UNIVERSITÀ CATTOLICA del Sacro Cuore

DECRETO RETTORALE N. 9942

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 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»;

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 – XXXIX ciclo";

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 Catolica 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;

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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*";

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;

vista la delibera adottata dal Senato accademico, nell'adunanza del 17 aprile 2023;

vista la delibera adottata dal Consiglio di amministrazione, nell'adunanza del 27 aprile 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 Catolica 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.

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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, 28 aprile 2023

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

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

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ALLEGATO 1

Call for applications 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 subject to verification of eligibility by the Ministry.

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

Duration: 4 years.

Positions:
Funded positions: 3

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 University of Notre Dame, Indiana - United States of America) on "A common mechanism to Cooperative Effects in Many Body Quantum Systems".

Background and motivation

Cooperative quantum effects emerge from the interaction between the constituents of a system and they are often connected to important functional aspects. It has been proved their robustness to noise and for this reason they might be essential to develop quantum devices able to work at room temperature. There are many examples of cooperative effects in condensed matter physics such as superconductivity, superradiance, plasmon excitation and giant resonances in nuclei. Therefore one guess a common mechanics underlying them all, as was pointed out by U. Fano (Rev. Mod. Phys. 64, 1992). For instance, the superconducting gap in ultra-small metallic nanoparticles is mathematically equivalent to the superradiant gap in an ensemble of two-level systems.

One of the fundamental aspects which leads to collective phenomena is the presence of long-range interactions between the constituents of a system. Indeed, long-range forces can induce extended coherent states separated from the rest of the spectrum by an energy gap. Such a gap is the main responsible for the robustness of these coherent states. Long-range forces can be due to Coulomb interactions, as in the case of plasmons excitation, or they can be originated by the common interaction with a single mode of an external environment. For instance, in the case of superconductivity the phonon mediates an attractive interaction between the electrons (which is long ranged in momentum space), or in the case of superradiance where the interaction is mediated by the electromagnetic field. Engineering the external environment allows us to control the nature of the long-range forces, and thus the collective effects induced by them. This is what has been recently achieved in ion traps (P.Richerme et al, Nature, 511, 198, 2014) or in superconducting qubits in an open one-dimensional transmission line (AF Van Loo et al, Science 342, 1494, 2013). This Ph.D. project will follow different directions: (i) to deepen the understanding of a common theoretical framework able to explain the emergence of cooperative phenomena in many body systems, such as many excitation superradiance and superconductivity. In particular following previous results [NC Chávez et al., Eur. Phys. Jour. B 92, 1-12 (2019)] we would like to study the connections between superconductivity and superradiance. This will allow us to understand the general conditions for the emergence of robust cooperative quantum effects; (ii) to consider the interplay of cooperativity and noise in realistic systems relevant for quantum transport and out-of-equilibrium dynamics in many-body systems. Superradiance has been recently discovered in perovskites superlattices [G. Rainò et al, Nature, 2018 563, 671]. Under small fluence an interpretation of the experimental results was given by our group in [F.Mattiotti et al, Nano Lett. 2020, 20 7382]. On the other hand, for large fluence, and thus for many excitations present in the system, a coherent theoretical framework has still to be developed. In this project we would like to pursue precisely this line of research in collaboration with the theoretical (B. Janko) and experimental (M. Kuno) groups at the Univ. of Notre Dame. (iii) Another interesting application of many body cooperative effects is in the framework of cavity physics. In this context hybrid light matter states, called polaritonic states, can be created. It has been demonstrated experimentally that polaritons can undergo a BEC transition [J.Littlewood, Physics Today 63, 8, 42 (2010)], forming a condensate. It would be very interesting to investigate the possibility of having a BEC-BCS transition for polaritons. This could help to create a superconductor for excitons, which might be very relevant for ENERGY science applications and Quantum Information Processing

Candidate Profile

- Master's degree or comparable qualification in Physics or adjacent fields. The title must be obtained before October 31st, 2023;
- A strong interest for collaboration with experimental groups is greatly appreciated;
- Previous experience in Numerical Simulations and Data Presentation is strongly required;
- Candidates should have a solid theoretical background in Quantum and Statistical Mechanics;
- 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

- Participation in the international collaboration between Università Cattolica del Sacro Cuore (Brescia Italy) and the University of Notre Dame University of Notre Dame, Indiana - United States of America) with at least one year spent in both institutions;
- Double degree opportunity;
- Further collaborations with prof. Giuseppe Luca Celardo (Università degli Studi di Firenze, Italy) and prof. Masaru Kuno (Dept of Chemistry, University of Notre Dame, Indiana - United States of America).

Supervisors

- Prof. Fausto Borgonovi Università Cattolica del Sacro Cuore, Italy (fausto.borgonovi@unicatt.it);
- Prof. Boldizsar Janko University of Notre Dame, Indiana - United States of America), (bjanko@nd.edu).

