



DECRETO RETTORALE N. 10120

Bando di concorso per l'ammissione al corso di Dottorato internazionale in *Science* presso l'Università Cattolica del Sacro Cuore - XXXIX 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;
- vista la nota del Ministero dell'Università e della Ricerca, prot. n. 3992 del 2 marzo 2023 avente ad oggetto la “Procedura informatizzata per l'accreditamento dei corsi di dottorato – 39 ciclo”;
- 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”>>;
- visti i principi, ai sensi degli artt. 5 e 9 del Regolamento (UE) n. 2021/241;



- visti i principi trasversali previsti dal Regolamento (UE) n. 2021/241, con particolare riferimento al principio della parità di genere e al principio di protezione e valorizzazione dei giovani;
- visto l'articolo 17 Regolamento UE 2020/852 che definisce gli obiettivi ambientali, tra cui il principio di non arrecare un danno significativo (DNSH, "*Do No Significant Harm*"), e la relativa Comunicazione della Commissione Europea C (2021) 1054 final del 12 febbraio 2021, recante "Orientamenti tecnici sull'applicazione del principio "non arrecare un danno significativo" a norma del regolamento sul dispositivo per la ripresa e la resilienza";
- visto l'articolo 47 "Pari opportunità, generazionali e di genere, nei contratti pubblici PNRR e PNC" del D.L. 31 maggio 2021, n. 77 convertito in legge 29 luglio 2021, n. 108;
- 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;
- visto il decreto ministeriale n. 118 del 2 marzo 2023, portante l'attribuzione per l'anno 2023/2024, a valere sul PNRR Missione 4, Componente 1 "*Potenziamento dell'offerta dei servizi di istruzione: dagli asili nido all'Università*" – Investimento 3.4 "*Didattica e competenze universitarie avanzate*" e Investimento 4.1 "*Estensione del numero di dottorati di ricerca e dottorati innovativi per la pubblica amministrazione e il patrimonio culturale*";
- visto l'avviso pubblico per la presentazione di proposte progettuali per il "Rafforzamento e creazione di Infrastrutture di Ricerca" da finanziare nell'ambito del PNRR Missione 4, "Istruzione e Ricerca" - Componente 2, "Dalla ricerca all'impresa" - Linea di investimento 3.1, "Fondo per la realizzazione di un sistema integrato di infrastrutture di ricerca e innovazione", finanziato dall'Unione Europea - *NextGenerationEU*, approvato con decreto del 28 dicembre 2021, n. 3264 e al successivo decreto direttoriale del 21 giugno 2022, n. 130, di approvazione del progetto *Italian Integrated Environmental Research Infrastructures System (ITINERIS)*, presentato dall'Istituto di Ricerca sugli Ecosistemi Terrestri del Consiglio Nazionale delle Ricerche (CNR) (CNR-IRET);
- 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 e della verifica di ammissibilità da parte del Ministero delle borse di studio attribuite ai sensi del decreto ministeriale n. 118/23;
- visto il proprio decreto n. 9942 del 28 aprile 2023, recante: "Bando di concorso per l'ammissione al corso di Dottorato internazionale in Science presso l'Università Cattolica del Sacro Cuore - XXXIX ciclo – sede di Brescia";



- vista la delibera adottata dal Senato accademico, nell'adunanza del 12 giugno 2023;
- vista la delibera adottata dal Consiglio di amministrazione, nell'adunanza del 21 giugno 2023,

DECRETA

Art. 1

L'attivazione del corso di Dottorato Internazionale in *Science* – XXXIX 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 giugno 2023

IL RETTORE
(Prof. Franco Anelli)

IL DIRETTORE GENERALE
(Dott. Paolo Nusiner)



UNIVERSITÀ
CATTOLICA
del Sacro Cuore



Finanziato
dall'Unione europea
NextGenerationEU

ALLEGATO 1 AL DECRETO RETTORALE N. 10120 DEL 29 GIUGNO 2023

Public competition announcement for the International PhD in Science at Università Cattolica del Sacro Cuore – XXXIX 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-milano>.

