

DOCTORAL PROGRAMME IN CHEMICAL SCIENCES

Director prof. Anna Maria Papini

XL cycle – academic year 2024/2025

SCIENTIFIC AREA	
ADMINISTRATIVE OFFICE	Department of Chemistry “Ugo Schiff” (DICUS)
WEB	www.dottoratoscienzechimiche.unifi.it
CURRICULA	<ol style="list-style-type: none">1. Chemistry2. Science for the Conservation of Cultural Heritage
POSITIONS AVAILABLE: 13 Positions with Scholarship: 13 Positions without Scholarship: <i>not available</i>	
RANKING LIST FOR STANDARD POSITIONS SCHOLARSHIPS AVAILABLE: 1	Department of Chemistry “Ugo Schiff” (DICUS) - Progetto Ministeriale “Dipartimenti di Eccellenza 2023-2027” 58503_DIPECC_23_27 C.U.P. B97G22000740001 https://www.chim.unifi.it/vp-673-dipartimento-di-eccellenza-2023-2027.html
RANKING LISTS FOR POSITIONS WITH SPECIFIC RESEARCH TOPICS SCHOLARSHIPS AVAILABLE: 12	<ol style="list-style-type: none">1 - Department of Chemistry “Ugo Schiff” (DICUS) Thematic: “Study of the magnetic anisotropy of metal complexes using ab initio methodologies.” Project description: The PhD student must study the magnetic and spectroscopic properties of transition metal and lanthanide complexes via ab initio methodologies. The candidate must also reproduce the interaction between electric fields and the magnetic properties (spin electric effect). Supervisor: prof. Mauro Perfetti Funded by PERFETTI_ERC_ELECTRA - Electrically Controlled Magnetic Anisotropy CUP B95F22000160006 Progetto UE Horizon Europe1 - Cofunded by University of Florence and CNR/ICCOM - Consiglio Nazionale delle Ricerche - Istituto di Chimica dei Composti OrganoMetallici Thematic: “Synthesis of Organic and Hybrid Organic-Inorganic Functional Materials for Heterogeneous Catalysis, Gas Storage and Molecular Sensing.” Project description: Synthesis and characterization of organic (Covalent Triazine Frameworks) and hybrid organic-inorganic (Metal-Organic Frameworks) porous materials for applications in the field of heterogeneous catalysis and electrocatalysis aimed at the activation/conversion of small molecules (O₂, CO₂, H₂O, N₂), to the physical storage of molecules of environmental (CO₂, NO_x, CFCs) or energetic (H₂)

relevance as well as luminescent sensing of wastewater pollutants (POPs, PFAS, VOCs).
Supervisor: prof. Giuliano Giambastiani. **Co-supervisors:** dr. Giulia Tuci and dr. Andrea Rossin

10 – Cofunded by University of Florence and Department of Chemistry “Ugo Schiff” (DICUS)

Thematic 1: “Study of the magnetic properties of metal complexes.”

Project description: The PhD student will study the magnetic and spectroscopic properties of transition metal and lanthanide complexes via experimental techniques such as EPR and magnetometry. The candidate must also study and model the interaction between electric fields and the magnetic properties (spin electric effect).

Supervisor: prof. Mauro Perfetti

Cofunded by PERFETTI_ERC_ELECTRA - Electrically Controlled Magnetic Anisotropy CUP B95F22000160006 Progetto UE Horizon Europe

Thematic 2: “Circular economy and sustainable development in plastics and end-of-life biomass, including waste and industrial biowaste.”

Project description: Circular economy and sustainable development in plastics and end-of-life biomass, including waste. The project will apply and develop thermochemical or chemical conversion reactions of residual biomass and of end-of-life plastics. The resulting products will be solid, liquid and gaseous, stockable, transportable and usable as clean energy sources or as a source of chemical products for the chemical industry or for the synthesis of molecules of interest in food, cosmeceutical or nutraceutical.

Supervisor: prof. Luca Rosi

Cofunded by ROSI-CRF-RICERCATORIAFIRENZE - A Second life for waste plastics and residual biomasses Economia circolare e sviluppo sostenibile nel settore delle materie plastiche a fine vita e delle biomasse residuali CUP B99J21021900007 finanziato da Fondazione Cassa di Risparmio Firenze

Thematic 3: “Study of electrodeposited or vapor phase deposited (PVD) metals in the technological, energy and Made in Italy fields.”

Project description: The research will be in the sector of electrodeposition and vapor phase deposition of alloys and metals and their morphological, compositional and structural characterization with Microscopic and Spectroscopic methods. Also important will be the study of catalysts in the field of fuel cells and hydrogen production and the verification of the corrosion resistance of metal multilayers obtained in the Made in Italy field, from fashion accessories to furniture components.

Supervisor: prof. Massimo Innocenti

Cofunded by INNOCENTI-3M

Thematic 4: “Paramagnetic complexes for optical and chirality-induced spin polarization.”