No. 1 scholarship (joint research project between Università Cattolica del Sacro Cuore and KU Leuven) on "Quantum protocols for super-efficient solar cells based on layered semiconductors" - Position with scholarship pursuant to Ministerial Decree 118/23 - under the topic "Tematiche PNRR" – CUP: J53C23000710001

Background and motivation

Despite the immense research and development effort of the last decades, the energy conversion efficiency of state-of-art solar cells remains intrinsically hampered to the Shockley-Queisser classical limit of 32%. This limit is due to thermalization processes, i.e. internal losses of the adsorbed photon energy in excess of the band gap of the light-harvesting material. Upon inspiration from quantum-coherence-enhanced photosynthesis in Nature, the possibility of a quantum-based operation of solar cells has been recently envisioned as a strategy to overcome such limitation of the classical physics.

This PhD project intends to take this challenge by directly addressing the fundamental

processes governing the coherent to incoherent crossover in the exciton dynamics of layered semiconductors with the ultimate purpose to realize super-efficient solar cell.
Layered semiconductors are nowadays at the forefront of research for their peculiar and tunable optoelectronic properties which stem from a combination of the reduced dimensionality and the efficient light absorption. The photophysics of these materials is governed by formation of strongly bound excitons that are stable up to room temperature and whose decoherence and depopulation dynamics are dictated by competing processes occurring at different timescales. A universal feature is the occurrence of an initial coherent regime determined by the laser-induced macroscopic polarization, rapidly followed by an incoherent regime, where excitons relax toward an incoherent admixture of bound electron-hole pairs.
The goal of this doctoral project is to unravel the microscopic mechanisms governing the exciton dynamics along the crossover between the two regimes which typically evolves on a femtosecond timescale.
To achieve these goals, experimental techniques sensitive to both decoherence and depopulation dynamics of the photoexcited states are required. Here, we choose a combination of transient optical spectroscopy and interferometric time-resolved multi-photon photoemission spectroscopy (inter-tr-mPPE) to attain a complementary view on the ultrafast quasi-particle relaxation dynamics, the coherence of optical excitation and its dephasing in the time and energy domain.
The chosen materials family is formed by metal iodide semiconductors which provide an ideal platform for investigating exciton dynamics. Due to their low dimensionality, these materials show a well-defined exciton line in the infrared-visible regime, corresponding to an exciton binding energy of hundreds of meV. Moreover, the absence of structural or electronic phase transitions in these materials helps the straightforward investigation of the bare exciton formation and the role of the environment such as lattice vibrations, defects, and the presence of excited free carriers on the exciton dynamics.
Much of the initial experimental efforts of the project will focus on the implementation of the inter-tr-mPPE experimental setup available at Università Cattolica del Sacro Cuore and the grow and characterization of the samples exploiting the facility at KU Leuven.
The prjoect subject falls within the goals of the Programma Nazionale della Ricerca 2021-2027, see par. 5.4.5 Tecnologie quantistiche, Articolazione 4, pg. 107 (https://www.mur.gov.it/sites/default/files/2021-01/Pnr2021-27.pdf)

Candidate Profile

- Master's degree or similar qualification in Physics, Materials Science, Chemistry or adjacent fields. The title must be obtained before October 31st, 2023;
- A solid background in physics, materials science or materials chemistry is required;
- Experience with femtosecond laser systems and in time resolved spectroscopies (pump-probe set up), and in home-built instrumentation 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.

Opportunities

- Experimental research participating to the international collaboration between research groups KU Leuven and Italy, with at least one year spent in both institutions;
- Double degree opportunity.

Supervisors:

- Prof.ssa Stefania Pagliara, Università Cattolica del Sacro Cuore (Italy) (stefania.pagliara@unicatt.it);
- Prof. Jin Won Seo, KU Leuven (Belgium) (maria.seo@kuleuven.be);
- Dott.ssa Selene Mor, Università Cattolica del Sacro Cuore (Italy) (selene.mor@unicatt.it).

No. 1 scholarship (joint research project between Università Cattolica del Sacro Cuore and KU Leuven) on "Cooperative electronic dynamics in high-Tc superconductors and corundum heterostructures" funded by Università Cattolica del Sacro Cuore – MUR PRIN 2020, prot. 2020JLZ52N_003, CUP J55F21004280008, Light-matter interactions and the collective behavior of quantum 2D materials (Q-Lima)

Background and motivation

Cooperative effects induced by light-matter interactions have been studied for decades. These studies have focused on atomic and molecular systems and have led to spectacular experimental findings in the realm of cavity quantum-electrodynamics (QED). In standard cavity-QED, direct interactions between matter constituents are often weak and can be neglected. In this case, collective effects are solely due to effective interactions, which emerge from the microscopic interactions between matter constituents and a common cavity mode. Recent experimental advances have made it possible to monolithically integrate graphene and other low-dimensional materials, such as transition metal dichalcogenides (TMDs) or 2D oxides, with optical microcavities, paving the way for fundamental studies of cavity QED at the nanometer scale with 2D materials as the active medium.

On the other hand, the coherent interaction between light and matter can be enhanced by strong driving with coherent ultrashort light pulses. Tailored excitation schemes can lead to Floquet engineering of the electronic bandstruture or the coherent manipulation of solid-solid transitions. One of the most exciting research direction is the development of protocols to coherently manipulate the superconducting phase in high-temperature superconductors, such as copper oxides, or to coherently control the electron dynamics in oxide heterostructures.

