is far from truly mechanistic and should be still validated. The aim of this PhD project is the micrometeorological characterization of the size-resolved PM deposition and resuspension processes to European broadleaved forests under different climatic conditions with related possible physiological interactions. The research will consist of a combination of experimental and observational work both in the field (eddy covariance) and in the Lab (wind tunnel or growth chambers) with the aim to improve the actual deposition models.

Università Cattolica del Sacro Cuore - tutor: Prof. Giacomo Gerosa;

KU Leuven - tutor: prof. Bart Muys

Workplace: Università Cattolica del Sacro Cuore (Italy), KU Leuven (Belgium)

Candidate Profile

- Diploma: Master's degree or comparable qualification in physics, with a strong background in environmental physics and ecology. Degrees in environmental science, forest or plant science are welcome too, provided a sound preparation in environmental physics are presented. The title must be obtained before October 31st, 2018.
- A solid background in atmospheric physics and micrometeorology is required electronics, as well as skills in electronics, programming and modelling.
- Experience in Knowledge of ecology and plant physiology will be considered as an advantage. Applicants should love experimental work in open-air and should not deny the practical work, such as wiring, cabling and installing probes, mounting masts and supports, programming and running new instrumentation.
- Good knowledge of the English language, both spoken and written, is essential.
- Strong commitment, ability to work in a team, and eager for international mobility is desired.

Art. 2

Assessment procedure

The comparative evaluation of candidates applying to the International PhD in Science aims to discern the candidates aptitude for and interest in the scientific research proposed in the Research Program. The examination panel reserves the right to ask for a telephone

or remote interview (such as Skype or similar).

Art. 3

Admission requirements

Application for participation in the competition, with no restrictions with respect to age and nationality, is open to candidates holding a Master's degree, or an Italian university degree obtained under the education system prior to Italian Ministerial Decree no. 509 of November 3rd, 1999 or a second-level university qualification obtained abroad and deemed eligible.

Application for participation is also open to candidates due to obtain one of the above-mentioned qualification by October 31st, 2018. In this case, examination candidates shall provide the Examination Panel with a self-declaration form attesting graduation or a qualification from a foreign university. Failure to do so will be cause for invalidation of the application.

Italian, EU and non-EU candidates that obtained, or will obtain, a qualification abroad, **by October 31st, 2018**, for the sole purpose of admission to the PhD Programme shall request recognition of its eligibility in the PhD Programme application form. To this end, the application shall be accompanied with appropriate documentation to enable the Examination Panel to rule on the request for eligibility.

Art. 4

Application form

Candidates who intend to participate in the competition must submit an application to the Rector of Università Cattolica del Sacro Cuore by **Friday September 28th, 2018**.

The application form is available at <http://dottorati.unicatt.it/concorsi-milano> **until 2 p.m. (local time) on the expiration date of the present public announcement.**

In the application form, to be filled in online only, available in English and just online, candidates shall declare under their responsibility:

- one of the 4 research topics established by Università Cattolica del Sacro Cuore;
- personal information: surname, first name, fiscal code (for Italian nationals only), date and place of birth, citizenship, residence and domicile elected for the purposes of the competition;
- for graduate students: qualification, date it was obtained and name of the conferring university;
- foreign languages known besides English.

Candidates must complete their application with the following documents – upload format .pdf or .jpg:

- a detailed *curriculum vitae et studiorum* written in English;
- self-certified Master's degree document with final mark and exams transcript, or certification of qualification obtained abroad with final mark and exams transcript translated in English. A self-certified translation will be accepted for the purpose of selection;
- certification of any other qualifications, such as postgraduate and advanced specialisation degrees, obtained in Italy and/or abroad; a copy of any other qualification considered useful for the purposes of the comparative evaluation. The documentation as to be translated in English. A self-certified translation will be