Project description: The PhD student will operate in the frame of the ERC Project "Chirality and spin selectivity in electron transfer processes: from quantum detection to quantum enabled technologies" by synthesizing and investigating mono- and polynuclear paramagnetic complexes of interest for quantum technologies. The focus will be on integrating the paramagnetic centers in photo-active molecular structures to realize an efficient mechanism for photo-induced spin polarization.

Supervisor: prof. Roberta Sessoli

Cofunded by SESSOLI_ERC-2022-SYG_CASTLE - Chirality and spin selectivity in electron transfer processes: from quantum detection to quantum enabled technologies CUP B97G21000120006 Project EU Horizon Europe

Thematic 5: “Molecular recognition of Fusobacterium envelope components by Siglecs.”

Project description: The project proposes a multidisciplinary approach aimed at elucidating the mechanisms by which *Fusobacterium nucleatum* avoids or modulates the host immune response and the role of siglec proteins in this process. The research will combine NMR spectroscopy, computational methodologies, and other biophysical techniques.

Supervisor: prof. Marco Fragai

Cofunded by PRIN2022_FRAGAI - Molecular recognition of *Fusobacterium* envelope glycans by Siglecs – GLYDOME CUP B53D23015790006 FRAGAI_GSK_2022 CUP B97G22000470007

Thematic 6: “Materials from renewable sources: production and functionalization of nanostructured materials and their applications.”

Project description: The project aims to use renewable materials (cellulose and saccharide polymers) to create new nanostructured composites for biomedical applications. The research activity will focus on material functionalization to develop surfaces with modulable chemical-physical properties, advanced drug delivery systems and 3D-printed devices.

Supervisor: prof. Stefano Cicchi

Cofunded by 1) CICCHI_ITALFIMET_2024 ITALFIMET_CICCHI_2023 CUP B97G22000730007; 2) RICHICHLIBERALITA19 and 3) CSGI (Consorzio Interuniversitario per lo sviluppo dei Sistemi a Grande Interfase)

Thematic 7: “Design and synthesis of modified peptides of SARS CoV-2 Spike protein to characterize the immune response.”

Project description: The PhD student will be involved in the design by bioinformatic approaches and the development of synthetic modified peptides to evaluate the persistence and magnitude of adaptive immune response to anti-SARS-CoV-2 vaccine, including the assessment of cross-reactions to virus variants, in healthy children and in immunocompromised paediatric and adult patients to evaluate the implications for innovative vaccination strategies.

Supervisor: prof. Anna Maria Papini

Cofunded by RF_2021_SARSCOV2_PAPINI - Persistence and magnitude of adaptive immune response to anti-SARS-CoV-2 vaccine, including assessment of cross reaction to virus variants, in healthy children and in immunocompromised paediatric and adult patients: implication for vaccination strategy - Research Type: a) Theory-enhancing - Project Type: Progetti ordinari di Ricerca Finalizzata - Project Code: RF-2021-12374177 CUP: B95E22000780001 Applicant institution: Regione Toscana - Ente finanziatore: Ministero della Salute.

Thematic 8: “Discovering the SEcret woRld of pOlyseroTONin for green molecular ImprINting and its application in bioanalytics (SEROTONIN).”

Project description: Investigating serotonin (SE) as a molecularly imprinted biopolymer (MIBP) for a future generation of green and mimetic receptors for Abs-free (bio)assays. SE spontaneously polymerizes while embedding a peptide template in the network, leading to adherent nanofilms acting as affinity binders. Surface Plasmon Resonance and Long Period Fiber Gratings will be used for characterization and validation. Machine Learning will be applied to develop an ex-ante selection method of the peptide templates.

Supervisor: prof. Simona Scarano

Cofunded by “Ministero dell'Università e della Ricerca” PRIN2022_PNRR_SCARANO - Discovering the SEcret woRld of pOlyseroTONin for green molecular ImprINting and its application in bioanalytics (SEROTONIN) CUP B53D23025250001 and SCARASIR2015 - Early diagnosis of acute myocardial infarction by nanosensing: coupling emerging bioreceptors for Troponin T to Localized Surface Plasmon

