



DECRETO RETTORALE N. 11411

Bando di concorso per l'ammissione al corso di Dottorato internazionale in *Science* presso l'Università Cattolica del Sacro Cuore - XL ciclo – sede di Brescia

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.p.r. 28 dicembre 2000, n. 445;
- visto il d.lgs. 30 giugno 2003, n. 196;
- vista la legge 30 dicembre 2010, n. 240, in particolare l'art. 19;
- visto il decreto ministeriale n. 226 del 14 dicembre 2021;
- visto il decreto ministeriale n. 930 del 29 luglio 2022, recante: «Disposizioni per consentire la contemporanea iscrizione a due corsi universitari»;
- 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 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;
- visto il proprio decreto n. 6764 del 30 settembre 2020, recante: «Modifiche al “Codice etico dell'Università Cattolica del Sacro Cuore”»;
- visto il proprio decreto n. 8347 del 16 febbraio 2022, recante: «Modifiche al “Regolamento dei corsi di dottorato di ricerca e delle scuole di dottorato di ricerca dell'Università Cattolica del Sacro Cuore”»;
- visto il “Gender Equality Plan dell'Università Cattolica del Sacro Cuore”, approvato dal Senato Accademico del 13 dicembre 2021 e dal Consiglio di Amministrazione del 15 dicembre 2021;
- valutata l'opportunità di avviare le procedure di selezione sotto condizione dell'accREDITAMENTO e della verifica di mantenimento dei requisiti di accREDITAMENTO da parte di ANVUR;



- vista la delibera adottata dal Senato accademico, nell'adunanza del 15 aprile 2024;
- vista la delibera adottata dal Consiglio di Amministrazione, nell'adunanza del 24 aprile 2024,

DECRETA

Art. 1

L'attivazione del corso di Dottorato Internazionale in *Science* – XL 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, 29 aprile 2024

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

IL DIRETTORE GENERALE
(Dott. Paolo Nusiner)
F.to: P. Nusiner

Call for applications for the International PhD in Science at Università Cattolica del Sacro Cuore – XL Cycle – Brescia campus

**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.

The number of studentships may be increased thanks to funding from public and private institutions, provided that the pertinent agreement is signed within the date of expiration of the present public announcement. Any subsequent amendments and/or additions to the call for applications will be publicized at <https://dottorati.unicatt.it/concorsi>

The activation of the PhD programme and the related selection procedures are under the condition of accreditation, the verification of the maintenance of the requirements by ANVUR.

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

Duration: 4 years.

Positions:

Funded positions: 2

Information: <https://scuoledidottorato.unicatt.it/phdschools/science-home?rdeLocateAttr=en>

Details of the positions (see also <https://scuoledidottorato.unicatt.it/phdschools/science-10695.html>):

No. 1 scholarship (joint research project between Università Cattolica del Sacro Cuore and the University of Notre Dame) on “Optical properties of Nanoplastics”.

Background and motivation

The pervasive distribution of nanoplastics (NPLs) with dimensions less than 1 μ m in the environment prompted considerable scientific inquiry and public health concerns. Reliable detection of NPLs is essential for understanding their environmental and ecological impacts [1]. In contrast to engineered nanoparticles or larger microplastics,



NPLs have been less widely studied, and effective separation, detection and quantification methods are still under development for environmental samples [2]. Since commercial NPLs (polystyrene) are not specifically designed as reference materials for environmental nanoplastics, test materials better mimicking environmental nanoplastics should be developed. Furthermore, heterogeneous NPLs samples present a characterization challenge, e.g. the determination of the refractive index of such mixed materials [3], and the sample evolution as a function of environmental characteristics optical properties are undergoing scrutiny for their applicability to heterogeneous NPLs samples to determine the refractive index of complex samples [4].

The main scope of the project is dual. A first step will investigate the optical properties of controlled NPLs through spatially averaged and spatially resolved optical techniques. A second step will translate initial findings into realistic NPLs models, refining and validating a new class of NPLs models closely resembling their environmental counterparts. A particular care could be devoted to the NPLs photodegradation.

The major expected project results are: 1) development of novel tools tailored specifically for investigating NPLs optical properties. 2) Advancement in analytical techniques for characterizing heterogeneous nanoplastic samples.