- accepted for the purpose of selection;
- a list of the publications deemed useful for the purposes of the comparative evaluation, and a list thereof on unstamped paper;
 - two references letters written in English. The letters shall be sent to the same email address indicated above phd.science@unicatt.it within the date of expiration of the present public announcement;
 - for non-native speakers of English, a certificate attesting adequate proficiency in English, such as:
 - FCE;
 - CAE;
 - CPE;
 - BEC
 - *British Chamber of Commerce*;
 - *Trinity College*;
 - TOEFL;
 - IELTS;
 - or certificate of the kind deemed useful to prove proficiency in English;
 - an identification document, duly signed;
 - fiscal code (for Italian nationals only);
 - card-size photograph;
 - students with a degree obtained or to be obtained in NON-EU countries shall provide a translation, authentication and a certificate of equivalence of qualification of their foreign degree certificates, issued by the Italian Consulate/Embassy representative offices in the countries where they have obtained/will obtain the degree. EU students must provide a Diploma Supplement from the University where they completed their studies as an alternative to the certificate of equivalence of qualification.

The application will be considered complete and valid only upon payment of the selection fee (not refundable) of € 100,00 to be paid by credit card (VISA or MASTERCARD).

The University reserves the right to adopt measures for the exclusion of candidates who do not have the prerequisites required or did not comply with the indications of the public announcement, also after the competition-related examinations have taken place.

Candidates with disabilities must specify in their application the aid required in relation to their disability, in accordance with Law no. 104 of February 5th, 1992.

Art. 5

Application at the Partner Universities

Regarding scholarships at the Partner Universities, as mentioned in the Art.1, the recruitment rules for candidates applying for the International Ph.D. in Science will be provided by each institution according to its own procedures.

Art. 6

Examination Panel

The Examination Panel of the comparative evaluation for admission to the PhD Programme in Science is appointed by Rector's Decree for the competition-related

examinations.

The Examination Panels will consist of three academics/researchers pertaining respectively to the PhD Research Programme Topic in Differential geometry and applications to modern physics or Topic in Cooperative Effects in quantum systems.

The composition of the Panels will be published, after the expiration date of the present public announcement, at <http://dottorati.unicatt.it/concorsi-milano>

In a preliminary meeting or preliminary meeting the Examination Panels shall define the criteria for the comparative evaluation necessary for a single merit-based ranking to be drawn up. These criteria will be published, as by law enacted, at <http://dottorati.unicatt.it/concorsi-milano>

Art. 7

Admission to PhD Programmes

Candidates are admitted to the International PhD in Science according to the ranking, until the established number of positions have been filled.

The results of the competition in the form of a single merit-based ranking will be published at <http://dottorati.unicatt.it/concorsi-milano>

Art. 8

Enrolment

Candidates admitted to the PhD must enrol via the Doctoral Studies Office at Università Cattolica del Sacro Cuore - Largo Gemelli 1, 20123 Milan, by sending the following documentation by email:

- the PhD Programme application form (once uploaded this will produce a confirmation email sent to the candidate);
- Personal and Tax data Form.

The documents must be sent within 7 (seven) days of receipt of the email concurring enrolment confirmation at Università Cattolica del Sacro Cuore.

Art. 9

Aid and studentships

Tuition fees for the International PhD in Science at Università Cattolica del Sacro Cuore are set annually by the Board of Directors.

PhD students enrolled at Cycle XXXIV in Università Cattolica del Sacro Cuore are required to pay annual tuition fees amounting to € 1,500.00 (one thousand five hundred/00) in two equal instalments: one upon matriculation or renewal of enrolment, and one on June 30th each year.

A scholarship on the PhD programme is compatible with other income (also earned on a regular basis) in the calendar year of the scholarship, provided that such income does not exceed the scholarship itself. Should these income limits be surpassed, the scholarship shall be revoked for the year in question. Students with scholarships shall annually declare the income and notify of any excess of the prescribed limits.

The scholarships are renewed annually, provided that the PhD students have completed the programme of activities set for the previous year.

The amount of the scholarship, paid in monthly instalments, is € 15.343,28 per year, before social security charges. The scholarship is subject to the payment of social security contributions (INPS separate management) pursuant to Art. 2, Paragraph 26, of Law 335 dated of August 8th, 1995, and subsequent amendments. The scholarship is

exempt from local income tax and personal income tax (IRPEF).