	<p>Resonance (LSPR) for a high sensitive point-of-care testing CUP B12I15001040008.</p> <p>Thematic 9: “Realization of smart control systems to determine the freshness of fish and seafood.”</p> <p>Project description: In recent years, with the rapid development of the fishing and aquaculture industries, the consumption of fish products has increased. However, incidents of seafood poisoning have become increasingly frequent, causing serious damage to the health of consumers. The project will involve the development of intelligent control systems for monitoring quality throughout the supply chain that threatens aquaculture, the fishing industry and consumers.</p> <p>Supervisor: prof. Giovanna Marrazza</p> <p>Cofunded by MARRAZZA_FlpSHEUTRUST_2022 Programma Horizon Europe - Cluster 6 Food, Bioeconomy, Natural Resources, Agriculture and Environment CUP B53C22001690006 Progetto UE Horizon Europe</p> <p>Thematic 10: “Circular and sustainable Made-in-Italy: synthesis of nitrogen-containing glycomimetics from biomass for eco-design strategies.”</p> <p>Project description: The project involves the use of carbohydrates and other chiral derivatives from biomass (e.g. D-mannose, D-glucose, D-arabinose, levoglucosenone, (+)- e (-)-limonene, gallic acid), to obtain high added value nitrogen-containing compounds, known for their biological activity. The new nitrogen-containing glycomimetics, accessed through green reactions, will be evaluated as antibacterial and antifungal agents for applications in textile from an eco-design perspective.</p> <p>Supervisor: dr. Camilla Matassini</p> <p>Cofunded by 1) PNRR_PE11_PHD Progetto PE11 - Made-in-Italy circolare e sostenibile - Piano Nazionale di Ripresa e Resilienza, Missione 4 Componente 2 - Investimento 1.3 - Partenariati estesi - finanziato dall’Unione europea - NextGenerationEU CUP: B83C22004890007; 2) MARRADIETRUSCA19</p>
<p>STUDY/RESEARCH PERIODS ABROAD</p>	<p>3-6 months</p>
<p>DOCUMENTS REQUIRED FOR THE ADMISSION (under penalty of exclusion)</p>	<ul style="list-style-type: none"> ● Copy of the Identification Document ● Self-declaration for qualifications obtained in Italy (laurea Triennale, Specialistica o Magistrale o ciclo unico) with a list of all exams taken and their marks, title of the thesis and graduation mark (download the form here, make sure you fill in all the fields) ● Qualifications obtained abroad (Bachelor’s and Master Degrees or combined cycle Degree) with a list of all exams taken, number of credits, and their marks, title of the thesis and graduation mark. <p><i>The same documentation except for the final mark must be submitted by those who will graduate within the 31/10/2024</i></p>
<p>DOCUMENTS REQUIRED FOR THE EVALUATION</p>	<p>MANDATORY</p> <ul style="list-style-type: none"> ● Curriculum vitae et studiorum including a typewritten self-declaration for each qualification obtained (bachelor and master, or combined cycle degree) reporting the date of first enrollment, exams passed with number of credits, weighted and arithmetic average of the marks ● One Research project for EACH fellowship the candidate shall compete (each one shall be congruent to each specific thematic (up to 13 projects) ● Title and extended abstract of the M.Sc. thesis (maximum five A4 sheets)

	<p>OPTIONAL</p> <ul style="list-style-type: none"> ● List of scientific publications ● List of qualification documents including periods spent abroad for study or research mobilities ● Up to a maximum of two reference letters 															
RESEARCH PROJECTS	<p>Each research project shall be written in English in no more than 12,000 characters including spaces, including abstract (no more than 500 characters including spaces), introduction and references, in order to assess the applicant's aptitude to research.</p> <p>The candidate can apply for several rankings by submitting a specific research project for each ranking (clearly state the reference to the chosen thematic).</p>															
INTERVIEW MODE	<p>In person (In the application form candidates may ask to conduct the interview remotely)</p> <p>The interview can be conducted in the English language. If it is presented in Italian, the interview shall include an assessment of English language proficiency.</p>															
EVALUATION MARKS	<table border="1"> <thead> <tr> <th>parameter</th> <th>minimum score</th> <th>maximum score</th> </tr> </thead> <tbody> <tr> <td>Curriculum vitae et studiorum, research project, publications, other qualification documents</td> <td>40/120</td> <td>60/120</td> </tr> <tr> <td colspan="3">Applicants who obtain a mark of at least 40/120 in the evaluation of the above parameters will be admitted to the interview</td> </tr> <tr> <td>Interview: discussion of the research project, publications and qualification documents</td> <td>40/120</td> <td>60/120</td> </tr> <tr> <td colspan="3" style="text-align: center;">Eligibility is achieved with a minimum score of 80/120</td> </tr> </tbody> </table>	parameter	minimum score	maximum score	Curriculum vitae et studiorum, research project, publications, other qualification documents	40/120	60/120	Applicants who obtain a mark of at least 40/120 in the evaluation of the above parameters will be admitted to the interview			Interview: discussion of the research project, publications and qualification documents	40/120	60/120	Eligibility is achieved with a minimum score of 80/120		
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FURTHER INFORMATION ON THE EXAMINATION	<p>The interview will be focused on each research project. The discussion with the committee members will be based on the scientific background of the candidate also in the field of the research performed for the Bachelor and Master thesis or for equivalent titles. Each research project must be presented by maximum 8 slides. Moreover the candidate can present 1 slide to introduce the CV.</p>															

EXAMINATION SCHEDULE			
	DATE	TIME	PLACE
INTERVIEW	July 11 th , 2024	08:30 a.m.	Biblioteca "Parrini" Via della Lastruccia, 13 Sesto Fiorentino (FI)
<p>The list of candidates admitted to the interview and the final ranking will be published at the following web page: https://www.unifi.it/p12593</p>			