References:

- [1] Bank MS, et al. *Nat Rev Earth Environ.* 2022; 3:736-737. DOI: 10.1038/s43017-022-00365-x
- [2] Nguyen B, et al. *Acc. of Chem. Res.* 2019; 52: 858-866. DOI: 10.1021/acs.accounts.8b00602
- [3] K. Kniazev et al. *Environ. Sci. Technol.* 2021, 55, 15891–15899. <https://doi.org/10.1021/acs.est.1c05181>
- [4] O. Nwachukwu et al. *Environ. Sci. Technol.* 2024, 58, 1312–1320. <https://doi.org/10.1021/acs.est.3c06498>

Candidate Profile

- Master's degree or similar qualification in Physics or adjacent fields obtained before October 31st, 2024;
- A strong interest for multidisciplinary research is required;
- 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.

Opportunities

- The student will be guided by experienced tutors at the Università Cattolica del Sacro Cuore (UCSC), the University of Notre Dame (ND), and the University of Brescia (UniBS);
- Modelling and experimental research within the international collaboration between UCSC, ND and UniBS, with at least one year spent at ND;
- Opportunity to obtain the Ph.D. title from ND and from UCSC.



Supervisors

- Prof. Luca Gavioli, Università Cattolica del sacro Cuore, Italy, luca.gavioli@unicatt.it;
- Prof. Masaru Kuno, University of Notre Dame, Indiana (United States of America) mkuno@nd.edu;
- Dr.ssa Stefania Federici, Università degli Studi di Brescia, Italy, stefania.federici@unibs.it.

No. 1 scholarship (joint research project between Università Cattolica del Sacro Cuore and KU Leuven) on “Holographic dualities and non-perturbative methods in quantum field theory”.

Background and motivation

The holographic principle, asserting that the physical properties of a gravitational system are encoded in its boundary, has garnered substantial support from the study of quantum information, including the study of entanglement, computational complexity, error correction and bulk reconstruction. In parallel, a great improvement in the understanding of Anti de-Sitter/Conformal Field Theory (AdS/CFT) correspondence has been achieved in recent years by focusing on certain applications of the duality, such as non-relativistic limits, defects and quenches. A further challenge is to extend holographic approaches to asymptotically dS spacetimes.

The main goal of the project is to acquire a solid knowledge in theoretical physics and to conduct independent research within the following topics:

Black holes and quantum information in AdS/CFT.

Theories with defects or boundaries.

Non-relativistic limits applied to AdS/CFT duality.

Investigation of holography in de Sitter space.

Solitons and instantons.

The candidate is also expected to carry out research projects in theoretical physics, interacting with the theory staff of Università cattolica del Sacro Cuore (UCSC) and of KU Leuven (KU).

Candidate Profile

- Master's degree or similar qualification in Physics, Mathematical Physics or adjacent fields obtained before October 31st, 2024;
- A solid background in Quantum Mechanics, General Relativity and Quantum Field Theory is required;
- Experience in AdS/CFT and black holes physics 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 eagerness for international mobility is desired.

Opportunities

- Perform theoretical research in an interdisciplinary research environment and actively participate to the international collaboration between research groups in Italy and KU Leuven, with the aim of achieving a doctorate diploma under the joint supervision by UCSC and KU Leuven. The overall tutoring activity will be conducted by Roberto Auzzi and Giuseppe Nardelli, staff members at UCSC, and Thomas Van Riet, staff member at KU Leuven.
- Opportunity to obtain the Ph.D. title from KU and from UCSC

Supervisors

- Prof. Roberto Auzzi, Università Cattolica del Sacro Cuore, Italy, roberto.auzzi@unicatt.it;
- Prof. Giuseppe Nardelli, UCSC, Università Cattolica del Sacro Cuore, Italy, giuseppe.nardelli@unicatt.it;
- Prof. Thomas Van Riet, KU Leuven, Belgium, thomas.vanriet@kuleuven.be.

Art. 2

Assessment procedure

The comparative evaluation of candidates applying to the International PhD in Science aims to discern the candidate's aptitude for and interest in the scientific research proposed in the Research Program. The examination panel reserves the right to ask for an online interview.

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, 2024. 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 who obtained, or will obtain, a qualification abroad, by October 31st, 2024, 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 **Thursday June 20th, 2024**.

The application form is available at <https://dottorati.unicatt.it/concorsi> until 12 p.m. (CEST) of the expiration date of the present public announcement.

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

- the choice of at least one of the research projects offered 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* 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 qualification, 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 must 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;
- 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.



Candidates may also preferably complete their application with the following documents:

- two references letters written in English. The letters shall be sent directly by the writer to the 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.

