Universidad Autónoma de Madrid

UAM-CSC AGREEMENT

LIST OF 4-YEARS' PhD PROPOSALS

FACULTY OF ECONOMICS

Proposal number 1	
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web	
https://www.uam.es/economicas/facultad/departamentos/contabilidad/antonini-morales-carla	
Title of the proposal	
The use of new technologies in Sustainability Accounting: Enhancing Transparency, Accountability and Corporate Reporting?"	
Abstract	
The integration of new technologies into sustainability accounting is transforming how organizations measure, manage, and communicate their environmental, social, and governance (ESG) performance. This research examines the role of artificial intelligence in enhancing or obscuring transparency, accountability, and the quality of corporate sustainability reporting. It explores how this technology that is expected to improve data accuracy, traceability, comparability, and the reliability of sustainability information not necessarily is accomplishing the goal. Furthermore, the study considers the challenges associated with technological adoption, including data privacy, algorithmic bias, digital governance, and the lack of standardized reporting frameworks. By examining the opportunities and limitations of technology-driven sustainability accounting, this research aims to contribute to a deeper understanding of how digital innovation can support more credible, consistent, and accountable corporate sustainability disclosure.	

Proposal number 2	
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web	
https://www.uam.es/uam/investigacion/grupos-de-investigacion/detalle/f1-611 and https://portalinvestigacion.umh.es/investigadores/2182226/detalle	
Title of the proposal	
Economic Analysis of Novel Synthetic Molecules for Antiangiogenic Therapy	
Abstract	
Antiangiogenic therapy is a cornerstone in the treatment of solid tumors and neovascular diseases, yet its high cost and variable clinical benefit raise concerns about economic sustainability. This project will conduct an economic evaluation of novel synthetic molecules designed to inhibit pathological angiogenesis, comparing	

them with current standard-of-care agents such as monoclonal antibodies and tyrosine kinase inhibitors. Using decision-analytic models (Markov and partitioned survival), we will estimate incremental costs, quality-adjusted life years, and cost-effectiveness ratios across clinical scenarios. Early health technology assessment methods will identify key value drivers and the thresholds at which these compounds could become cost-effective, while probabilistic and scenario-based sensitivity analyses will address the uncertainty of preclinical data. The study will be carried out in collaboration with the projects of emerging research groups working on the design, synthesis, and preclinical validation of these molecules, integrating economic evidence from the earliest stages of development and guiding go/no-go decisions.

Proposal number 3	
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https://www.uam.es/economicas/facultad/departamentos/contabilidad	
Title of the proposal	
Private Equity and Governance in Audit Firms: Drivers, Services and Consequences in a global market	
Abstract	
Since 2019, private equity (PE) investment in audit firms has moved from the margins to the centre of ownership change in the profession. Standard setters have responded. The International Ethics Standards Board for Accountants (IESBA) develops the international code of ethics, including independence requirements, and in 2026 it began a workstream on PE investment and its ethical implications. The International Auditing and Assurance Standards Board (IAASB) sets international auditing and assurance standards and is coordinating with the IESBA, because the issue affects audit quality. Academic evidence, however, remains scarce and largely US-based, which motivates this doctoral research. Building on Navallas et al (2026) comparative study of corporate governance in audit firms (Navallas et al., 2026) and following the institutional governance research (Zattoni et al., 2020), the project will adopt a comparative methodology to analyse the main international governance models. Doctoral students will examine how each model addresses independence, transparency, oversight and the governance implications of external capital. The expected outcome is evidence-based recommendations for regulators and for an international governance framework for audit firms.	

Proposal number 4	
Name and Surname	**Email**
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Title of the proposal	
The Recent Evolution of Income Inequality in China	
Abstract	

Universidad Autónoma de Madrid

This research project aims to analyse the recent evolution of income inequality in China, examining its main dimensions and underlying determinants. It will investigate disparities between urban and rural areas, differences across provinces, and the distribution of income by source, including wages, capital income, and social transfers. The research will also explore how inequality varies according to individual and household characteristics, such as gender, age, and other relevant socioeconomic factors. Particular attention will be paid to the interactions between these dimensions and to the extent to which recent economic transformations and public policies have contributed to reducing or reinforcing existing inequalities. Drawing primarily on available statistical data, the project will seek to identify the main trends in income distribution and assess their implications for China's social and economic development. The research offers an opportunity to develop analytical skills while contributing to a better understanding of inequality in contemporary China.

Proposal number 5	
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Title of the proposal	
Sustainable Transport Infrastructure, Productivity, Social and Territorial Cohesion, and the Green Transition	
Abstract	
This research proposal explores how sustainable transport infrastructure contributes to productivity growth, social and territorial cohesion, and the green transition. It provides a multidisciplinary framework for doctoral research on the economic, social, and environmental consequences of investments in low-carbon transport systems. The proposal integrates three complementary research lines. First, it examines the effects of sustainable transport infrastructure on firm productivity, regional competitiveness, and economic development through improved connectivity and reduced transport costs. Second, it investigates how transport accessibility shapes labor market opportunities, social inclusion, and territorial disparities. Third, it addresses key challenges of the ecological transition through two doctoral research topics: the determinants and diffusion of electric vehicle adoption, and the economic and social impacts of transport-related emission reduction policies. Using micro-level data and advanced causal inference methods, the proposed research will generate evidence to support transport policies that promote sustainable, inclusive, and territorially balanced development.	

Proposal number 6	
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https://sites.google.com/site/carmenarguedasuam/	
Title of the proposal	
Economic and environmental implications of second-hand markets	
Abstract	
This proposal aims to advance the microeconomic modelling of second-hand initiatives, with a particular focus on the environmental consequences of such practices. The proposal is motivated by the booming of peer-to-peer (P2P) platforms that connect buyers and sellers or renters of second-hand goods (Vinted, Wallapop, Facebook Marketplace, ...) as well as the emergence of circular hubs within firms, including companyrun platforms featuring buy-back schemes and related initiatives (Ikea circular hub, Zara preowned, ...). Second-hand practices are closely connected to the broader shift towards circularity, which is gaining prominence as societies and institutions become increasingly aware of the need for more sustainable economic systems. On the policy side, this awareness is for example reflected in the EU Green Deal and the EU Circular Economy Action Plan (2020, 2025), as well as in the U.S. EPA's Sustainable Materials Management framework. On the societal side, individuals are progressively adapting their behavior in ways that facilitate the adoption of circular business models. Together, these developments are reshaping market structures and strategic interactions between firms, platforms, and consumers. However, recent empirical literature highlights potential drawbacks of such initiatives, including increased consumption levels, larger production volumes, greater transportation needs, or moral licensing, among others. An emerging body of theoretical research seeks to identify the drivers of these undesired effects. We aim to contribute to this growing literature by modelling the interaction between markets for new goods and second-hand initiatives under different assumptions, and analyzing the strategic behavior of firms, sharing platforms, and individuals, along with its implications for prices, production levels, and welfare. Clarifying these mechanisms will enable our research to inform the design of more effective policies that align second-hand practices with the transition toward circularity.	

Proposal number 7	
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https://sites.google.com/view/kleinuam/inicio	
Title of the proposal	
Beyond Board Presence: Power, Profiles and Qualitative Diversity of Women Directors in Listed Companies	
Abstract	
Regulatory pressure, notably EU Directive 2022/2381, has pushed women's representation on boards of listed companies towards 40%. Yet numerical presence	

does not guarantee influence. This PhD project moves beyond headcounts to examine who women directors are, how they reach the boardroom, and whether they gain effective power. Building on preliminary evidence from the IBEX 35, which shows high representation but scarce access to chair positions, executive roles and key committees, the thesis will combine quantitative analysis of board composition, social network analysis of director interlocks, and a qualitative diversity index capturing professional, educational and international backgrounds. The project will extend the analysis to a cross-country comparison, including firms in China, and will test how sector, ownership structure and institutional context shape the translation of formal parity into real influence, informing corporate governance policy and theory.

Universidad Autónoma de Madrid

FACULTY OF EDUCATION SCIENCES

Proposal number 8	
Name and Surname	**Email**
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https://educaciondigital5.wixsite.com/educaciondigital	
Title of the proposal	
DIGITAL EDUCATION AND INNOVATION IN TEACHING	
Abstract	
Its main objective is to study the integration of technologies (AI, virtual platforms, multimedia, etc.) into educational processes, both within the curriculum and in the learning of the Chinese language. It is based on three pillars. To investigate the techno-pedagogical elements that underpin the effective use of technologies in education and training. To design innovative educational spaces supported by digital technologies (artificial intelligence, virtual and augmented reality, the metaverse, digital twins, etc.) To carry out pioneering research into digital educational resources and their associated methodologies.	

Proposal number 9	
Name and Surname	**Email**
Miren Perez Eizaguirre	miren.perez@uam.es
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https://sites.google.com/view/gidem/inicio?pli=1&authuser=0	
Title of the proposal	
Music Education in the 21st Century: Teaching Methodologies, Pedagogical Innovation and Comparative Perspectives	
Abstract	
This doctoral research project aims to investigate contemporary approaches to music education, focusing on teaching methodologies, pedagogical innovation and teacher education in different educational contexts. The research will explore curriculum development, teaching and learning strategies, assessment practices and the development of musical competencies in primary, secondary and higher education. Particular attention will be given to innovative pedagogical approaches and the relationship between educational practices and sociocultural contexts. The project may adopt qualitative, quantitative or mixed-methods research designs, including questionnaires, interviews, classroom observations and educational interventions. Depending on the doctoral candidate's academic background and research interests, comparative studies between Spain and China may be developed. The expected outcomes include contributions to music education research, the identification of	

effective pedagogical practices and evidence-informed recommendations for improving music teaching, learning and teacher professional development.

Proposal number 10	
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https://orcid.org/0000-0002-8779-280X	
Title of the proposal	
The Effects of High-Angle Tactical Video Feedback on Visual Search, Action Selection and On-Field Transfer in High-Level Football Players	
Abstract	
This three-stage study will examine visual search, reported action options and decision rationale in high-level football players. Football decisions require players to identify tactical information within limited time and space. High-angle footage displays relationships among teammates, opponents and space, offering a basis for structured feedback. At baseline, players will complete attacking video tasks with eye tracking, select actions, explain their choices and report alternatives. They will then be randomly allocated to high-angle tactical video feedback or a regular-training control group. The study period will last six to eight weeks, with both groups continuing regular football training. Video tasks will assess group differences in changes from baseline to immediate post-test and delayed retention testing. On-field assessments before and after training will examine transfer through action selection, execution and pre-reception scanning. The findings may clarify how players use tactical information and inform video feedback methods for developing decision making in high-level football.	

Proposal number 11	
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https://www.uam.es/uam/investigacion/grupos-de-investigacion/detalle/f1-665	
Title of the proposal	
Human Agency, Regulation, and Social Interaction in AI-Mediated Learning	
Abstract	
Artificial intelligence is increasingly embedded in educational environments, but its influence on how students think, regulate learning, and interact with others remains insufficiently understood. This project examines the psychological and social conditions under which AI-based support strengthens human agency, metacognitive regulation, and collaborative learning or instead encourages dependence and the substitution of learners' cognitive effort. Drawing on educational psychology and sociocultural perspectives, it will investigate how characteristics of learners, forms of AI scaffolding, and patterns of social interaction shape educational experiences and outcomes. Empirical work may examine individual and peer-mediated learning activities using complementary quantitative and qualitative approaches, with particular attention to autonomy, strategic engagement, and shared regulation. The project aims	

to generate evidence to guide human-centred AI integration in education, preserving students' active role in learning and meaningful interaction with others.

Proposal number 12	
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Title of the proposal	
Artificial Intelligence Dependence and Deep Learning in Higher Education: The Mediating Role of Self-Regulated Learning and the Protective Role of Critical AI Literacy	
Abstract	
The rapid integration of artificial intelligence (AI) into higher education raises fundamental questions about its implications for students' cognitive, motivational, and self-regulatory processes. This research project will investigate the relationship between AI dependence and deep learning, focusing on the mediating role of self-regulated learning and the moderating role of critical AI literacy. Drawing on self-regulated learning theory and emerging perspectives on AI-assisted education, the project will examine whether greater AI dependence is associated with reduced engagement in deep learning through lower levels of academic self-regulation. Furthermore, it will explore whether critical AI literacy acts as a protective factor by weakening these negative associations. A multi-study research design will be proposed, combining psychometric validation, explanatory modeling, and longitudinal or cross-context analyses. The expected findings will contribute to understanding the psychological mechanisms underlying AI-assisted learning and provide an evidence-based framework for promoting learner autonomy, critical AI engagement, and meaningful learning in higher education.	

Proposal number 13	
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https://www.uam.es/uam/investigacion/grupos-de-investigacion/detalle/f1-665	
Title of the proposal	
Digital Well-Being and Responsible Generative AI Use in Teacher Education: a Socio-Emotional and Intercultural Approach	
Abstract	
This PhD project will investigate how generative artificial intelligence (AI) use in initial teacher education relates to digital well-being, self-regulated learning, and socio-emotional competencies. It will examine attitudes toward AI, academic uses, problematic reliance on technology, and factors supporting critical, inclusive, and ethical practices. A mixed-methods design will combine validated questionnaires, interviews, and longitudinal follow-up with university students. A cross-cultural comparison between Spain and China will be explored, subject to access to partner	

samples. Findings will inform the design and evaluation of a brief educational intervention promoting responsible AI use, learner autonomy, and digital well-being. Hosted by the BIDAE research group at Universidad Autónoma de Madrid, the project will integrate educational psychology, teaching innovation, and psychoeducational assessment, offering opportunities for interdisciplinary and international collaboration.