The studentship amount shall be increased by max. 50 percent, for a period not over 18 months, if the PhD student is authorised by the Teaching Panel to conduct research abroad.

Starting from the second year, to each PhD student, with or without a studentship, is granted an annual sum covering research activities in Italy and abroad amounting to 10 percent of the annual gross amount of the scholarship, equal to € 1.534,33.

Art. 10

Public employee

Current legislation on leave of absence or special leave applies to public employees admitted to International PhD in Science.

Art. 11

Incompatibility

Attendance of the PhD Programme is not compatible with enrolment in other study programmes, postgraduate schools (except for medical specialisation schools), and other PhD Programmes (except in the case of joint dissertation supervision agreements).

Art. 12

Obligations of PhD students

PhD students are required to take part regularly in the activities set out in their curricula, and to commit to the regulatory norms of their University of enrolment.

Art. 13

Conferment of PhD degree

The procedure of PhD degree conferment is governed by the regulatory norms of the University of enrolment.

Art. 14

Public disclosure

This public announcement is published on the *Euraxess* European website, on the MIUR website and at: <http://dottorati.unicatt.it/concorsi-milano>

Art. 15

Final provisions

For any matter not explicitly contemplated in this public announcement, the provisions indicated in the Regulatory Norms of the University of PhD students' enrolment shall apply.

Head of the procedure of the present selection is Dr Roberto BRAMBILLA, Director of Postgraduate Education and Research Partnership, Via Carducci 28/30, Milan, Italy.

Nomina dei membri del collegio dei docenti del corso di Dottorato internazionale in *Science*, con sede amministrativa presso l'Università Cattolica del Sacro Cuore in accordo con la Katholieke Universiteit Leuven (Belgium), la Pontificia Universidad Católica de Chile Santiago (Chile) e l'University of Notre Dame du Lac - Notre Dame, Indiana (USA), – ciclo XXXIV

Collegio dei docenti:

- Prof. Prashant V. KAMAT - University of Notre Dame du Lac, Indiana – Coordinatore;
- Prof. Fausto BORGONOVÌ, Università Cattolica del Sacro Cuore;
- Prof. Luca GAVIOLI, Università Cattolica del Sacro Cuore;
- Prof. Marco SQUASSINA, Università Cattolica del Sacro Cuore;
- Dott. Francesco BANFI, Università Cattolica del Sacro Cuore;
- Dott. Claudio GIANNETTI, Università Cattolica del Sacro Cuore;
- Dott. Riccardo MARZUOLI, Università Cattolica del Sacro Cuore;
- Prof. Alejandro CABRERA, Pontificia Università del Cile (CILE);
- Prof.ssa Patricia CLARCK, University of Notre Dame du Lac, Indiana;
- Prof. Giuseppe DE NITTIS, Pontificia Università del Cile (CILE);
- Prof. Steven DE FEYTER, Università Cattolica di Lovanio (BELGIO);
- Prof. Mario FAVRE, Pontificia Università del Cile (CILE);
- Prof. Greg HARTLAND, University of Notre Dame du Lac, Indiana;
- Prof. Boldizsar JANKO, University of Notre Dame du Lac, Indiana;
- Prof. Masaru KUNO, University of Notre Dame du Lac, Indiana;
- Prof. Walter LUYTEN, Università Cattolica di Lovanio (BELGIO).
- Prof. Jeronimo MAZE, Pontificia Università del Cile (CILE);
- Prof. Enrique MUNOZ, Pontificia Università del Cile (CILE);
- Prof. Lino PEREIRA, Università Cattolica di Lovanio (BELGIO).
- Prof.ssa Sylwia PTASINSKA, University of Notre Dame du Lac, Indiana;
- Prof. Riccardo RAABE, Università Cattolica di Lovanio (BELGIO);
- Prof. Javier RECIO, Pontificia Università del Cile (CILE);
- Prof. Marco ZAMBON, Università Cattolica di Lovanio (BELGIO).