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. Scholarships pursuant to Ministerial Decrees n. 118/23 are subjected to verification of eligibility by the Ministry.

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

Duration: 4 years.

Funded Positions: 4

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

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 KU Leuven) on “Multi-functional architectures for the green transition based on 2D materials platforms” - Position with scholarship pursuant to Ministerial Decree 118/23 (CUP J53C23000720001) - under the topic “Transizioni digitali e ambientali”

Background and motivation

Climate change and environmental degradation are a major threat to our lives. Sustainability and green transition represent a way to overcome these global challenges. Among the many aspects that can be addressed by researchers in the field of physics, chemistry and materials engineering, energy conversion represents one of the most promising fields, enabled by the possibility to rapidly prototype novel devices through 2D platforms and green chemistry functionalization. Indeed, the engineering of 2D materials, nanostructures, and multifunctional device architectures is of great importance for energy conversion and also energy storage platforms. Multifunctionality is an added value, as it can enable self-powering of devices, thus further reducing energy consumption.

This project is targeted at the development of novel, multifunctional, 2D platforms for energy conversion. In a surface-to-device approach, the project can be outlined in three steps: (i) choice of the 2D platform and functionalization of surfaces, (ii) exploration of multifunctional properties (iii) device prototyping.

Step (i) relies on the capability to study the morphology, physical properties, and surface reactivity of 2D platforms mainly based on graphene, MoS₂, and MXenes. This part of the study is rooted in extensive use of surface science and microspectroscopy techniques, including X-ray, UV, and laser photoemission, atomic force microscopy, scanning tunneling microscopy and micro-Raman spectroscopy. Step (ii) relies on the capability to test the multi-functional properties of the functionalized 2D platforms. Testing will be carried out to explore the photocatalytic properties, the light conversion through heterojunctions (hybrid solar cells), and novel sensing capabilities. Step (iii) is aimed to prototype and test one of the most promising platforms developed in step (i) and (ii).

The project will be carried out at the Surface Science and Spectroscopy Lab of the Università Cattolica del Sacro Cuore (Brescia Campus, Italy) and, on an equal footing, at the Molecular Imaging and Photonics division of KU Leuven (Belgium).

Profile

Master's degree or comparable qualification in physics, chemistry or materials science and engineering. The title must be obtained before October 31st, 2023.

A strong interest for multidisciplinary research and innovation is required.

Previous experience in surface science, electron or laser spectroscopies, or advanced microscopies is welcome.



Candidates should have a solid background in quantum physics and chemistry at the nanoscale and device development and engineering.

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

Experimental research participating to the international collaboration between Università Cattolica del Sacro Cuore, and KU Leuven with at least one year (and up to two years) spent in both institutions.

Double degree opportunity.

Supervisors

Prof. Luigi Sangaletti, Università Cattolica del Sacro Cuore, Italy,
luigi.sangaletti@unicatt.it;

Prof. Steven De Feyter, KU Leuven, BE, steven.defeyter@kuleuven.be.

No. 1 scholarship (joint research project between Università Cattolica del Sacro Cuore and KU Leuven) on “Modeling and simulations of cardiovascular system in pathological situations” - Position with scholarship pursuant to Ministerial Decree 118/23 (CUP J53C23000710001) - under the topic “Tematiche PNRR”

Background and motivation

Fluid dynamics modeling of blood flow and electrical propagation in myocardial tissue are fields of research widely studied nowadays.

Blood has interesting properties that vary depending on the type of vessel in which it moves. Moreover, its behavior can change deeply in pathological situations, which will be the focus of this project since they are of the utmost interest in clinical practice. Examples of a pathological condition are chronic venous disease (CVD) and coronary artery disease (CAD). CVD occurs very often during aging and affects almost 40% of the total population. CAD is the leading cause of death worldwide. In either of those pathological situations it is often necessary to use a specific drug therapy or in some cases even surgical treatments.

The mechanical contraction of the heart is governed by an electrical stimulus. Describing the trend of this stimulus is very important in pathological situations, such as cardiac arrhythmias that are an important cause of death, e.g. via cardiac arrest or via blood clot formation. Nowadays there is still a lack of comprehension of the dynamics of heart



rhythm disorders, so that a mathematical model of these problems can be very useful to better understand the underlying physiology [1].