In case of absence of an adequate English proficiency certificate, the Examination panel will verify the English proficiency during the oral interview.

The application is complete and valid only after having paid the participation fee of € 100.00 (non-refundable) for the selection to be paid online by credit card after uploading the .pdf of the application, which it is generated at the end of the upload path of all documents.

To confirm the successful registration to the selection exam, the candidate will receive a confirmation email from the Università Cattolica del Sacro Cuore Doctorates Office.

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, in order to attend the selection examination, must specify in their application the aid required in relation to their disability, in accordance with Italian Law no. 104 of February 5th, 1992.

Art. 5 **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.

For each project/scholarship published within the present call, the Examination Panel will consist of three academics/researchers pertaining respectively to the PhD Research topic.

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



In a 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 <https://dottorati.unicatt.it/concorsi>

Art. 6

Admission to PhD Programme

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 <https://dottorati.unicatt.it/concorsi>

Students who have been awarded a research grant, unless otherwise specified, may be admitted to the PhD Programme in supernumerary, without being awarded a scholarship, subject to passing the admission tests, provided that the PhD Programme in which they participate concerns the same scientific area of research for which they are recipients of grants.

Art. 7

Enrolment

The winners of the competition must complete the registration within 5 days starting from the day following the one in which the related email with the invitation will be received, by accessing the following website: <https://iscrizioni.unicatt.it/iscrizioni/>

Art. 8

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 are required to pay tuition fees annually amounting to € 1,516.00, to be paid in three instalments: the first (of € 516.00) upon enrolment, the second (of € 500.00) by February 28th, and the third (of € 500.00) on June 30th each year.

For the Italian law, 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 studentship, paid in monthly instalments, is € 16,243.00 per year, before social security charges. The studentship is subject to the payment of social security contributions (INPS specific management) pursuant to Art. 2, Paragraph 26, of Italian Law 335 dated of August 8th, 1995, and subsequent amendments. The studentship is exempt from local income tax and personal income tax (IRPEF).

The studentship amount shall be increased by max. 50%, for a period not over 12 months pursuant to Art. 9, Paragraph 3 of the Ministerial Decree 226/21, if the PhD student is authorised by the Teaching Panel to conduct research abroad.

Starting from the first year, to each PhD student, with or without a studentship, is granted a sum covering research activities in Italy and abroad amounting to 10% of the annual gross amount of the studentship, equal to € 1,624.30.

Art. 9

Public employees

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

Art. 10

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. 11

Conferment of PhD degree

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

Art. 12

Public disclosure

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

Art. 13

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.



ALLEGATO 2 DEL DECRETO RETTORALE N. 11411 DEL 29 APRILE 2024

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 XL

Collegio dei docenti:

- Prof. Prashant V. KAMAT - University of Notre Dame du Lac, Indiana - Coordinatore;
- Prof. Luca GAVIOLI, Università Cattolica del Sacro Cuore;
- Prof.ssa Stefania PAGLIARA, Università Cattolica del sacro Cuore;
- Prof. Daniele TESSERA, Università Cattolica del Sacro Cuore;
- Prof. Francesco BALLARIN, Università Cattolica del Sacro Cuore;
- Dott.ssa Giulia GIANTESIO, Università Cattolica del Sacro Cuore;
- Dott. Riccardo MARZUOLI, Università Cattolica del Sacro Cuore;
- Prof. Francesco BANFI, Università di Lione (FRANCIA);
- Prof.ssa Patricia CLARCK, University of Notre Dame du Lac, Indiana; (STATI UNITI D'AMERICA);
- Prof. Steven DE FEYTER, Università Cattolica di Lovanio (BELGIO);
- Prof. Jan ELSSEN, Università Cattolica di Lovanio (BELGIO);
- Prof. Mario FAVRE, Pontificia Università del Cile (CILE);
- Prof. Bejamin GORISSEN, Università Cattolica di Lovanio (BELGIO);
- Prof. Dardo GOYENECHÉ, 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. Jeronimo MAZE, Pontificia Università del Cile (CILE);
- Prof. Enrique MUNOZ, Pontificia Università del Cile (CILE);
- Prof. Lino DA COSTA 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. Roberto RODRIGUEZ, Pontificia Università del Cile (CILE);
- Prof.ssa Flavia ZACCONI, Pontificia Università del Cile (CILE);
- Prof. Marco ZAMBON, Università Cattolica di Lovanio (BELGIO).