Proposal number 14	
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Aikaterini Evangelia Psegiannaki	aikaterini.psegiannaki@uam.es
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https://arts-vit.com/	
Title of the proposal	
MakerSpaces for All: Fostering Inclusive Educational Innovation through STEAM and Maker Culture	
Abstract	
This research project investigates the potential of Maker culture methodologies, technologies, and spaces to cultivate diverse, equitable, and inclusive learning environments. By integrating artistic and design thinking across STEAM disciplines, the study explores how Maker-centered frameworks develop vital 21st-century skills, including creativity, critical thinking, and problem-solving. Our central objective is to rethink contemporary educational contexts by leveraging technological advancements to bridge real-world challenges with personalized learning. The project will evaluate the educational impact of empowering students as active creators and collaborators. Ultimately, this research aims to provide actionable, evidence-based strategies that transform traditional learning communities into dynamic hubs of innovation, promoting equal opportunities and preparing students for an increasingly complex future. https://doi.org/10.5209/tekn.95310 http://hdl.handle.net/10486/717837	

Universidad Autónoma de Madrid

FACULTY OF LAW

Proposal number 15	
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https://www.uam.es/uam/investigacion/grupos-de-investigacion/detalle/f1-648	
Title of the proposal	
Unequal treaties and extraterritorial jurisdiction in China	
Abstract	
This line of research seeks to examine the role played by international treaties and the establishment of extraterritorial institutional mechanisms by the Western powers in China between the second half of the nineteenth century and the first half of the twentieth century. Such a perspective makes it possible to analyse how law became a crucial vehicle for the articulation of the logics of informal imperialism in Asia. In particular, when defining the objects of study, priority will be given to treaties that lend themselves to analysis through diplomatic archival sources (such as the Sino-Spanish Treaty of 1864) and to judicial or quasi-judicial authorities that can be examined through surviving archival records.	

Proposal number 16	
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Title of the proposal	
Opening the Black-Box of Algorithm-mediated Public Governance. Artificial Intelligence Implications in Governments, Public Services, and People (#AIPublicGov).	
Abstract	
This project proposes a systematic and empirical analysis, with the aim of generating data and theory, of the implementation of artificial intelligence (AI) systems in the public sector, taking a comprehensive approach to the impact of AI at three levels: macro (policy and institutional design), meso (public organisations and services), and micro (the relationship between AI and public sector employees and citizens). Previous research suggests that the development and implementation of AI in the public sector, whilst it may create new opportunities and has the potential to transform governments and public administrations and their interactions with the public, also presents potential governance challenges regarding decision-making processes, trust, legitimacy, privacy, biases, digital inclusion and diversity, as well as the control of personal data, amongst others.	

Universidad Autónoma de Madrid

FACULTY OF MEDICINE

Proposal number 17	
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Title of the proposal	
Claudin-targeted radiotheranostic peptides for precision imaging and therapy of pancreatic ductal adenocarcinoma	
Abstract	
Pancreatic ductal adenocarcinoma (PDAC) is one of the deadliest malignancies worldwide, with a five-year survival rate of just 11%. Late diagnosis, early metastatic dissemination, dense stromal desmoplasia, and intrinsic resistance to conventional chemo- and radiotherapy severely limit current treatment outcomes. Despite advances in surgical management and systemic therapies, effective, tumour-specific therapeutic strategies remain an urgent unmet need. Targeted radionuclide therapy (TRT) has emerged as a promising modality in precision oncology by combining the cytotoxic effects of radiotherapy with the specificity of molecularly targeted ligands. When integrated with molecular imaging, TRT enables radiotheranostics, offering simultaneous tumour localisation, molecular characterisation and real-time assessment of therapeutic response. Peptide-based vectors are particularly suitable for this approach due to their favourable pharmacokinetics, high tumour penetration, minimal immunogenicity, and chemical flexibility, allowing rational optimisation for enhanced specificity and binding affinity. A critical factor for TRT efficacy is the choice of an optimal molecular target. Claudin-4 and claudin-18.2, two tight junction proteins, are frequently overexpressed in PDAC while absent or minimally expressed in normal pancreatic tissue. Their high prevalence, tumour-restricted localisation and accessible extracellular loops make them ideal candidates for peptide-based radiotheranostics. Current therapeutic strategies targeting these claudins, including monoclonal antibodies and antibody-drug conjugates, are limited by poor tumour penetration, slow pharmacokinetics, immunogenicity and high production costs. While the C-terminal fragment of Clostridium perfringens enterotoxin (cCPE) provides a promising scaffold for claudin-4 targeting, existing variants demonstrate insufficient in vivo tumour retention and rapid clearance, and no peptide ligands have yet been developed for claudin-18.2. The project aims to develop next-generation peptide radioligands targeting claudin-4 and claudin-18.2 for radiotheranostic applications. We will pursue two complementary strategies: (1) rational redesign of the cCPE scaffold using advanced structural and computational modelling to	

optimise binding affinity, specificity, and pharmacokinetics for claudin-4; and (2) identification of high-affinity, selective peptide ligands for claudin-18.2 through phage display technology combined with computational analysis. Selected ligands will be modified for radiolabelling and evaluated in vitro to determine their binding, specificity, and biological activity in PDAC cells. The most promising radioligands will then be tested in vivo in preclinical PDAC models to assess tumour targeting, retention, imaging performance and radiotherapeutic potential, with the results guiding future translational development.
By integrating peptide engineering, computational design, and nuclear imaging, the project will advance peptide-based radiotheranostics to precisely target claudin-4 and claudin-18.2 in PDAC. This project will generate novel molecular vectors, establish a precision-targeted therapeutic platform, and lay the foundation for improved patient stratification, personalised treatment and more effective management of this highly lethal cancer.

Proposal number 18	
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Title of the proposal	
Targeting the NRF2 transcription factor to modulate neuroinflammation and promote resilience in Alzheimer's disease.	
Abstract	
Alzheimer’s disease (AD) remains one of the leading causes of dementia worldwide, and effective disease-modifying therapies are still lacking. Increasing evidence indicates that maladaptive neuroinflammatory responses contribute to disease progression and cognitive decline. The NRF2 pathway is a master regulator of cellular stress responses and inflammation, but its activity is frequently impaired during ageing and neurodegeneration. We hypothesize that pharmacological enhancement of NRF2 signalling can reprogram detrimental neuroinflammatory responses, improve cellular resilience and slow pathological processes relevant to AD. This project will explore the therapeutic potential of modulating NRF2 in the context of AD, with particular attention to its impact on neuroinflammation and cellular stress. By investigating this pathway across complementary experimental settings, we aim to generate an understanding of how NRF2 activation may influence disease-related mechanisms. The findings will provide a foundation for future studies evaluating NRF2-based strategies and their contribution to the development of therapeutic approaches for AD.	

Proposal number 19	
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Title of the proposal	
Functional analysis of microRNAs and their target genes in immunity and cancer	
Abstract	
Our research aims at understanding the cellular and molecular basis of cancer and autoimmune diseases with a central focus on immune tolerance. Our immune system continuously faces the challenge of protecting the organism from a large variety of invading pathogens and arising tumors without attacking our own tissues. This exquisitely regulated specificity of recognition is achieved through a series of immune tolerance mechanisms that operate in different immune cell subsets, including T and B cells. Defects in immune tolerance constitute the basis for the development of autoimmune diseases, including lupus erythematosus, rheumatoid arthritis, type 1 diabetes and multiple sclerosis. On the other hand, immune tolerance is central to the failure of tumor immunosurveillance and certain cancer immunotherapies. Despite intensive study, the mechanisms underlying immune tolerance are poorly understood. Specifically, the role of microRNAs (miRNAs) in these mechanisms remains largely unexplored. miRNAs are endogenously encoded small RNAs 19–23 nucleotides in length that regulate the expression of their target genes by pairing through imperfect sequence complementarity with their target messenger RNAs (mRNAs) and promoting degradation and/or translational repression of the mRNA. Hundreds of miRNAs are expressed in the immune system, and they have essential roles in regulating the development and function of lymphocytes. Expression-profiling studies have revealed that many miRNAs are dysregulated in lymphocytes from patients with autoimmune diseases, and mouse genetic studies have established causative roles for a few of those miRNAs in regulating autoimmunity. The present project focuses on studying the role of specific miRNAs and their target genes in immune tolerance. Uncovering the mechanisms governing immune tolerance is key for understanding autoimmune diseases and tumor progression and for the development of new therapeutic strategies for the treatment of these diseases.	

Proposal number 20	
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Title of the proposal	
Molecular Mechanisms of Joubert Syndrome and Related Ciliopathies	
Abstract	
Primary cilia are cell type-specific antennae whose transduction of chemical, mechanical or optical signals is essential for human embryonic development and	

postnatal life. Cilia-dependent processes in our bodies include neural, skeletal and heart development, vision, hearing, cognition, motor control, kidney function, food intake and smell, among others. Ciliopathies are genetic diseases caused by cilia malfunction. Most ciliopathies are rare diseases affecting multiple organs. This is the case of Joubert-Boltshauser syndrome (JBTS), which affects 1 in 100.000 people and is associated with motor and cognitive deficits, kidney disease, retinal degeneration, and polydactyly. Mutations in INPP5E, a phosphoinositide phosphatase of the ciliary membrane, cause JBTS. In the lab we use mammalian cell culture models to study how INPP5E regulates growth factor signaling and microtubule dynamics in primary cilia, and how these processes are perturbed in JBTS. If you are interested, please contact us: francesc.garcia@uam.es

Proposal number 21	
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https://www.linkedin.com/in/maria-f-c-665471a9/	
Title of the proposal	
Oncología de Precisión basada en Sensórica Cuántica y Agentes de IA Generativa	
Abstract	
El cáncer sigue siendo la segunda causa de muerte a nivel global, debiéndose su alta letalidad principalmente al proceso metastásico . El gran desafío actual reside en las micrometástasis latentes: colonias celulares microscópicas que permanecen invisibles a las técnicas de imagen clínica convencionales (CT, MRI, PET) durante años antes de manifestarse. Esta "ceguera tecnológica" en estadios tempranos impide la estratificación precisa del paciente y resulta en una elevada carga asistencial y económica para el Sistema Nacional de Salud (SNS) debido a tratamientos subóptimos o tardíos. La oncología de precisión enfrenta el desafío crítico de identificar biomarcadores universales que permitan no solo la detección temprana, sino también la cuantificación precisa de la agresividad tumoral en un entorno de alta heterogeneidad biológica. Este proyecto identificaremos receptores rpurinergicos como una diana terapéutica y diagnóstica de carácter. Usando sensórica cuántica y IA generativa.	

Proposal number 22	
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Isabel Perez Santos	isabel.perezs@uam.es
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http://www.ahnfmed.uam.es/investigacion/ver-grupo/id/33	
Title of the proposal	
Noradrenergic innervation of the thalamus: Distribution, origin, and implications in fear-conditioning circuits	

Abstract
This PhD project will investigate the organization and functional role of noradrenergic innervation in thalamic nuclei involved in conditioned fear and its alteration in post-traumatic stress disorder (PTSD). Using rodent models and human postmortem samples, the student will apply anatomical tracing, histology, noradrenaline focal lesions, and behavioral analyses to characterize thalamic noradrenergic circuits and their connectivity with the amygdala and medial prefrontal cortex. The project will test the hypothesis that dysfunction of these pathways contributes to impaired fear extinction in PTSD, providing mechanistic insight into emotional regulation and potential therapeutic targets.

Proposal number 23	
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https://pubmed.ncbi.nlm.nih.gov/?term=prados-rosales&sort=date#	
Title of the proposal	
Abstract	
We are seeking a highly motivated candidate to investigate the biogenesis, cell-free fragmentomics, and host innate immune sensing of Mycobacterium tuberculosis extracellular RNA (exRNA) and extracellular vesicles (MEVs). You will employ cutting-edge methodologies—including cP-RNA-seq, CRISPR/Cas9 macrophage knockouts, automated SEC, and single-molecule live-cell super-resolution (iSIM) microscopy—and complete a funded 3-month research stay at The Francis Crick Institute in London	

Proposal number 24	
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https://portalcientifico.uam.es/en/ipublic/researcher/262033 ORCID 0000-0001-9067-2991	
Title of the proposal	
Role of ISG15 in MPXV transmission	
Abstract	
Monkeypox virus (MPXV) has caused two consecutive WHO-declared global health emergencies, with the emerging clade Ib strain spreading through sustained human-to-human transmission at unprecedented rates. Understanding the host mechanisms that restrict epidemic MPXV is urgently needed. Our laboratory has recently established that human ISG15 is a clade-dependent restriction factor for MPXV (McGrail et al., CommBio 2026), generated the first ISGylome of poxvirus-infected human cells, and identified A33 and A26 as the first ISGylated poxviral proteins — with all modification sites conserved across epidemic strains. We have additionally shown that specific host ISG effectors, including MX1 and IFIT family members, are upregulated in ISG15-deficient cells and likely contribute to MPXV restriction (Campaña et al., under revision).	