The aim of this doctoral project is to define a continuum mechanics model for such pathological conditions. Indeed, the availability of a model can then lead to the study of blood flow patterns and cardiac electrical signals through numerical simulations. Interpretation of the results obtained from the simulations can, for example, be used by clinicians to suggest ways to prevent the degeneration of the disease, drug therapies or surgery.

The main goal of this doctoral project is therefore to build up a mathematical and numerical model of pathological situations for the mutual effect of cardiac arrhythmias and the resulting flow in veins and arteries.

Remaining in the framework of continuum mechanics, the blood can be modeled as a Newtonian or a Non-Newtonian fluid. Great attention will be paid to considering blood viscosity as dependent on hematocrit or other physiological parameters that can be regulated by drug therapy [2]. In order to consider relevant pathological situations (e.g. CVD or CAD), the proposed model will be studied in different geometries and in various scenarios [3].

From a mathematical point of view, cardiac arrhythmias will be described by reaction-diffusion systems where several parameters will take into account pathological conditions.

Several numerical simulations will be done and compared, employing techniques like the finite element method, and integrating when possible relevant clinical data, either patient-specific or available from literature.

The initial part of the project will focus on the fluid dynamics modeling at Università Cattolica del Sacro Cuore in Italy, under the supervision of G. Giantesio and F. Ballarin. Then, the PhD student will also perform research visit(s) with a combined length of minimum 1 year at KU Leuven in Belgium in the arrhythmia modeling group of H. Dierckx. Both disciplines will be integrated in the second half of the project.

References

- [1] R.H. Clayton et al. Models of cardiac tissue electrophysiology: Progress, challenges and open questions, Prog. In Biophysics and Molecular Biology 104 (2011).
- [2] G.P. Galdi, R. Rannacher, A.M. Robertson, S. Turek. Hemodynamical Flows, Birkhauser (2008).
- [3] F. Ballarin et al. Fast simulations of patient-specific haemodynamics of coronary artery bypass grafts based on a POD-Galerkin method and a vascular shape parametrization, J. Comput. Phys 315 (2016).

Profile

Master's degree or comparable qualification in mathematics, engineering, physics or adjacent fields. The Master's degree must be obtained before October 31st, 2023.



A strong interest in multidisciplinary research (mathematical physics, numerical analysis, medicine) is required.

Previous experience in the project's topics (e.g. flow models, nonlinear waves, mathematical modeling of complex phenomena) is 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.

Opportunities

Interdisciplinary research with a potential future medical impact, via the international collaboration between Università Cattolica del Sacro Cuore and KU Leuven, with at least one year spent in both institutions.

Opportunity of a Double PhD degree.

Supervisors

Dr. Giulia Giantesio, Università Cattolica del Sacro Cuore, Italy,
giulia.giantesio@unicatt.it;

Dr. Francesco Ballarin, Università Cattolica del Sacro Cuore, Italy,
francesco.ballarin@unicatt.it;

Dr. Hans Dierckx, KU Leuven, Belgium, h.dierckx@kuleuven.be.

No. 1 scholarship (joint research project between Università Cattolica del Sacro Cuore and KU Leuven) “Characterization of source and sinks of O₃, NO and NO₂ in lowland deciduous forests. Measurements and modeling aspects”, cofounded by Istituto di Ricerca sugli Ecosistemi Terrestri del Consiglio Nazionale delle Ricerche (CNR) (CNR-IRET) as part of the project Italian Integrated Environmental Research Infrastructures System (ITINERIS) – PNRR M4C2

Background and motivation

Ozone (O₃) is a secondary air pollutant that forms in the troposphere because of chemical reactions between nitrogen oxides and volatile organic compounds, favored by solar radiation and high temperatures. It has a strong phytotoxic action and negative consequences on the carbon sequestration capacity of natural ecosystems.