The aim of this project is to address the possibility of using ultrashort resonant light-pulses to selectively enhance the coherence of specific electronic states that are responsible for the emergence of macroscopic quantum phases. The first platform that will be investigated is constituted by copper oxide superconductor, in which the interplay between high-energy charge-transfer optical excitations and the onset of unconventional superconductivity is well known. We will address how the formation of the superconducting condensate affects the decoherence time of charge-transfer excitations.

We will investigate the possibility of coherently manipulating the electronic excitations to modify the condensate. As a second step we will investigate collective and coherent electron dynamics in heterostructures constituted by layers of corundum materials, such as Al2O3, Cr2O3, V2O3, Fe2O3, Ga2O3, in which the electronic, optical and magnetic properties can be engineered by proper heterostructuring.
The PhD student will develop a coherent 2-dimensional electron spectroscopy (2DES) experiment to investigate the decoherence dynamics of optical and electronic excitations in nanostructured correlated materials. 2DES measures the third-order material coherent polarization by exploiting two coherent phase-locked pulses acting as a pump, and a third pulse acting as a probe, allowing for simultaneous resolution of excitation and detection frequency axes with fs temporal resolution. 2DES thus allows to investigate not only the population relaxation time, but directly the decoherence time of relevant modes. 2DES will be used to probe the decoherence dynamics of charge-transfer excitations in superconducting copper oxides. In particular, we will look for signatures of modification of the intrinsic decoherence dynamics driven by: i) the formation of the superconducting condensate; ii) the coupling with the coherent laser field. Similar experiments will be performed on corundum heterostructures.
A crucial challenge is related to the sample dimensions, which command spatial resolution, mandatory to perform 2DES on micrometer-sized samples, possibly embedded in cavities. Much of the initial experimental efforts will focus on the implementation of a microscopy measurement scheme, to be coupled to state-of-the-art 2DES setups available at Università Cattolica del Sacro Cuore, providing few-micron spatial resolution while retaining the intrinsic temporal resolution (10-20 fs).

Candidate profile

- Master's degree or comparable qualification in physics, materials science or adjacent fields. The title must be obtained before October 31st, 2023;
- A strong interest for multidisciplinary research is required;
- Previous experience in ultrafast science, solid state spectroscopies, coherent radiation/matter interaction, cavity-embedded devices 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

- The PhD will join the ultrafast dynamics group, led by Prof. Claudio Giannetti, and will have full access to the research facilities of the ILAMP research center, located in the new Mompiano Campus in Brescia;
- The researcher will take part to a joint experimental/theoretical effort to tackle the control of coherent dynamics in condensed matter by using different multidisciplinary platforms. The network includes Prof. J-P Locquet and M. Houssa (KU Leuven), Prof. Marco Polini (theory of collective phenomena in 2D materials, Università degli Studi di Pisa), Prof. Massimo Capone (theory of correlated materials, SISSA Scuola Internazionale Superiore di Studi Avanzati - Trieste), Prof. Fulvio Parmigiani (quantum materials, Università degli Studi di Trieste);

- The PhD will spend approximately 1 year (out of 4) at KU Leuven. At the end of the program the PhD student will be awarded a degree from both Università Cattolica del Sacro Cuore and KU Leuven (double-degree).

Supervisors:

- Prof. Claudio Giannetti, Università Cattolica del Sacro Cuore, Italy, (claudio.giannetti@unicatt.it);
- Prof. Jean Pierre Locquet, KU Leuven, Belgium, (jeanpierre.locquet@kuleuven.be).

Art. 2
Scholarships according to Ministerial Decree 118/23

Further funded positions, according to Ministerial Decree 118/23 and financed by the National Recovery and Resilience Plan (PNRR) (Programma Nazionale di Ripresa e Resilienza - PNRR), are also foreseen within the present Call.

The availability of the mentioned scholarships covers the following areas:

- 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 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 Ministerial Decree 118/23, art. 7);
- Spend a study period abroad, from a minimum of 6 up to 18 months.

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 **June 30th, 2023**.

The application form is available at http://dottorati.unicatt.it/concorsi-milano until 2 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. 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 http://dottorati.unicatt.it/concorsi-milano
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 http://dottorati.unicatt.it/concorsi-milano

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 http://dottorati.unicatt.it/concorsi-milano

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/

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 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. 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
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. 12
Conferment of PhD degree

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

Art. 13
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. 14
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 Catolica de Chile Santiago (Chile) e l'University of Notre Dame du Lac - Notre Dame, Indiana* (USA), – ciclo XXXIX

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;
- Dott. 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. Alejandro CABRERA, Pontificia Università del Cile (CILE);
- 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 ELSEN, Università Cattolica di Lovanio (BELGIO);
- Prof. Mario FAVRE, Pontificia Università del Cile (CILE);
- Prof. Bejamin GORISSEN, Università Cattolica di Lovanio (BELGIO);
- 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 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);
- Dott. Luca DE TRIZIO, Istituto Italiano di Tecnologia IIT, Genova.