Building on these findings, we aim to define the functional consequences of viral protein ISGylation on virion dissemination and identify the host effectors responsible for epidemic MPXV restriction in human cells.

Proposal number 25	
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https://www.uam.es/uam/investigacion/grupos-de-investigacion/detalle/f1-602	
Title of the proposal	
Epidemiological and genetic insights of kidney function mediation in biological aging	
Abstract	
Background: Kidney dysfunction is associated with accelerated biological aging, potentially mediated by circulating proteins. However, the underlying causal mechanisms remain unclear. Methods: Using UK Biobank data, we will investigate the longitudinal association between kidney function, assessed by cystatin C-based estimated glomerular filtration rate (eGFRcys), and biological age acceleration (BAA). Leukocyte telomere length (LTL) will serve as an additional aging marker. Proteomic analyses will identify circulating proteins associated with accelerated aging. Genome-wide association studies and two-sample Mendelian randomization will explore causal relationships between kidney function, candidate proteins, and aging phenotypes. Expected Results: We hypothesize that reduced kidney function contributes to accelerated biological aging and shorter LTL, potentially mediated by proteins including Klotho, GDF-15, and FGF23. Conclusions: This study aims to clarify the mechanisms linking kidney dysfunction to biological aging and identify potential biomarkers and therapeutic targets for preventing premature aging.	

Proposal number 26	
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https://www.iib.uam.es/en/web/iibm/departamentos?p_p_id=APGIportlet_WAR_IIBMappPortlets_INSTANCE_vjNkurhVUlsL&p_p_lifecycle=0&_APGIportlet_WAR_IIBMappPortlets_INSTANCE_vjNkurhVUlsL_codIgrupo=165&_APGIportlet_WAR_IIBMappPortlets_INSTANCE_vjNkurhVUlsL_action=getIgrupo&groupname=gr_oxygene	
Title of the proposal	
Beyond Cell Culture: Characterizing Early In Vivo Transcriptional Adaptations to Hypoxia	
Abstract	
Oxygen is essential for the survival and function of mammalian tissues, as aerobic metabolism is required to sustain physiological processes. Disruptions to oxygen homeostasis are central to the pathogenesis of prevalent diseases, including cancer, obesity, and cardiovascular, cerebrovascular,	

and respiratory conditions. Cellular responses to hypoxia are orchestrated by Hypoxia-Inducible Factors (HIFs), which regulate gene expression to restore homeostasis through metabolic reprogramming and enhanced oxygen delivery. However, much of the current understanding of cellular responses to hypoxia is derived from in vitro studies, leaving key aspects, particularly the role of HIFs in the early transcriptional response, poorly characterized in vivo. This raises concerns about the extrapolation of in vitro findings to in vivo systems. In line with this, preliminary data from our research suggest significant differences between in vivo and in vitro transcriptional responses to hypoxia. Additionally, the transcriptional response to intermittent hypoxia, which underlies pathologies such as Obstructive Sleep Apnea (OSA), remains poorly understood compared to sustained hypoxia.

This project aims to fill these gaps in knowledge and uncover the molecular mechanisms driving hypoxia responses in vivo. Specifically, we will address the following objectives:

1. Investigate the role of HIFs in the early transcriptional response to sustained and intermittent hypoxia, and explore the contribution of epigenetic adaptations, particularly DNA methylation, which is regulated by oxygen availability.
2. Examine the contribution of other transcription factors in the hypoxic response, with a focus on the YAP/TAZ pathway. Our preliminary data suggest that YAP1 is activated in heart and lung of mice exposed to short-term hypoxia, which may have implications in vascular remodeling.
3. Explore the crosstalk between hypoxia and xenobiotic stress responses, specifically the competition for ARNT binding between HIF and Aryl Hydrocarbon Receptor (AHR) transcription factors. This interaction may influence drug metabolism and metabolic processes during hypoxia.

By integrating genetic models, transcriptomic and genomic profiling, and bioinformatic approaches, this research will provide critical insights into the transcriptional and epigenetic adaptations to intermittent and sustained hypoxia in vivo. By describing transcriptional regulation in intact tissues, our work aims to advance the understanding of hypoxia-associated diseases and identify novel therapeutic opportunities, including the potential benefits of hypoxia preconditioning.

Proposal number 27	
Name and Surname	**Email**
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web	
https://foschgroup.github.io/	
Title of the proposal	
Novel agro-industrial by-products for healthy ageing	
Abstract	
The ageing process is related to decline of cardiometabolic and cognitive function. There is a growing interest in novel foods and supplements to ameliorate these alterations. The industrial processing of cocoa and coffee generates by-products with bioactive compounds of potential interest. In animal models of hypertension and	

obesity we have previously identified that extracts derived from these food by-products are effective in the reduction of blood pressure (DOI: 10.1113/JP287097) and body fat (DOI: 10.3390/foods12142708). AIMS: To evaluate the effects of oral supplementation in aged rats with novel extracts derived from cocoa and coffee by-products to identify specific therapeutic targets for future clinical translation. METHODS. The project will assess key outcomes involving cardiovascular, metabolic and cognitive health, evaluating physiological parameters (blood pressure, glucose tolerance and behaviour tests), and will identify the potential mechanisms through molecular techniques in relevant tissues.

Proposal number 28	
Name and Surname	**Email**
Marta Miret Garcia	marta.miret@uam.es
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https://www.ccomsuam.org/?lang=en	
Title of the proposal	
Infant cognition and behavior	
Abstract	
Infant cognitive and behavioral development is shaped by a complex interplay of biological, perinatal, and environmental factors, including prematurity, fetal growth patterns, nutritional status, and early-life health conditions. Understanding how these factors influence developmental trajectories is essential for identifying children at risk and informing early intervention strategies. The primary objective of this research stay is to investigate cognitive and behavioral outcomes in infants and to examine the determinants associated with variability in these outcomes. Particular attention will be given to the role of prenatal, neonatal, and postnatal factors that may affect early neurodevelopment. The project will involve the analysis of both clinical and research databases, enabling the integration of routinely collected health information with data generated through scientific studies. Conducted in collaboration with the Department of Psychiatry and the Department of Pediatrics at the Universidad Autónoma de Madrid, this research will contribute to advancing knowledge on early child development and its underlying risk and protective factors.	

Proposal number 29	
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web	
http://arantxa.ii.uam.es/~pvarona/research.html / http://www.ahnfmed.uam.es/investigacion/ver-grupo/id/25	
Title of the proposal	
Fear control in an autism mouse model through closed-loop automated optical stimulation and AI-based analysis tools	
Abstract	
This PhD project aims to develop and apply Artificial Intelligence (AI) tools to detect and regulate conditioned fear in mouse models of Autism Spectrum Disorder (ASD). The	

research combines expertise in neurotechnology and neuroscience to create a closed-loop system that uses real-time AI algorithms to estimate fear levels and adapt non-invasive infrared laser stimulation of the medial prefrontal cortex. Using the FMR1 knockout mouse, a widely used model of autism characterized by excitatory-inhibitory imbalance and altered fear responses, the project will investigate whether AI-guided modulation of neuronal excitability can restore normal fear regulation. Supervised and unsupervised machine learning approaches will be employed for behavioral and electrophysiological data analysis, as well as for characterizing the mechanisms underlying infrared neurostimulation. The project is expected to generate innovative open-source tools, a novel non-invasive neurostimulation technology, and high-impact scientific publications at the interface of artificial intelligence and neuroscience.

Proposal number 30	
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web	
https://www.uam.es/uam/investigacion/grupos-de-investigacion/detalle/f1-575	
Title of the proposal	
Nanovesicles from medicinal plants as drug delivery vehicles. Deciphering the dynamic impact of vesicle cargo.	
Abstract	
Plant-derived vesicles (PDVs) from different medicinal plant parts have been shown to hold very promising therapeutic potential to alleviate inflammation and promote tissue regeneration in a plateau of degenerative pathologies. In our group, we have optimised isolation, storage and drug encapsulation of PDVs, as well as the use of -omic analyses to characterize vesicle cargo. The project will investigate different formulations of drugs in PDVs, testing the biosafety and efficacy in vascular potency assays in vitro. Besides, the dynamic variation of the cargo enclosed in PDVs and its impact in the synergistic effects with the drugs assayed will be analysed.	

Proposal number 31	
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https://www.iib.uam.es/en/web/iibm/departamentos?p_p_id=APGIportlet_WAR_IIBMappPortlets_INSTANCE_vjNkurhVUlsL&p_p_lifecycle=0&_APGIportlet_WAR_IIBMappPortlets_INSTANCE_vjNkurhVUlsL_codIgrupo=200&_APGIportlet_WAR_IIBMappPortlets_INSTANCE_vjNkurhVUlsL_action=getIgrupo&groupname=gr_mitogene	
Title of the proposal	
Expression of the mitochondrial genome: new factors and involvement in mitochondrial diseases	
Abstract	
Mitochondria produce most cellular ATP through oxidative phosphorylation (OXPHOS). The biogenesis of the OXPHOS system requires coordinated expression of nuclear and mitochondrial genomes. This project aims to elucidate how mitochondrial gene	

expression contributes to OXPHOS biogenesis, and how its disruption leads to mitochondrial dysfunction and disease. This will help improve diagnosis and therapy for patients.The project is funded by Spain's State Research Agency. We have identified an uncharacterised mitochondrial protein and generated knockout Drosophila and mouse models. Combining the use of cell lines and these animal models, the student will characterise its function. The candidate will receive training in molecular biology, biochemistry, cell culture, imaging, CRISPR/Cas, Drosophila and mouse genetics, and mitochondrial function analysis. Our group belongs to UAM and the Instituto de Investigaciones Biomédicas Sols-Morreale (CSIC-UAM). The student will present results at group and department seminars, join junior committee activities, attend international conferences and perform research stays abroad.

Proposal number 32	
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https://portalcientifico.uam.es/en/ipublic/researcher/331953	
Title of the proposal	
Neuroprotective effects in an animal model of preterm birth of a novel agro-industrial by-product extract	
Abstract	
The industrial processing of cocoa/coffee generates by-products containing potentially neuroactive compounds. This project investigates, for the first time, the effects of chronic oral administration of a bioactive matrix, extracted from cocoa shells and coffee pulp, on in vivo neurodevelopmental alterations in an animal model of preterm birth. The project will assess key outcomes involving neuroplasticity, behaviour, cognition, neuroinflammation, and the endocannabinoid system. Behavioural testing will examine learning, memory and anxiety-related responses. In parallel, hippocampal and prefrontal cortical analyses will quantify synaptic plasticity markers (BDNF, synaptophysin), inflammatory mediators and endocannabinoid signalling components (CB1/CB2, FAAH). RT-qPCR, immunoblotting and immunohistochemistry will assess gene expression, protein abundance and regional distribution. Associations between behavioural outcomes and molecular changes will be examined to determine whether supplementation-related differences in cognition and anxiety-related behaviour coincide with changes in neuroplasticity, inflammation or endocannabinoid signalling. Ultimately, this research aims to assess neuroprotective potential and identify molecular correlates of behavioural responses.	

Proposal number 33	
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https://www.idipaz.es/areasCientificas/MaternoInfantilAdolescente/InfeccionesSistemicasPediatria	

Title of the proposal
Microbiome-host interaction in pediatric infectious diseases
Abstract
Host–Microbiome Interactions and Translational Research in Pediatric Infectious Diseases. We are seeking a motivated PhD candidate to join a multidisciplinary research group focused on pediatric infectious diseases, with particular emphasis on HIV, tuberculosis, and other infections affecting vulnerable pediatric populations. Our research integrates clinical, immunological, microbiome, and epidemiological data to better understand host–pathogen interactions, immune responses, and disease outcomes. Ongoing projects aim to identify novel diagnostic and prognostic biomarkers, explore potential therapeutic targets, and investigate the role of the microbiome in susceptibility to infection, immune regulation, and treatment response. The successful candidate will contribute to translational research projects involving clinical cohorts, advanced molecular and immunological techniques, and high-dimensional data analysis. Depending on their background and interests, the position may also focus on biostatistics, clinical epidemiology, predictive modeling, and the integration of complex datasets to address clinically relevant questions. We welcome applicants with backgrounds in biomedical sciences, microbiology, immunology, bioinformatics, biostatistics, or related disciplines.

Proposal number 34	
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https://www.uam.es/uam/investigacion/grupos-de-investigacion/detalle/f1-290 https://portalcientifico.uam.es/es/ipublic/researcher/261886 https://scholar.google.com/citations?user=1IKOVx0AAAAJ&hl=en https://www.fjd.es/iis-fjd/en/research-areas-groups/crm-cardiovascular-renal-metabolic-diseases	
Title of the proposal	
Maintaining kidney health	
Abstract	
Chronic kidney disease (CKD) causes one death every 20 seconds and represents one of the fastest growing causes of death, set to become the 5th global cause of death by 2040. We will leverage in-house multiomics datasets and data mining of publicly available databases to define a novel actionable condition of very high risk of CKD that allows to fulfil the 2025 World Heath Organization (WHO) mandate to prevent CKD and its downstream adverse consequences for cardiovascular health. This information will be used to develop a novel biomarker signature that allows to monitor kidney risk and its response to current therapeutic interventions. Additionally, we will use this information to design and test in preclinical models novel therapeutic approaches for maintaining or restoring kidney health.	