Ozone is deposited on vegetation and transported down in the intra-canopy space to the soil. In tall canopies like forests, turbulence is damped, and the time scale of turbulent O₃ transportation becomes comparable to that of chemical transformations, whose role cannot be neglected. The emission of NO from the forest floor (not yet completely characterized) and the emission of isoprene from the canopy contribute decisively to those chemical transformations. Moreover, in the intra-canopy space, chemistry is strongly



influenced by light and temperature gradients that drive photodissociation and reaction rates.

These processes influence a substantial part of what is defined as non-stomatal deposition which, ultimately, contributes to determining the O₃ concentration at the leaf level and then the dose of O₃ absorbed by the vegetation through the stomata. The phytotoxic O₃ dose is usually calculated using big-leaf monolayer dual sink models, at most distinguished between sunlit and shaded leaves (e.g. DO₃SE model, Emberson et al., 2000). However, doubts were raised about the correct formulation of the intra-canopy transport, which is currently based on parameterizations derived from a single experiment carried out on corn fields (van Pul & Jacob, 1994). Multilayer models try to resolve the intra-canopy turbulent transport from a theoretical point of view through first order closure techniques, but forest measurements or fluid dynamic simulations to assess their reliability are still lacking. The opportunity to move toward multilayer models has been highlighted by some recent publications (Bonan, 2021), pushed also by the fact that the computational effort that these models require is no longer a major limitation.

Whichever type of model is used, the phytotoxic dose is calculated on the amount of O₃ absorbed by the stomata. The latter is determined by the stomatal conductance which, in simplest models, is predicted by a Jarvisian scheme that does not include photosynthesis (Jarvis, 1976). However, there is a close relationship between stomatal conductance and photosynthetic assimilation and some empirical models of conductance, such as the Ball-Berry model (Ball et al. 1987; Collatz et al. 1991), take this dependence into account. This mechanistic representation of the stomatal behavior requires CO₂ demand, CO₂ supply, and water loss to be matched. The CO₂ demand is modeled with the Farquhar scheme for gross photosynthesis (Farquhar et al., 1980); the CO₂ supply is modeled with the Fick's law of diffusion through the stomata, and the water loss is modeled with the equations for evapotranspiration starting from the leaf temperature, which in turn results from the resolution of the energy balance at leaf level.

Finally, in the background, there is the unresolved question of the difficulty in identifying direct signals of O₃ damage to photosynthesis detectable through Net Ecosystem Exchange measurements at the ecosystem level. It would be interesting to investigate and test methodologies to identify the reduction of net CO₂ assimilation directly from gas exchange measurements.

Aims

The PhD project aims at characterizing the sources and sinks of O₃, NO and NO₂ (and isoprene, if possible), and the possible influence of their dynamics on the CO₂ fluxes in one or more lowland deciduous forests of the ICOS infrastructure network (Integrated Carbon Observation System, <https://www.icos-cp.eu>), by means of multi-level concentration measurements above and within the canopy, eddy covariance measurements of turbulent fluxes above and within the canopy, and soil chamber measurements of gas exchange from the forest floor. Measurements will be used to develop single layer and multilayer deposition models that include a description of stomatal and non-stomatal absorption processes and chemical transformation processes as more mechanistic as possible. Application of the models to other forests of the



ICOS network and comparisons of the results in latitudinal/climatic gradients are desirable.

The measurements will be carried out primarily at the ICOS IT-BFt ecosystem station which is specifically equipped for long-term flux measurements and concentration profiles.

The candidate may address and deepen one or more of the open aspects highlighted above.

References

Ball, J. T., Woodrow, I. E., & Berry, J. A. (1987). A model predicting stomatal conductance and its contribution to the control of photosynthesis under different environmental conditions. In *Progress in photosynthesis research: volume 4 proceedings of the VIIth international congress on photosynthesis providence, Rhode Island, USA, august 10–15, 1986* (pp. 221-224). Springer Netherlands

Bonan, G. B., Patton, E. G., Finnigan, J. J., Baldocchi, D. D., & Harman, I. N. (2021). Moving beyond the incorrect but useful paradigm: reevaluating big-leaf and multilayer plant canopies to model biosphere-atmosphere fluxes—a review. *Agricultural and Forest Meteorology*, 306, 108435

Collatz, G. J., Ball, J. T., Grivet, C., & Berry, J. A. (1991). Physiological and environmental regulation of stomatal conductance, photosynthesis and transpiration: a model that includes a laminar boundary layer. *Agricultural and Forest meteorology*, 54(2-4), 107-136

Emberson, L. D., Ashmore, M. R., Cambridge, H. M., Simpson, D., & Tuovinen, J. P. (2000). Modelling stomatal ozone flux across Europe. *Environmental Pollution*, 109(3), 403-413

Farquhar, G. D., von Caemmerer, S. V., & Berry, J. A. (1980). A biochemical model of photosynthetic CO₂ assimilation in leaves of C₃ species. *planta*, 149, 78-90

Jarvis, P. G. (1976). The interpretation of the variations in leaf water potential and stomatal conductance found in canopies in the field. *Philosophical Transactions of the Royal Society of London. B, Biological Sciences*, 273(927), 593-610

Van Pul, W. A. J., & Jacobs, A. F. G. (1994). The conductance of a maize crop and the underlying soil to ozone under various environmental conditions. *Boundary-Layer Meteorology*, 69, 83-99

Profile

Master's degree or comparable qualification in Mathematics, Physics, Biology, Environmental sciences, or adjacent fields. The title must be obtained before October 31st, 2023.

A strong interest for multidisciplinary research is required.

Candidates should have a solid background in computer science, micrometeorology and ecology. Documented experience and skills in instrumental setup, data analysis and programming (i.e. MATLAB) are also 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

Experimental research participating to the international collaboration between Università Cattolica del Sacro Cuore (Italy) and the Katholieke Universiteit of Leuven (Belgium) with at least one year spent in both institutions.

Double degree opportunity.

Supervisors

Prof. Giacomo Alessandro Gerosa Università Cattolica del Sacro Cuore, Italy, giacomo.gerosa@unicatt.it;

Prof. Bart Muys, KU Leuven, Belgium, bart.muys@kuleuven.be;

Dott. Riccardo Marzuoli, Università Cattolica del Sacro Cuore, Italy, riccardo.marzuoli@unicatt.it

No. 1 scholarship (joint research project between Università Cattolica del Sacro Cuore and Notre Dame du Lac, Indiana, USA) on “Transition metal oxides photoelectrodes for hydrogen production: the challenge of nanogranular materials” funded by Università Cattolica del Sacro Cuore – MUR PRIN 2022, prot. 2022474YE8_001 “Supersonic Cluster beam synthesis of Innovative TRansition metal Oxides PHotoelectrodes for HYdrogen production (SCI-TROPHY)”

Background and motivation

Devices converting renewable energies to fuels such as H₂ may be based on photoelectrochemical water splitting: electron/hole pairs generated at two photoelectrodes (PE) drive the half-reactions producing H₂ and O₂. However, scant efficiency, photocorrosion and instability affects the state of the art PE made of ternary metal oxides (TMOs) like CuFe₂O₄. Such limitations are ascribed to *the low charge transfer* induced by the small polarons due to the TMO hybrid valence band orbitals, and to *the high recombination rate of charge carriers* at the TMO surface and bulk states. Moreover, current PE lacks a comprehensive investigation of different TMO phases, stoichiometries and transport properties for sizes below 50 nm. The project strategy is to overcome the current limits by: 1) *reducing the TMO sizes* by producing PE of ZnFe₂O₄ and BiFeO₃ with a *nanogranular morphology (NG-TMO) at scales below 50 nm* by supersonic cluster beam deposition (SCBD); 2) *determining the PE morphological, optical and electrochemical behavior* for two different NG-TMO compounds; 3) *determining the PE transport behavior* from the reaction kinetic constants (k_t for the



hopping process and k_r for recombination process), as a function of TMO selected stoichiometries, phases and sizes.

The expected project breakthroughs are: 1) a new class of nanostructured PE for electrochemistry, NG-TMOs; 2) morphological, optical and stoichiometric properties correlation with PE thickness and annealing temperature; 3) Electrochemical properties correlation with the PE thickness and annealing temperature; 4) charge transport correlation with morphology, optical response, stoichiometry; 5) reveal the role of small polarons and surface recombination in NG-TMOs at scales below 50 nm.