Universidad Autónoma de Madrid

FACULTY OF PHYLOSOPHY AND HUMANITIES

Proposal number 35	
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web	
https://sites.google.com/view/ivangopu?pli=1&authuser=1	
Title of the proposal	
Rethinking Theory and Practice in East Asian International Relations	
Abstract	
The PhD project will study relations among East Asian countries, their interactions with other countries/regions (including territorial disputes or resilience of strategic supply chain), or the internal factors shaping their foreign policies (social movements, party politics, economic-technological priorities, etc.). It should try to (re)interpret concepts such as power, (inter)dependence, hierarchy, regime differences, etc. It should ground the analysis in empirical evidence to advance theoretical claims. Projects addressing the external effects of East Asian foreign policies will only be accepted if they are used to provide empirical support for explaining interstate relations or the domestic drivers of foreign policy.	

Proposal number 36	
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https://www.uam.es/fyl/facultad/departamentos/historia-moderna/irene-vicente-martin	
Title of the proposal	
Iberian Global Networks in Early Modern Asia: Inter-Imperial Interactions, Encounters, and Global Rivalries (16th–17th Centuries)	
Abstract	
This line of research explores the dynamic role of the Iberian powers in early modern Asia, examining how Spanish and Portuguese expansion intersected with powerful Asian polities, global commercial networks, and interimperial rivalries during the sixteenth and seventeenth centuries.By situating the Iberian presence within a Global and Connected History framework, this research line invites doctoral proposals that investigate the multi-centered nature of early modern globalization in East and Southeast Asia—from the Portuguese strongholds of Macao and Goa to the Spanish footprint established via Manila and the Trans-Pacific Galleon route. Prospective PhD candidates are encouraged to submit proposal topics aligned with—but not limited to—the following thematic axes: 1) Hispano-Portuguese Interactions: Diplomacy, trade, administrative friction, and informal cooperation between Spanish Manila, Portuguese Macao, and regional hubs (especially during and surrounding the period of the Iberian Union, 1580–1640; 2) Asian Sovereignty & Local Agency: Interactions, negotiations,	

tributatary relationships, or conflict resolution between Iberian actors and Asian powers (Ming/Qing China, Tokugawa Japan, and Southeast Asian sultanates and kingdoms); 3) Inter-European Rivalries in Asia: The geopolitical, military, and economic impact of Dutch (VOC) and English entry into the Asian sphere and its disruption of Iberian maritime routes and trade monopolies. 4) Global Circulation of Knowledge & Goods: The exchange of cartographic, linguistic, scientific, religious, and material culture between Europe, Asia, and the Americas.

Proposal number 37	
Name and Surname	**Email**
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https://www.researchgate.net/profile/Rafael-Garrido-Pena-2/research	
Title of the proposal	
Religiosidad y prácticas simbólicas durante el Neolítico en la Península ibérica.	
Abstract	
Se reuniría y analizaría toda la diversidad de manifestaciones arqueológicas del mundo simbólico y religioso de las poblaciones peninsulares desde la introducción de la economía de producción (agricultura y ganadería) a mediados del VI milenio AC hasta la transición entre el IV-III milenio (comienzo del Calcolítico). Ello incluiría la recopilación sistemática y estudio del registro funerario, desde las inhumaciones en fosas y abrigos/cuevas de los primeros agricultores y ganaderos hasta las sepulturas megalíticas. Pero también las ricas manifestaciones gráficas del arte rupestre (Macroesquemático, Levantino) y todas las apariciones de motivos simbólicos en cerámicas y otros elementos de cultura material (ídolos, etc). Así se llegarían a establecer los rasgos básicos de los diferentes sistemas de creencias, desde los comienzos del Neolítico y cómo se fueron transformando a medida que las sociedades peninsulares iban cambiando con la creciente intensificación de la economía, el crecimiento demográfico y el desarrollo de las desigualdades sociales.	

Proposal number 38	
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web	
https://www.uam.es/uam/investigacion/grupos-de-investigacion/detalle/f1-664	
Title of the proposal	
Filosofía española e iberoaemericana	
Abstract	
Se apoyarán proyectos de tesis doctoral que traten temas/autores vinculados al pensamiento español e iberoamericano, con especial atención por debates sobre exilio, género, interculturalidad y educación. También se apoyarán estancia de investigadores que quieran profundizar en su tesis sobre las relaciones entre filosofía, literatura y ciencias sociales.	

Proposal number 39	
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web	
https://researchportal.vub.be/en/persons/silvia-almenara-niebla/supervised-student-theses/	
Title of the proposal	
Seeing, Sharing, Feeling: Images and Digital Media in Everyday Life	
Abstract	
How do people use images and digital technologies to make sense of their lives? This research line invites you to explore how individuals and communities see, narrate and feel their experiences through photographs, films, social media and everyday screen practices. Combining digital, visual and collaborative methods (such as visual elicitation, digital ethnography and participatory approaches), it draws on anthropology, gender studies, media and migration studies, with particular attention to emotions and visual representation. You are free to shape your own topic: from everyday media experieces to diasporic identities, migration and borders. As a PhD student, you will design an original case study and develop creative, ethical research practices. You will be supervised by a researcher with extensive experience guiding international students, including Chinese students, with possible co-supervision with other European Universities as I'm part of the ECREA Diaspora, Migration and the Media section and I collaborate with several researchers across Europe. I welcome applicants from anthropology, media, communication, sociology, film, gender and migration studies.	

Proposal number 40	
Name and Surname	**Email**
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https://www.uam.es/fyl/facultad/departamentos/filologia-espanola/olga-batiukova-belotserkovskaya	
Title of the proposal	
Corpus Linguistics Tools for Teaching Lexical and Grammatical Aspects of Spanish to Chinese-Speaking Learners	
Abstract	
The selected doctoral candidate will undertake a PhD dissertation focusing on the use of corpus linguistics tools to teach those aspects of Spanish vocabulary and grammar that pose the greatest difficulties for Chinese-speaking learners of Spanish as a second language. A high level of proficiency in spoken and written academic Spanish is essential, as is technical knowledge of corpus linguistics, Spanish syntax, and lexicology.	

Proposal number 41	
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Clara Cantos Delgado	clara.cantos@uam.es
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https://portalcientifico.uam.es/es/ipublic/researcher/333017	
Title of the proposal	
Pragmalinguistic Self-Presentation Strategies of Chinese Mobile Dating App Users in Spain	
Abstract	
Chinese university students studying in Spain often resort to social media and Mobile Dating Apps (MDAs) (e.g. Bumble) to meet prospective friends or romantic interests. However, the linguistic self-presentation of Chinese MDA users in Spain still remains unexplored. Thus, this project aims to explore the pragma-linguistic choices Chinese users make in their profiles. Drawing on traditional pragmatic theories, humour theory and hyperpersonal communication, this project aims to answer: (1) Which languages, politeness strategies and humour types do users deploy? (2) How do these choices vary according to relational goals and time spent in Spain? (3) How do users justify these choices, and what risks they perceive? This study aims to analyse around 200 donated profiles, followed by interviews (approx. 50 users) through a mixed methods approach with the assistance of Atlas.ti. Findings will inform awareness-raising materials on pragmatics and digital self-presentation for Chinese students in the Spanish context.	

Universidad Autónoma de Madrid

POLYTECHNIC SCHOOL

Proposal number 42	
Name and Surname	**Email**
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http://www-vpu.eps.uam.es/webvpu/gti/user/29/	
Title of the proposal	
Advancing Medical Image Analysis through Unsupervised Domain Adaptation and Data-Centric Learning	
Abstract	
Medical image analysis increasingly relies on deep learning models, yet their performance often degrades when applied to data from different hospitals, scanners, imaging protocols, or patient populations. This PhD project aims to develop robust and generalisable methods for medical image analysis by combining unsupervised domain adaptation with data-centric learning strategies. The research will investigate techniques to transfer knowledge across domains without requiring extensive annotations in the target domain, while exploring how data selection, curation, augmentation, and synthetic image generation can improve model training. Particular attention will be given to domain generalisation and challenging scenarios involving heterogeneous medical imaging datasets, potentially including brain tumour segmentation and cross-population MRI analysis. Furthermore, the project will explore adaptive learning strategies that jointly optimise data utilisation and model training. By integrating advances in representation learning, generative models, and medical imaging foundation models, the expected outcome is a set of methods that improve model robustness, reduce annotation requirements, and enhance generalisation across diverse clinical settings.	

Proposal number 43	
Name and Surname	**Email**
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https://www.hctlab.com/	
Title of the proposal	
Design and Development of Specialized Unmanned Aerial Systems for Multisensor Remote Sensing and Intelligent Environmental Monitoring	
Abstract	
This PhD proposal focuses on the use of Drones equipped with thermal, RGB, radiometric, multispectral, and LiDAR sensors for the inspection and monitoring of renewable energy infrastructures, particularly solar photovoltaic plants and high-voltage power lines. The research will address UAV-based data acquisition, sensor integration, calibration, georeferencing, and advanced multisensor data processing. Special emphasis will be placed on developing artificial intelligence, deep learning, and computer vision	

algorithms for automated pattern recognition, anomaly detection, defect identification, and predictive maintenance. Applications will include detecting defective photovoltaic modules, thermal hotspots, structural damage, vegetation encroachment, and faults in electrical transmission lines. The project will also investigate multisensor data fusion, 3D reconstruction, and LiDAR point-cloud analysis to improve inspection accuracy and reliability. The developed methodologies will be validated using experimental UAV datasets and real-world infrastructure inspection campaigns.

Proposal number 44	
Name and Surname	**Email**
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https://miso.es/	
Title of the proposal	
Trustworthy LLM-Assisted Model-Driven Engineering	
Abstract	
The proposed research will investigate how to ensure the trustworthiness of LLM-generated software engineering artifacts in schema-rich and safety-critical domains. The PhD candidate will develop a trustworthy agentic framework for Model-Driven Engineering (MDE) that combines LLM-based agents with MDE technologies. The framework will be evaluated through realistic software engineering scenarios, potentially including industrial safety-critical configuration, model transformation, and code generation. The expected outcome is a set of model- and tool-agnostic methods that enable MDE practitioners to adopt LLM-based automation while preserving consistency, traceability, validation, and assurance.	

Proposal number 45	
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http://www-vpu.eps.uam.es/webvpu/en/publications/external-publications/	
Title of the proposal	
Adaptive Generative Optimization for Enhanced Cross-Domain Vision Systems	
Abstract	
The project's objective is the optimization of Visual Artificial Intelligence systems for real-world scenarios, addressing limitations in adaptability, scalability, and data reliability. Robustness and flexibility of AI systems can be improved by increasing the diversity of training data, through the use of generative methods, tools for measuring the quality and diversity of generated data, and the development of training algorithms capable of producing models adaptable to different domains. The project will consider an active interaction between data generation and adaptation, where generative processes produce data customized to the target domain(s), and training strategies guide the generation of new data.	

Universidad Autónoma de Madrid

Proposal number 46	
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https://scholar.google.com/citations?user=rEntVSYAAAAJ&hl=en	
Title of the proposal	
LLM-Driven Automated Front-End FPGA Design: Synthesizable RTL Generation and Closed-Loop Verification	
Abstract	
Automating front-end FPGA development remains a critical challenge due to strict hardware concurrency, timing constraints, and physical synthesizability requirements. While Large Language Models (LLMs) have achieved notable success in general software generation, translating natural language specifications into functionally correct Register-Transfer-Level (RTL) code often suffers from domain-specific hallucinations, non-synthesizable constructs, and lack of hardware resource awareness. This research project aims to develop a robust, domain-adapted LLM framework specifically tailored for automated VHDL/Verilog RTL generation and front-end verification. The methodology investigates hardware-specific supervised fine-tuning, reasoning-enhanced techniques, and closed-loop agentic architectures integrating industry-standard simulation and formal equivalence checking. By leveraging iterative feedback directly from EDA toolchains, the proposed framework automatically diagnoses syntax and functional discrepancies to perform autonomous code repair. Ultimately, this work seeks to deliver an intelligent, verified design assistant that bridges natural language specifications and deterministic hardware implementation for next-generation FPGA systems.	

Proposal number 47	
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Title of the proposal	
Intelligent Resource Orchestration and Optimization in Hybrid Quantum-Classical Communication Networks	
Abstract	
Quantum communication networks promise unprecedented capabilities for secure communications and distributed quantum computing. However, their operation critically depends on classical communication infrastructures for signaling, synchronization, resource management, and coordination of quantum operations. This research aims to develop intelligent orchestration mechanisms that jointly optimize classical and quantum network resources, addressing the unique challenges of entanglement distribution, quantum memory constraints, decoherence, and probabilistic operations. The proposed work will investigate novel network control	

architectures, adaptive routing and scheduling algorithms, and AI-driven resource allocation strategies to improve network performance, reliability, and scalability. Particular attention will be paid to the interplay between classical network conditions and quantum communication efficiency, exploring how coordinated management can overcome existing limitations. Through modeling, simulation, and comparative performance evaluation, the research will contribute to the design of efficient, scalable, and resilient quantum-classical communication infrastructures, supporting the development of future quantum internetworking technologies and distributed quantum applications across heterogeneous network environments.

Proposal number 48	
Name and Surname	**Email**
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Title of the proposal	
Exploiting Heterogeneous Hardware for Terabit-Scale Network Monitoring	
Abstract	
A new generation of hardware is transforming network traffic processing. SmartNICs and DPUs integrate programmable cores next to the network interface, converged accelerators combine them with GPUs on a single board, and AI accelerators such as NPUs and TPUs are reaching servers and network devices. However, network monitoring systems barely exploit this power, and at 100 Gb/s and beyond they still rely on static filters and fixed rules to decide what traffic to keep. This thesis will investigate how to harness these heterogeneous platforms to bring intelligence to high-speed traffic capture and analysis, running machine learning models at line rate to select, summarize and classify traffic as it arrives. A key question is which tasks suit each type of hardware, since packet processing does not map naturally onto architectures designed for other workloads. The work will build on the group's long track record in high-performance traffic capture.	

Proposal number 49	
Name and Surname	**Email**
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https://www.miso.es/	
Title of the proposal	
Improving agentic development with model-driven engineering	
Abstract	
Advances in generative AI are reshaping software development. Coding assistants and agentic programming systems like Claude Code and Codex promise substantial productivity improvements and high levels of autonomy and automation. Recent practitioner surveys report that AI-based development has become mainstream. However, AI-based development has problems related to reliability, and (monetary and	

environmental) cost. Moreover, since developer tasks shift to steering agents and specifying requirements, there is a risk of accumulating cognitive and intent debt. This project aims to attack this problem by proposing novel approaches to agentic development, which makes models -- of high-level of abstraction -- a first-class artefact of the development process. This way, models will be used for understanding agent-generated code (reducing cognitive and intent debt), for its formal verification (improving reliability), and for deterministic, template-based code generation (reducing cost). Hence, this PhD thesis will contribute to the integration of model-driven engineering techniques and agentic development.

Proposal number 50	
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https://scholar.google.com/citations?user=i4U5duMAAAAJ&hl=en	
Title of the proposal	
Prototype-based generative models for counterfactual explanations	
Abstract	
Counterfactuals show how a model's decision changes when the values of a small set of concepts are altered while keeping the rest intact. This thesis aims at building interpretable generative vision models that instantiate images from learned prototypes, so that counterfactuals are generated by editing concept prototypes and decoding. It starts by studying how prototypes encode semantic concepts and how to disentangle concepts that generally co-occur in the training data. It also asks how to discover counterfactual dimensions without labels, through probes or anchor sets, and how to add dimensions unseen in training, as new prototype combinations or as prototypes learned from a few examples. The generated image can be modeled as a weighted mixture of prototypes. The counterfactuals can then be used for multiple purposes, including transparency audits and the probing of vision models for intersectional biases. Co-supervised by Carlos Santiago (IST).	

Proposal number 51	
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https://portalcientifico.uam.es/en/ipublic/researcher/261729	
Title of the proposal	
Network Troubleshooting through Graph Machine Learning and Generative AI	
Abstract	
When a network service degrades, finding the root cause means tracing interactions among thousands of hosts, applications and services across cloud platforms and data centers. A slow login or a frozen video call may stem from an overloaded database or a misconfigured server far from the symptom. Troubleshooting remains slow and expert-driven, because the answer lies in the dependencies between services rather than in isolated devices. Graph machine learning captures these dependencies, learning from	

traffic how faults propagate and guiding network operations center (NOC) teams to their origin. However, labeled incidents are scarce, and real traffic is rarely shareable. Generative AI fills this gap with realistic synthetic traffic and failure scenarios to train and evaluate these models. This thesis will combine both approaches to locate root causes automatically, building on the group's long-standing experience in network observability, from high-speed traffic capture to the analysis of large operational networks.

Proposal number 52	
Name and Surname	**Email**
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https://dperdices.github.io	
Title of the proposal	
Cybersecurity in the Era of AI Agents and Large Language Models	
Abstract	
The rapid expansion of communication infrastructures, driven by cloud services, data centers, distributed applications and massive traffic growth, creates unprecedented demands for network security. Yet rising traffic volumes, widespread encryption, multi-service complexity, and increasingly sophisticated cyberattacks are pushing traditional defenses beyond their limits. In this scenario, artificial intelligence (AI) emerges as a promising paradigm, with AI agents as a novel embodiment of its potential. These agents perceive network conditions, reason with domain-specific large language models (LLMs), and act through software interfaces, detecting intrusions and anomalous behavior, correlating security events and explaining threats to analysts, paving the way toward secure, AI-assisted networks of the future. This thesis will contribute to this vision by designing and validating such AI-driven security solutions, within a research group with a long track record in network monitoring and strong industry links, which provides access to real traffic from production networks and state-of-the-art GPU infrastructure.	

Proposal number 53	
Name and Surname	**Email**
Angel Lareo Fernández	angel.lareo@uam.es
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https://angellareo.github.io/	
Title of the proposal	
Life-cycle environmental impact of adapting foundation models	
Abstract	
Training a foundation model is an iterative tuning process with enormous impacts, but it is usually considered a one-off event. Adapting a model is not. Popular open-weight models are fine-tuned thousands of times and uploaded to platforms such as Hugging Face or ModelScope. This thesis aims at measuring the environmental life-cycle impacts of model adaptation beyond energy and carbon emissions, including water use and the depletion of mineral resources embodied in GPUs. It studies how architecture,	

adaptation technique, task performance, hardware, training settings and grid location shape these impacts. We hypothesize a rebound effect with efficient adaptations multiply and raise the total impacts' footprint. Then, it estimates the aggregate impact of the adaptation ecosystem, combining per-adaptation measurements with upload and download statistics. The results matter for carbon-neutrality targets such as the EU's 2050 and China's 2060 goals and will inform greener and more frugal adaptation choices. Co-supervised with Marcos Escudero-Viñolo.

Proposal number 54	
Name and Surname	**Email**
Ivan Gonzalez Martinez	ivan.gonzalez@uam.es
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https://www.uam.es/uam/investigacion/grupos-de-investigacion/detalle/f1-32	
Title of the proposal	
Generative AI for Network Traffic Modeling	
Abstract	
This project aims to develop a novel generative AI model that converts textual descriptions into realistic network traffic flows --similar in concept to text-to-image multimodal models. Instead of using few-shot prompting or fine-tuning existing architectures [1, 2] as in our previous publications, this research proposes a new Transformer-based framework specifically designed for packet-level and flow-level synthesis. The objective is to bridge natural language and network behavior, enabling applications such as simulation, anomaly detection, and synthetic dataset generation. Ideal candidates should have a strong passion for deep learning, natural language processing (NLP), and network systems. 1. Javier Aday Delgado-Soto, et al. 2025. GPT on the wire: Towards realistic network traffic conversations generated with large language models. Comput. Netw. 265, C (Jun 2025). https://doi.org/10.1016/j.comnet.2025.111308 2. Iván González, Jorge E. López de Vergara, Javier Aday Delgado-Soto, Daniel Perdices, Luis de Pedro, Training LLMs to Speak Network, Proceedings of the 4th International Conference on Computing, IoT and Data Analytics, ICCIDA 2025, Madrid, Spain, 17-18 July 2025. Available at http://arantxa.ii.uam.es/~jlopezv/publicaciones/iccida25igm.pdf	

Proposal number 55	
Name and Surname	**Email**
Luis de Pedro	luis.depedro@uam.es
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http://www.hpcn-uam.es/	
Title of the proposal	
Quantum communcations testbed using quantum dots technology	
Abstract	
The student will develope and ecosystem for a test bed using quantum dot technology as part of a Pathfinder project. They will use quantum dot technology devices to test the feasibility of an actual quantum network	

Universidad Autónoma de Madrid

FACULTY OF PSICHOLOGY

Proposal number 56	
Name and Surname	**Email**
Luis Manuel Blanco Donoso	luismanuel.blanco@uam.es
web	
https://scholar.google.com/citations?user=t2F_8CUAAAAJ&hl=es	
Title of the proposal	
Occupational health, psychosocial risks, and well-being in contemporary work environments	
Abstract	
This research line focuses on the study of psychosocial factors that influence employees' health, well-being, and functioning in contemporary work settings. It aims to examine both emerging risks associated with digitalization, artificial intelligence, hybrid work, and new forms of work organization, as well as specific risks affecting occupations characterized by high emotional and caregiving demands. These include burnout, secondary traumatic stress, moral injury, technostress, workplace cyberbullying, digital surveillance, and technological overload. The line will also examine personal, social, and organizational resources that may prevent or buffer their effects on mental health, work engagement, performance, and employee retention. Doctoral theses may combine longitudinal and diary studies, instrument development and validation, and intervention research, with particular attention to healthcare and care professionals and drawing on frameworks such as the Job Demands-Resources model.	

Proposal number 57	
Name and Surname	**Email**
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https://sites.google.com/site/colomresearch/Home	
Title of the proposal	
Neuroscience of cognitive abilities	
Abstract	
Through a combination of interdisciplinary research, cutting-edge technology, and strategic collaborations, we strive to uncover the secrets of the brain and its connections with human intelligence. Our team of highly qualified researchers is devoted to studying the brain's higher cognitive functions, from neuronal plasticity to functional connectivity, with the aim of shedding light on the mental processes that underlie human intelligence. We employ a variety of advanced neuroimaging techniques, including functional magnetic resonance imaging (fMRI), positron emission tomography (PET), magnetic resonance spectroscopy (MRS), electroencephalography (EEG), and magnetoencephalography (MEG), to investigate the structure and functional dynamics of the brain during cognitive tasks. These complementary methods allow us	

to examine neural activity across different spatial and temporal scales, providing an integrated view of the mechanisms that underlie perception, memory, and higher-order cognition.

Proposal number 58	
Name and Surname	**Email**
David Aguado Garcia	david.aguado@uam.es
web	
https://portalcientifico.uam.es/es/ipublic/researcher/260800	
Title of the proposal	
Generative AI and the Validity of Digital Human Capital Signals in Entrepreneurial Assessment	
Abstract	
Those who select entrepreneurs increasingly form their first judgments from digital profiles such as LinkedIn pages and founder biographies, reading them as signals of competencies that cannot be observed directly. Generative AI (GenAI) now allows anyone to polish or rewrite such self-presentations at almost no cost. Focusing on early-stage founders assessed by accelerator and incubator staff, the project asks: when existing profile text is rewritten by AI, do profile cues still relate to independent evidence of founders' competencies, does the accuracy of evaluators' judgments change, and which assessment procedures support more accurate judgment?	

Proposal number 59	
Name and Surname	**Email**
Maria Nieves Perez	nieves.perez@uam.es
web	
https://www.uam.es/uam/investigacion/grupos-de-investigacion/detalle/f1-666	
Title of the proposal	
FORENSIC INVESTIGATIVE INTERVIEWS AND THE ANALYSIS OF STATEMENTS BY ADULT WOMEN	
Abstract	
The overall objective of the project is twofold. On the one hand, we are interested in examining how variables related to the context of the forensic investigative interview affect the quantity and quality of memory among adult participants acting as witnesses or victims of an incident of sexual harassment; and, on the other hand, to identify the most relevant elements of the statements' content on which judges and magistrates base their assessments of the statements' credibility in an alleged sexual harassment case, and how they weigh those elements against the assessments made by experts in psychological expert reports that analyze the complainants' statements.	

Proposal number 60	
Name and Surname	**Email**
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https://neurofacialgroup.wordpress.com/	
Title of the proposal	
Neurocognitive markers of neurodegenerative diseases	
Abstract	
Perceptive functions are studied by means of neuropsychological tests concerning memory, language and executive functions in Parkinson and Alzheimer diseases. Neurophysiological recordings are carried out in both resting conditions and in response to visual stimuli as faces and objects to target evoked signals that denote neurodegeneration. Also, we studied brain oscillations to investigate default neural networks in the aging brain. Moreover, both neuropsychological and neurophysiological activities are longitudinally analysed and integrated to define perceptive early markers and their progression along the ventral pathway in these neurodegenerative diseases. References: NeuroImage [doi: 10.1016/j.neuroimage.2025.121039] Cortex [doi: 10.1016/j.cortex.2025.08.004] Frontiers in Aging Neuroscience [doi: 10.3389/fnagi.2022.893818] Cortex [doi: 10.1016/j.cortex.2020.10.017]	

Universidad Autónoma de Madrid

FACULTY OF SCIENCES

Proposal number 61	
Name and Surname	**Email**
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web	
www.nanobig.eu	
Title of the proposal	
SINGLE PARTICLE SPECTROSCOPY FOR HIGH RESOLUTION REMOTE SENSING	
Abstract	
This PhD project aims to develop luminescent nanomaterials and advanced optical instrumentation for single-particle spectroscopy and sensing. The research will combine the design and optimization of luminescent nanoparticles with the development of high-sensitivity optical setups capable of detecting and characterizing individual emitters. Particular attention will be paid to improving signal-to-noise ratio, photostability, spectral and lifetime readout, and quantitative sensing performance at the single-particle level. The ultimate goal is to establish robust methodologies for nanoscale sensing with very high spatial resolution, enabling the measurement of local physical and chemical parameters in heterogeneous environments, including complex biological systems.	