The student will be tutored by three experienced tutors at the Università Cattolica del Sacro Cuore (UCSC) for the PE synthesis and physical properties characterization, at the University of Padova (UPD) and University of Notre Dame (ND) for the PE electrochemical characterizations.

Profile

Master's degree or comparable qualification in Physics, Chemistry, Material Science or adjacent fields. The title must be obtained before October 31st, 2023;

Previous experience in characterization or synthesis of nanostructured materials is a plus;

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

Experimental research participating to the international collaboration between Università Cattolica del Sacro Cuore, Notre Dame du Lac, Indiana (USA) and University of Padova, with at least one year spent in Notre Dame di Lac;

Double degree opportunity.

Supervisors

Prof. Luca Gavioli, Università Cattolica del Sacro Cuore, Italy, luca.gavioli@unicatt.it;

Prof. Prashant V. Kamat, Notre Dame du Lac, Indiana (USA), pkamat@nd.edu;

Prof. Gian Andrea Rizzi, University of Padova, Italy, gianandrea.rizzi@unipd.it.

Art. 2

Scholarships according to Ministerial Decree 118/23

Funded positions, according to Italian Ministerial Decree 118/23 and financed by the National Recovery and Resilience Plan (PNRR), are also foreseen within the present Call.



The availability of the mentioned scholarships covers the following areas:

- Italian Ministerial Decree 118/23: scholarships finalized to the research development on digital and green transition; on PNRR's specific themes (digitalization, innovation, competitiveness, culture e tourism; green revolution and ecological transition; sustainable mobility; education and research; inclusion and cohesion; health), on Public Administration issues, on cultural heritage themes;

PhD candidates resulting holders of a scholarship according to Italian Ministerial Decree 118/23, shall:

- Spend a study period within a firm or a research centre, from a minimum of 6 up to 18 months (this is not compulsory for candidates dealing with research positions on PNRR issues, according to Italian Ministerial Decree 118/23, art. 7);
- Spend a study period abroad, for a total period not exceeding 12 months, during the the PhD programme. The period may be extended up to a maximum of 18 months pursuant to Art. 9, para. 3 of Italian Ministerial Decree 226/21.

Art. 3

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. 4

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, 2023. 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, 2023, 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. 5

Application form

Candidates who intend to participate in the competition must submit an application to the Rector of Università Cattolica del Sacro Cuore by **September 4th, 2023**.

The application form is available at <https://dottorati.unicatt.it/concorsi> until 12 a.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 (if obtained in Italy), 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. 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.

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/examination-board>

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/results>

Art. 7

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/results>

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. 8

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/>

To obtain a visa, applicants, after completing the registration procedure, must register on the following website: www.universitaly.it and follow the indicated procedure.



Art. 9

Scholarships and contributions

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.

Scholarships are awarded for one year and are renewed on condition that the PhD student has completed the programme of activities planned 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. 10

Public employees

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

Art. 11

Rights and duties of PhD students

PhD students are required to regularly follow the activities envisaged for their training and to devote themselves with full commitment to individual and guided study programmes and to carrying out the research activities assigned by the Board of Professors. PhD students are also required to read the Code of Ethics of Università Cattolica and to



respect its principles and aims.

Art. 12

Public disclosure

This public announcement is published on the website of Università Cattolica del Sacro Cuore at <https://dottorati.unicatt.it/concorsi> on the Euraxess European website and on the Ministry of Universities and Research website.

Art. 13

Final provisions

For all matters not expressly provided for in this notice, the provisions of Rector's Decree No. 8347 of 16 February 2022 shall apply: "Amendments to the 'Regulations for PhD programmes and PhD schools at Università Cattolica del Sacro Cuore'" and current regulations.

The person in charge of the procedure for this call for applications is Dr Roberto BRAMBILLA, Director of Postgraduate Education and Research Partnership, Via Carducci 28/30, Milan (Italy).