Proposal number 62	
Name and Surname	**Email**
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web	
https://scholar.google.es/citations?user=xGwZEbcAAAAJ&hl=es&oi=ao	
Title of the proposal	
Soil health indicators in forests	
Abstract	
This project aims to identify robust, ecologically meaningful soil health indicators across Spanish forest ecosystems subjected to varying degrees of anthropogenic and environmental impact, such as logging, fire, grazing, pollution, or land-use change. Soil samples will be collected from a gradient of forest sites spanning disturbed to minimally impacted reference conditions, and analysed for physical, chemical and biological properties, including organic carbon and nutrient status, microbial biomass and activity, enzyme activities, and soil structure. By comparing these properties across the impact gradient, the project will determine which indicators consistently differentiate degraded from well-preserved soils, and therefore best reflect soil functional integrity. The resulting indicator set will support the development of practical, standardised protocols for monitoring forest soil health, informing land management, restoration priorities and conservation policy in Mediterranean and temperate forest systems across Spain, and providing a scientific basis for tracking recovery after disturbance.	

Proposal number 63	
Name and Surname	**Email**
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web	
https://www.cial.uam-csic.es/investigacion/departamentos/departamento-de-produccion-y-caracterizacion-de-nuevos-alimentos/grupo-de-lipidos-bioactivos/	
Title of the proposal	
Sustainable Pistachio Biorefinery for the Valorization of Oils and Bioactive Compounds through Green Extraction Technologies and Circular Economy Approaches	
Abstract	
This project aims to develop an innovative and sustainable pistachio biorefinery platform based on green extraction technologies and circular economy principles. The research focuses on the integral valorization of pistachio kernels and processing by-products, including shells and hulls, to obtain high-value oils and bioactive compounds with potential applications in the food, nutraceutical, and cosmetic sectors. Virgin pistachio oil will be produced through cold mechanical pressing and further optimized using supercritical CO_2 extraction to maximize lipid recovery without the use of organic solvents. Additionally, antioxidant-rich extracts containing phenolic compounds, anacardic acids, and gallotannins will be recovered from pistachio residues using environmentally friendly extraction techniques. Advanced analytical methodologies will be employed to assess lipid quality, oxidative stability, fatty acid composition, and bioaccessibility. The project will contribute to waste reduction, sustainable food production, and the generation of innovative biobased ingredients with enhanced commercial and societal value.	

Proposal number 64	
Name and Surname	**Email**
David Miguez	david.miguez@uam.es
web	
https://www.cbm.uam.es/index.php/scientific-programs/tissue-and-organ-homeostasis/cell-architecture-and-organogenesis/biophysics-and-systems-biology/	
Title of the proposal	
Effect of microplastics in vertebrate neurogenesis	
Abstract	
Microplastic and nanoplastic (MNPs) exposure during vertebrate organogenesis results in developmental retardation, birth effects, chronic inflammation, oxidative stress, metabolic imbalance, mutagenesis, and teratogenesis. It is known that MNPs can cross the placenta, breach the blood-brain barrier, and accumulate in the brain of humans (higher MNPs in the human brain correlate with a higher risk of dementia). We propose that the presence of these MNPs at developmental stages may disrupt neurogenesis. The project focuses on quantifying the effect of low doses of MNPs during the formation of the central nervous system of vertebrates, in terms of changes in balance between stem cell self-renewal and terminal differentiation. To do this, we use the developing retina of zebrafish (the most accessible region of the central nervous system) and expose it to fluorescently tagged polystyrene MNPs, and quantify its effect using	

RAMAN, confocal, and super-resolution microscopy. Once the specific effect of MNPs on the balance between neurogenesis and progenitor maintenance is understood, we propose to mitigate their effect using a chemical rescue approach.

Proposal number 65	
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https://weiguangcui.github.io/	
Title of the proposal	
Connecting the physcis within the extreme environments with the large-scale strcutre and cosmology	
Abstract	
The project aims to link the extremely dense environment in the Universe—galaxy clusters—with their surrounding filaments to understand their formation. This study will then connect this understanding to cosmology, showing how we can use their abundance, richness, and other predicted masses to constrain cosmological parameters. This will be applied to the ongoing full-sky surveys, such as Euclid and Romain.	

Proposal number 66	
Name and Surname	**Email**
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https://rednutricrop.es/grupo/emerseed-estres-abiotico-en-plantas-y-su-impacto-en-calidad-nutricional-de-semillas/	
Title of the proposal	
Unravelling Root Traits and Physiological Mechanisms Driving Quinoa Resilience to Combined Drought and Heat Stress	
Abstract	
Climate change is intensifying drought and heat stress, threatening crop productivity and agricultural sustainability. Understanding how root system architecture and physiological responses contribute to stress adaptation is essential for developing climate-resilient crops. This PhD project will investigate the mechanisms underlying quinoa (Chenopodium quinoa) resilience to individual and combined water deficit and heat stress, focusing on root plasticity, physiological performance, and recovery capacity. Using contrasting quinoa genotypes, the research will integrate dynamic root phenotyping, physiological and biochemical assessments, and transcriptomic analyses to identify key traits and molecular pathways associated with stress tolerance. Experiments under controlled conditions, complemented by field-based assessments, will explore how root development and aboveground physiological responses are coordinated under stressful environments. The project aims to identify potential phenotypic and molecular markers of resilience, advancing our understanding of plant adaptation to climate change and supporting the development of more sustainable and resilient cropping systems.	

Proposal number 67	
Name and Surname	**Email**
Jose Julian Aleman Lara	jose.aleman@uam.es
web	
https://josealemanlara.wixsite.com/froncat	
Title of the proposal	
Powering Molecular Discovery with Light and Electricity: Catalysis for Sustainable Synthesis	
Abstract	
Discover how light and electricity can transform the way we make molecules. This PhD project will develop new photocatalytic and electrochemical reactions to access valuable organic compounds through efficient, sustainable strategies. Key challenges include activating readily available starting materials, unlocking new radical reactivity and understanding how catalysts control reaction pathways. Selected directions may include the synthesis of molecules relevant to pharmaceuticals, the development of recyclable catalytic materials and continuous-flow processes. The candidate will join Professor José Alemán's international research group at Universidad Autónoma de Madrid, within the Institute for Advanced Research in Chemical Sciences (IAdChem). The project offers broad training in organic synthesis, photochemistry, electrochemistry, spectroscopy and mechanistic analysis, with scope to shape the research around the candidate's strengths and interests. We seek motivated applicants who enjoy experimental discovery and want to contribute to the future of sustainable chemistry.	

Proposal number 68	
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Maria Dolores Martin Fernandez	dolores.martin@uam.es
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https://www.uam.es/uam/investigacion/grupos-de-investigacion/detalle/f1-28	
Title of the proposal	
Quantum fluids of light for nanophotonic technologies	
Abstract	
This project will investigate quantum fluids of light as a platform for next-generation nanophotonic technologies since they are a versatile and scalable resource for integrated nanophotonic circuits. By engineering strong light-matter coupling in microcavities based on traditional semiconductors and transition metal dichalcogenides (TMDs such as $MoSe_2$ and WSe_2), it will explore the rich many-body physics accessible at room temperature. Interlayer excitons in TMD heterostructures provide long-lived dipolar polaritons with tunable interactions, enabling coherent propagation over extended length scales. Photonic graphene lattices — honeycomb-patterned microcavities — will be employed to emulate relativistic Dirac physics and engineer flat-band condensation. Topological polariton states, including edge modes protected by time-reversal symmetry breaking, will be characterized through momentum-resolved photoluminescence and interferometric techniques. The interplay	

between topology, nonlinearity, and quantum coherence will be systematically studied to demonstrate robust, backscattering-immune optical routing.

Proposal number 69	
Name and Surname	**Email**
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web	
https://www.uam.es/ciencias/facultad/dpto-biologia/alonso-caballero-alvaro	
Title of the proposal	
Mechanochemical regulation of surface adaptation in plant-associated Pseudomonas: PilY1 as a target for natural compounds	
Abstract	
We aim to understand how mechanical forces and chemical signals regulate surface adaptation in plant-associated Pseudomonas, including beneficial bacteria and plant pathogens. We will investigate PilY1, a protein associated with type IV pili, as a potential link between mechanical stimuli, intracellular signaling, and bacterial behavior. Using single-molecule manipulation, live-cell fluorescence microscopy, and microbiological assays, we will determine how force and ligand binding alter PilY1 conformational dynamics and test whether these changes affect intracellular signaling and thereby influence motility and biofilm formation. This knowledge will guide the identification and characterization of natural compounds that modulate PilY1 function, with potential applications in sustainable agriculture. We seek a highly motivated student interested in interdisciplinary research at the interface of biology, physics, and chemistry.	

Proposal number 70	
Name and Surname	**Email**
Carolina Canora Catalan	carolina.canora@uam.es
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https://portalcientifico.uam.es/es/ipublic/entity/18828	
Title of the proposal	
Volcanotectonic interactions and Cascading Geological Hazards in El Salvador	
Abstract	
El Salvador is located in a tectonically active region where volcanic processes interact with active fault systems, creating complex geological hazards. Understanding these interactions is essential to determine how tectonic deformation and magmatic or hydrothermal processes influence one another and potentially trigger cascading events. This PhD project aims to investigate the relationships between active faulting, volcanic activity, and associated geological processes in El Salvador, focusing on the mechanisms that control their spatial and temporal interactions. By integrating geological, structural, tectonic, and geomorphological evidence, the research will seek to identify potential links between fault activity, volcanic and hydrothermal processes, and the occurrence of secondary hazards. The project will contribute to a better understanding of the geological processes governing volcano-tectonic systems and their role in generating cascading hazards, providing a geological framework to improve multi-hazard assessment in El Salvador.	

Proposal number 71	
Name and Surname	**Email**
Jose Antonio Fernandez Salas	j.fernandez@uam.es
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https://josealemanlara.wixsite.com/froncat	
Title of the proposal	
Green Electrocatalysis through Hydrogen Atom Transfer	
Abstract	
Can electrons replace conventional reagents and enable cleaner and more selective organic transformations? This doctoral project aims to develop innovative electrocatalytic strategies for carbon–carbon bond formation under mild and sustainable conditions. Redox-active hydrogen atom transfer (HAT) promoters will be designed and explored to generate carbon-centred radicals directly from C–H bonds, enabling dehydrogenative couplings with high atom economy and without stoichiometric oxidants or reducing agents. Particular attention will be paid to catalyst design, mechanistic understanding and the use of environmentally responsible reaction conditions. A particularly ambitious objective is the development of chiral HAT electrocatalysts capable of controlling both redox activation and stereochemical outcome, eliminating the need for additional chiral catalysts. By integrating organic synthesis, electrochemistry, radical chemistry and asymmetric catalysis, this multidisciplinary project offers doctoral researchers the opportunity to develop innovative and sustainable tools for modern organic synthesis.	

Proposal number 72	
Name and Surname	**Email**
Maria Salome Rodriguez Morgade	salome.rodriguez@uam.es
web	
https://www.iadchem.uam.es/?page_id=75	
Title of the proposal	
Designing Smart Molecular Materials for Solar Energy and Biomedical Applications	
Abstract	
What if molecules could switch their optical properties on demand, harvest light more efficiently, or become active in response to external stimuli? This project explores these possibilities using subporphyrazines (SubPzs) and related systems: versatile molecular building blocks whose optical, redox, and supramolecular properties can be precisely tailored through chemical design. The research will focus on synthesizing innovative chromophores and assembling them into functional supramolecular materials with unconventional properties. Key objectives include developing smart fluorescent probes with switchable fluorescence and photosensitizing activity, light-responsive near-infrared absorbers operating beyond 800 nm, and ordered nanostructures with enhanced emission properties. By combining molecular synthesis, photophysical and electrochemical characterization, photochemistry, and supramolecular engineering, the project aims to uncover new light-driven processes and create functional materials for emerging solar energy and biomedical technologies. This project offers an	

opportunity to work at the interface of synthetic chemistry, photochemistry, and materials science, transforming molecular design into innovative functional systems.

Proposal number 73	
Name and Surname	**Email**
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https://www.cbm.uam.es/index.php/programas-cientificos/interacciones-con-el-entorno/microorganismos-en-la-salud-y-el-bienestar/envoltura-celular-bacteriana-durante-el-crecimiento-preseptal/?lang=es	
Title of the proposal	
Mechanistic and Therapeutic Insights into Preseptal Growth in Gram-Negative Bacteria	
Abstract	
By integrating molecular biology and biochemistry approaches alongside various microscopy techniques, our goal is to characterize the molecular mechanisms driving the biogenesis of bacterial cell envelopes, particularly focusing on the preseptal stage. Employing Escherichia coli as a model organism, we seek to gain deeper insights into the crucial role that cell envelope architecture and integrity play in the pathogenicity of Gram-negative bacteria.	

Proposal number 74	
Name and Surname	**Email**
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https://syschemdelaescosura.es/	
Title of the proposal	
Synthesis and study of photoswitchable hydrogel materials for catalysis and biosensing applications	
Abstract	
The use of supramolecular systems with dynamic bonds and an adaptive, stimuli-responsive character in the field of systems chemistry will enable to create smart active materials mimicking the responsiveness of living cells. In the proposed thesis project, the student will direct this strategy to the developement of hydrogels with catalytic and photoswitching behavior. The thesis will comprise two main tasks: Task 1 will be devoted to the design, synthesis and study of self-healing and adaptive hydrogels, while Task 2 will focus on arylazopyrazole-functionalized building blocks for the control with light of the hydrogels ´ self-assembly process as well as of their catalytic and biosensing properties.	

Proposal number 75	
Name and Surname	**Email**
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https://www.antonsolanaslab.com/	

Title of the proposal
Quantum light sources for quantum applications
Abstract
Single photons are the basic resource of quantum communication and photonic quantum computing, yet even the best sources deliver only a fraction of their photons to the user. This PhD project will establish where photons are lost in solid-state quantum light sources and how to recover them. The student will work with semiconductor quantum dots coupled to micropillars and emitters in hexagonal boron nitride coupled to open microcavities. Using low-temperature spectroscopy and higher-order photon-correlation measurements, the student will quantify the photon-number content of each source and trace its efficiency step by step, from emitter to single-mode fibre. This loss analysis will guide improvements such as optimised excitation schemes (resonant and phonon-assisted) and cavity design, and allow a direct comparison between deterministic and heralded sources under identical conditions. Finally, the best sources will be benchmarked in quantum key distribution protocols and, ultimately, spin–photon entanglement experiments.

Proposal number 76	
Name and Surname	**Email**
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https://nanobig.eu/	
Title of the proposal	
From Trapping to Sorting: Optical Tweezers for Selective Manipulation of Micro- and Nanoparticles	
Abstract	
This project aims to investigate the use of optical tweezers and structured light for the selective manipulation and sorting of micro- and nanoparticles. By tailoring optical force landscapes, the project will explore how particle properties such as size, refractive index, morphology and composition influence trapping and transport dynamics. Luminescent nanoparticles will be used as tunable model systems that allow simultaneous optical manipulation and spectroscopic monitoring. The knowledge generated will be applied to the selective handling of particles of increasing complexity, from engineered nanoparticles to micro/nanoplastics and biological nanoparticles such as extracellular vesicles. The project will establish new approaches for label-free particle discrimination and sorting, contributing to future photonic technologies for environmental monitoring, advanced materials processing and bioanalytical applications.	

Proposal number 77	
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https://www.uam.es/uam/investigacion/grupos-de-investigacion/detalle/f1-646	

Title of the proposal
Combined advanced oxidation and reduction processes for PFAS destruction in aqueous phase
Abstract
Perfluorinated alkyl substances (PFAS) are highly refractory environmental pollutants due to the exceptional strength of the carbon-fluorine bond. Traditional water treatment methods often fail to mineralize these compounds completely. This thesis aims to develop advanced oxidation and reduction processes by coupling novel photochemical and electrochemical technologies for the efficient destruction of PFAS. Special attention is devoted to achieving effective pollutant defluorination, overcoming one of the most critical bottlenecks currently reported in the literature. By optimizing reactor configurations and operating parameters, this research seeks to enhance mineralization yields and reaction kinetics. The outcomes will provide sustainable, scalable pathways for the complete elimination of persistent perfluorinated contaminants in aquatic matrices, offering valuable insights into degradation mechanisms and paving the way for advanced industrial water treatment applications.

Proposal number 78	
Name and Surname	**Email**
Luis Miguel Robledo Martin	luis.robledo@uam.es
web	
https://sites.google.com/view/nuclear theoryuam/home	
Title of the proposal	
Towards a fully microscopic theory of nuclear fission with beyond mean field techniques	
Abstract	
Beyond mean field techniques, like symmetry restoration (as a whole or in a domain) and fluctuations in relevant degrees of freedom including pairing will be considered in the theoretical description of nuclear fission. Observables like fission fragment properties or spontaneous fission lifetimes will be considered	

Proposal number 79	
Name and Surname	**Email**
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https://www.enriqueturiegano.es/	
Title of the proposal	
The Genetic Basis of Social Memory: from Drosophila to Humans	
Abstract	
Social memory is essential for recognizing individuals and regulating social interactions, yet its genetic basis remains largely unexplored. This project investigates whether human orthologues of memory-related genes identified in Drosophila melanogaster contribute to individual differences in social memory. Approximately 500 healthy adults will complete two experimental paradigms: face–name associative memory and a social learning task involving cooperation decisions	

based on previously learned group membership. Memory performance will be assessed after 2 and 24 hours to distinguish genetic contributions to early retention and longer-term consolidation.
Participants will be genotyped using high-density SNP arrays followed by imputation. Genetic analyses will mainly focus on human orthologues of 16 experimentally validated Drosophila genes and 68 additional candidate genes, examining individual variant associations and restricted polygenic scores. Broader gene sets will also be explored.
This comparative approach aims to identify evolutionarily conserved genetic contributions to human social memory and its temporal dynamics.

Proposal number 80	
Name and Surname	**Email**
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https://wastevalue.es/	
Title of the proposal	
Metal–Organic Frameworks for Peracetic Acid Activation: Advanced Catalytic Oxidation Processes for Water Treatment	
Abstract	
This project aims to develop innovative and sustainable technologies for water treatment based on the activation of peracetic acid (PAA) using metal–organic frameworks (MOFs) as catalytic materials. PAA is a promising oxidant for the removal of emerging contaminants from water due to its strong oxidizing properties and potential to generate highly reactive species under suitable conditions. MOFs offer unique opportunities for catalyst design owing to their tunable porosity, high surface area, and adjustable chemical composition. The project will investigate the synthesis, characterization, and catalytic performance of selected MOFs for PAA activation and the degradation of representative organic pollutants in aqueous matrices. Particular attention will be paid to identifying the reactive species involved, elucidating degradation mechanisms, and assessing the influence of operational parameters and water composition. Catalyst stability, reusability, and the formation of potentially harmful transformation products will also be evaluated. Ultimately, this research seeks to establish fundamental insights and practical strategies for advanced, efficient, and environmentally responsible water remediation.	

Proposal number 81	
Name and Surname	**Email**
Emma Martin Rodriguez	emma.martin@uam.es
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https://nanobig.eu/	
Title of the proposal	
Development of NIR-II Luminescent Nanomaterials for Bioimaging and Nanomedicine	

Abstract
We are offering a PhD project on the colloidal synthesis of nanoparticles and quantum dots emitting in the second near-infrared biological window (NIR-II, 1000-1700 nm). NIR-II-emitting nanomaterials are attracting growing interest as advanced optical probes for bioimaging due to their unique capabilities for deep-tissue imaging and high-resolution visualization in biological systems. The project will cover the design, synthesis, structural and optical characterization of high-performance nanomaterials, as well as their surface functionalization for applications in bioimaging and nanomedicine. The successful candidate will benefit from an interdisciplinary and international research environment, access to state-of-the-art facilities, specialized training, and collaborations with leading research groups. The project is ideal for highly motivated candidates with a background in Chemistry, Physics, Materials Science, Nanotechnology, or related disciplines and an interest in nanomaterials for biomedical applications.

Proposal number 82	
Name and Surname	**Email**
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www.pimpamchemistry.com	
Title of the proposal	
Bioinspired Photocatalytic Materials for Clean Water	
Abstract	
Clean water is one of the greatest global challenges of the 21st century. Inspired by nature's ability to harvest sunlight and drive complex chemical transformations, this PhD project will develop a new generation of bioinspired photocatalytic organic materials for water purification. The student will design and synthesize advanced materials that mimic key principles found in natural photoactive systems, exploring how molecular architecture controls light harvesting, charge transfer, and reactive oxygen species generation. These materials will be applied to the elimination of pollutants, microplastics, toxic metals, and pathogenic microorganisms from water. The project offers advanced training in organic and materials synthesis, photocatalysis, spectroscopy, and state-of-the-art characterization techniques. The successful candidate will join a young, dynamic, and internationally recognized research group, benefiting from close supervision, cutting-edge facilities, high-impact publications, international collaborations, research stays, and participation in leading scientific conferences, providing an outstanding platform for a successful international research career.	

Proposal number 83	
Name and Surname	**Email**
Linda Angela Zotti	linda.zotti@uam.es
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Title of the proposal
Electron transport through molecular junctions
Abstract
The relentless drive toward the miniaturization of devices goes far beyond a mere reduction in size. At the nanoscale, miniaturization opens up a vast range of new possibilities thanks to the exotic manifestations of various physical processes such as quantum interference or magnetism. One field of paramount importance for emerging (nano)technologies is molecular electronics, in which conventional electronic circuits are replaced by molecular junctions. In this project, electron transport through metal–molecule–metal junctions will be investigated. It will involve theoretical modelling based on various computational techniques. This project aims at gaining insight into the behaviour of dimeric junctions and the metal-molecule interface, which is currently a poorly-understood aspect, and a major hurdle for the future development of molecular electronic devices.

Proposal number 84	
Name and Surname	**Email**
Jorge Olmos Trigo	jorge.olmos@uam.es
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https://www.uam.es/ciencias/facultad/fisica-materiales/personal/jorge-olmos	
Title of the proposal	
Fundamental Limits of Chiral and Magneto-Optical Light–Matter Interactions: From Bounds to Optical Manipulation	
Abstract	
Chirality and nonreciprocity arise when a nanoparticle breaks parity or time-reversal symmetry. Both broken symmetries are fully encoded in the polarizability tensor of nanoparticles. This tensor, in turn, is constrained by energy conservation and passivity, which impose universal bounds on circular dichroism and magneto-optical responses. This PhD project builds on these bounds in three connected steps. First, we will derive them for arbitrary multipolar order using the T-matrix formalism, identifying the nanoparticles that saturate them. Second, since bounds are only meaningful if measurable, we will design protocols that retrieve the full polarizability tensor from one or two far-field observables. Third, because these bounds hold only for real frequencies, we will exploit complex-frequency excitations or/and optical gain to surpass them. Finally, since the same tensor governs optical forces and torques, surpassing the bounds will translate into enhanced mechanical effects, enabling enantioselective trapping and magneto-optical manipulation under general illumination conditions.	

Proposal number 85	
Name and Surname	**Email**
Jesus Martinez Garcia	jesus.martinezg@uam.es
web	
https://jesusmartinezgarcia.net/	
Title of the proposal	
Classifying positively curved algebraic varieties	

Abstract
The classification of algebraic varieties is a classical problem in algebraic geometry underpinning contemporary developments in moduli theory, birational and analytic geometry. Any algebraic variety (a shape given as solution to polynomial equations) can be constructed by putting together some basic building blocks. Fano varieties (one such type of block) are varieties of positive Ricci curvature. We will construct and describe explicit moduli spaces of Fano varieties of low dimension (typically 2 and 3). A moduli space is a parametrising space where each point represents one variety. Techniques used will include birational and computational algebraic geometry, AI and K-stability (a modern tool to study deformations of Fano varieties). Related work: * I. Cheltsov, T. Duarte Guerreiro, K. Fujita, I. Krylov, J. Martinez-Garcia. K-stability of Casagrande-Druel varieties. J. Reine Angew. Math. (Crelle's journal). 2025. * J. Martinez-Garcia. Constant scalar curvature Kähler metrics on rational surfaces. Mathematische Nachrichten. 2021.

Proposal number 86	
Name and Surname	**Email**
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https://members.ifimac.uam.es/stm2d/	
Title of the proposal	
Unravelling Chirality-Induced Spin Selectivity at Molecular–2D Material Interfaces	
Abstract	
How can chiral molecules induce spin selectivity without magnetic materials? Explore this question through a project investigating chirality-induced spin selectivity (CISS), a phenomenon that challenges conventional descriptions of spin transport. Chirality, the property that makes an object distinct from its mirror image, connects physics, chemistry, and biology. Yet how it generates spin polarization in non-magnetic systems remains unresolved. You will investigate this puzzle using two-dimensional transition metal dichalcogenides functionalized with chiral molecules. Combining molecular synthesis, ultrahigh-vacuum surface science, and spin-polarized scanning tunnelling spectroscopy, you will explore how molecular structure, chemical bonding, and substrate properties influence spin selectivity. This interdisciplinary project offers the opportunity to develop advanced experimental skills, investigate molecular interfaces at the atomic scale, and connect experimental observations with emerging theoretical models. Your research will help uncover the microscopic origins of CISS and advance our understanding of nanoscale spin control, opening new perspectives for molecular electronics and spin-based technologies.	

Proposal number 87	
Name and Surname	**Email**
Dirk Horst Ortgies	dirk.ortgies@uam.es
web	
https://nanobig.eu/	
Title of the proposal	
Targeted near-infrared imaging of heart attacks with luminescent nanoparticles	
Abstract	
The principal cause of death in most countries are cardiovascular diseases. Therefore fast, precise and cost-effective diagnosis and imaging of ischemic events – like heart attacks – is needed. The treatment and rehabilitation after such myocardial infraction would greatly benefit from earlier diagnosis and faster visualization. In this PhD thesis luminescent nanoparticles, which are not affected by the endogenous autofluorescence of tissues, will be synthesized. Special focus will be placed on the spectroscopic characterization (steady state and dynamic fluorescence, thermal properties) to be able to serve as targeted contrast and diagnostic agent for near-infrared imaging of the infarcted heart. Towards that goal their functionalization with commercially available cardiovascular drugs will be studied in vitro, ex vivo and in 3D cell cultures.	

Proposal number 88	
Name and Surname	**Email**
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https://www.cmam.uam.es/research/strategic-research-lines/quamtum-materials/	
Title of the proposal	
Creation via MeV ions of NV colour centres in diamond for magnetometry	
Abstract	
Diamond crystals with negatively charged nitrogen–vacancy (NV-) centers are promising systems for quantum magnetic sensing at the nanoscale with ultra-high sensitivity. Our goal is to exploit the possibilities at the CMAM tandem-type accelerator of ion-beam implantation in the MeV energy range as a precise and controlled way to create these NV- centers in synthetic diamond crystals, characterizing NV- and neutral NV0 centers both before and after annealing with Photoluminescence Spectroscopy and other techniques. Furthermore, this project also includes working on a related prototype to develop quantum sensors allowing to measure the magnetic field of biological systems among others. References: https://doi.org/10.1016/j.diamond.2024.111838 https://doi.org/10.1016/j.carbon.2023.04.004 https://doi.org/10.1016/j.carbon.2017.07.076 https://doi.org/10.1140/epjp/s13360-021-01085-9	

Proposal number 89	
Name and Surname	**Email**
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https://www.linkedin.com/in/carolina-belver-coldeira-6818ab77/?isSelfProfile=true	
Title of the proposal	
Beyond Pollutant Removal: Light-Driven Catalytic Materials for Cleaner Water	
Abstract	
This project aims to develop multifunctional catalytic materials for the removal of persistent organic contaminants from water, including selected organochlorine compounds and pharmaceuticals. The research will integrate pollutant adsorption and catalytic degradation, exploring how material composition, surface chemistry, and electronic properties influence treatment performance. Particular attention will be given to photo-assisted catalytic processes, investigating how light can enhance catalyst activity and pollutant transformation. Mechanistic studies will connect pollutant capture, reactive species generation, and degradation pathways to guide material design and process optimization. Beyond monitoring pollutant disappearance, the project will investigate transformation products, mineralization, and changes in toxicity to assess treatment effectiveness. Promising systems will be evaluated in complex water matrices, considering catalyst stability, reuse, and operating conditions. The project will provide interdisciplinary training in materials synthesis, characterization, environmental analysis, and catalytic processes, connecting fundamental research with practical challenges in sustainable water treatment within an international environment.	

Proposal number 90	
Name and Surname	**Email**
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web	
https://www.pimpamchemistry.com/	
Title of the proposal	
Photocatalytic nitrate reduction using Inorganic–Organic Hybrid Materials	
Abstract	
Photocatalytic nitrate reduction to ammonia offers a sustainable route to simultaneously remediate contaminated water and recover a valuable fuel and fertilizer. However, current photocatalysts suffer from fast charge recombination, poor selectivity towards ammonia, and limited stability. This project will design hybrid materials combining porous organic frameworks (COFs or porous organic polymers) with inorganic nanoparticles, exploiting the tunable porosity and light-harvesting properties of the organic and the inorganic component. The PhD student will synthesize and characterize these hybrids, tune the organic–inorganic interface, and evaluate their performance under simulated solar light in nitrate reduction towards green ammonia production. Combining spectroscopic, microscopy and kinetic studies, the work will establish structure–activity relationships to guide the rational design of selective, stable and scalable photocatalysts for water treatment and sustainable energy production.	

The work will be conducted within a collaborative research team with strong scientific output, providing an excellent platform for academic career development.

Proposal number 91	
Name and Surname	**Email**
Beata Maria Szydlowska	beata.szydlowska@uam.es
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https://szydlowskalab.com	
Title of the proposal	
Engineering 2D Materials and Functional Molecular Interfaces for Printed Electronics	
Abstract	
What if electronic materials could respond to their environment, change their properties, and be printed onto flexible surfaces? This PhD project explores two-dimensional (2D) materials, such as graphene, combined with responsive molecular systems to develop next-generation smart electronics. A particular focus is spin-crossover (SCO) materials, which reversibly switch between electronic spin states in response to stimuli such as temperature or light. We will investigate how their size, thickness, and interfaces with 2D materials influence switching behaviour. The candidate will gain hands-on experience in nanomaterial preparation, characterization, printing technologies, and device fabrication, connecting fundamental discoveries with applications in flexible sensors and adaptive electronics. Join PRISM Lab at Universidad Autónoma de Madrid for interdisciplinary research spanning chemistry, physics, and materials science. **Previous experience with spin-crossover materials or printed electronics is not required; curiosity, motivation, and enthusiasm for experimental research are highly valued.**	

Proposal number 92	
Name and Surname	**Email**
David Gonzalez Rodriguez	david.gonzalez.rodriguez@uam.es
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https://msmnlab.wixsite.com/dgrlab	
Title of the proposal	
Polar Self-assembled Molecular Materials	
Abstract	
Columnar nanostructures and liquid crystals, enabling control of the morphology and relative arrangement of individual π-conjugated molecules, are an important class of self-assembled organic materials that are making great impact in several optoelectronic technologies like transistors, solar cells, ferroelectric switches or light-emitting diodes. In collaboration with different groups, this project focuses on the self-assembly of cone-shaped π-conjugated molecules with axial dipole moments into non-centrosymmetric columnar supramolecular polymers and liquid crystalline materials. These systems may present switchable (ie. ferroelectric) or permanent polarization that can be coupled to charge transport, chiral-induced spin selectivity, (circularly polarized)	

luminiscence, or photovoltaic response, which are highly valuable features for future flexible organic optoelectronics.

Proposal number 93	
Name and Surname	**Email**
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https://msmnlab.wixsite.com/dgrlab/group	
Title of the proposal	
Biomimetic Molecular Containers for Advanced (Photo)catalytic Applications	
Abstract	
How can we recreate the remarkable efficiency of natural enzymes and photosynthetic systems using tailor-made molecules? This project will explore the design and synthesis of biomimetic molecular containers built from cofacially arranged porphyrins, creating confined nanoscale environments inspired by nature. By engineering these artificial cavities, we aim to control how molecules are recognized, organized, and transformed, unlocking new opportunities for selective catalysis and light-driven chemical reactions. Dynamic covalent chemistry and supramolecular interactions will be harnessed to construct adaptable architectures, while their structural, electronic, and photophysical properties will be investigated to understand how molecular confinement influences reactivity and energy transfer. Combining synthetic chemistry, supramolecular chemistry, and photochemistry, this research will bridge molecular design and function, paving the way towards artificial catalytic systems that emulate and potentially surpass selected features of natural systems.	

Proposal number 94	
Name and Surname	**Email**
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https://www.uam.es/psicologia/investigacion/grupos-de-investigacion/detalle/f1-563	
Title of the proposal	
Microbial Carbon Dynamics during Primary Soil Succession along the Antarctic Peninsula	
Abstract	
Climate change is transforming Antarctic terrestrial ecosystems, making it increasingly important to understand how newly exposed soils develop and respond to environmental change. This PhD project will examine the role of microorganisms in early soil development across the Antarctic Peninsula, using samples and data generated through the different research projects during the last 20 years. The doctoral candidate will receive interdisciplinary training in polar ecology, microbiology, environmental analysis and data science, while developing skills in independent research, scientific communication and international collaboration. The project will be conducted at the Universidad Autónoma de Madrid and will contribute to high-quality publications, open scientific resources and knowledge exchange. By combining fundamental research with internationally relevant environmental questions, the project will strengthen	

cooperation between Chinese and Spanish researchers, support the training of highly qualified scientific talent, and generate knowledge and transferable approaches relevant to the study and monitoring of vulnerable cold-region ecosystems under climate change.

Proposal number 95	
Name and Surname	**Email**
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https://www.uam.es/uam/investigacion/grupos-de-investigacion/detalle/f1-180	
Title of the proposal	
Next-generation green analytical platforms for screening emerging contaminants	
Abstract	
Emerging contaminants pose a global threat to water safety due to their potential risks to both environmental and human health. Therefore, it is crucial to develop analytical methods that enable real-time response and rapid decision-making to control the presence of these contaminants. This project aims to develop cutting-edge green analytical tools for the simultaneous on-site detection of different families of emerging contaminants such as pesticides and antibiotics. These tools will combine the use of advanced magnetic nanofluid sample extraction procedures with high-sensitivity ad-hoc electrochemical sensors based on nanohybrid composites formed by non-metallic/metallic nanomaterials and molecular imprinted polymers. To ensure the sustainability of the proposed analytical tools, deep eutectic solvents will be evaluated for use in both sample preparation and sensor development.	

Proposal number 96	
Name and Surname	**Email**
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https://www.uam.es/psicologia/investigacion/grupos-de-investigacion/detalle/f1-245 https://portalcientifico.uam.es/en/ipublic/researcher/261838	
Title of the proposal	
Next-Generation Biosensors for identifying and Tracking Pathogenic Bacteria and Antimicrobial Resistance Across One Health Environments (BIOS-BACTERIA/AMR-TRACK).	
Abstract	
The general objective of BIOS-BACTERIA/AMR-TRACK is to design, develop, characterize and validate next-generation multi-target electrochemical/electrochemiluminiscent biosensing platforms for the rapid, sensitive, selective and reliable detection of antibacterial resistance testing of pathogens and genes in the WHO BPPL (WHO 2024, WHO bacterial priority pathogens list) across interconnected clinical and environmental One Health scenarios. The project will investigate innovative biosensing architectures integrating advanced biorecognition strategies, new promising nanomaterials, including Metal-Organic Frameworks (MOFs), Mechanically Interlocked Carbon Nanotubes	

(MINTs) and hybrid nanomaterials, with electrochemical and electrochemiluminiscent transduction approaches

Proposal number 97	
Name and Surname	**Email**
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www.ferryprinslab.com	
Title of the proposal	
Perovskite and nanocrystal semiconductors for next-generation solar cells and LEDs: visualising energy transport to boost device efficiency.	
Abstract	
Metal-halide perovskites and colloidal nanocrystals are transforming optoelectronics, offering low-cost, solution-processed routes to highly efficient solar cells and light-emitting diodes. Yet their performance remains limited by how energy moves through these materials: excitons and charge carriers diffuse, get trapped at defects and grain boundaries, or are lost before they can be extracted or emitted. In this PhD project, you will use state-of-the-art transient microscopy, developed in our laboratory at IFIMAC-UAM, to directly visualise how excitons and charges move through perovskite and nanocrystal films on picosecond timescales. You will connect these insights to material design by synthesising and processing new perovskite compositions, nanocrystal assemblies and low-dimensional structures, and by fabricating prototype solar cells and LEDs to test their performance. The project, embedded in an ERC-funded team, offers training in materials synthesis, ultrafast spectroscopy and device engineering, and aims to establish design rules for the next generation of efficient, stable optoelectronic devices.	

Proposal number 98	
Name and Surname	**Email**
Pablo Molina de Pablo	pablo.molina@uam.es
web	
Title of the proposal	
Advanced Multimaterial Photonic Technologies for Selective Particle Sorting and Analysis	
Abstract	
This project aims to develop a novel multimaterial photonic platform for the selective manipulation and sorting of micro- and nanoparticles according to their intrinsic physical properties, including size, refractive index and surface charge. The proposed approach combines ferroelectric materials, nanophotonic structures, functional polymers and luminescent nanoparticles to generate reconfigurable force landscapes for label-free particle control. Luminescent particles will be used as model systems to investigate the physical mechanisms governing trapping and sorting processes. The technology will be validated using two representative application scenarios: micro- and nanoplastics as emerging environmental contaminants, and extracellular vesicles as model biological nanoparticles. The project will establish the scientific foundations of a	

versatile particle-sorting platform with potential applications in advanced manufacturing, environmental monitoring and future bioanalytical technologies.

Proposal number 99	
Name and Surname	**Email**
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web	
https://www.uam.es/ciencias/facultad/dpto-biologia/navarro-castilla-alvaro	
Title of the proposal	
Two sides of the same coin: behavioral plasticity of the European rabbit (Oryctolagus cuniculus) at the crossroads of conservation and population control	
Abstract	
The European rabbit represents a paradox: it is a keystone species threatened in parts of its native range, yet a destructive invasive elsewhere. This project will explore the behavioral responses of rabbits to ecological factors (e.g., competition, predation risk, social interactions) and to gradients of human influence (e.g., land use, infrastructure). The research aims to unravel the mechanisms that enable rabbits to adapt and thrive under shifting conditions, providing valuable insights and tools for conservation and management, potentially transferable to Asiatic regions where lagomorph species are both endangered and conflictive. References: [1] https://doi.org/10.1016/j.ecolind.2018.10.016 ; [2] https://doi.org/10.1093/cz/zox048 ; [3] https://doi.org/10.4404/hystrix-28.2-12332 ; [4] https://doi.org/10.1016/j.mambio.2013.08.004	

Proposal number 100	
Name and Surname	**Email**
Sergio Diaz-tendero Victoria	sergio.diaztendero@uam.es
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https://www.molpm.es/	
Title of the proposal	
Ultrafast Dynamics of Ionized Molecules	
Abstract	
Ionization triggers a wide range of ultrafast molecular processes through the interplay between electronic and nuclear dynamics. These processes can lead to charge redistribution, bond breaking, isomerization, and the formation of new molecular structures on femtosecond timescales. Understanding these mechanisms is a fundamental challenge in molecular physics and is essential for interpreting cutting-edge time-resolved experiments. The aim of this PhD project is to investigate the dynamics of complex molecular systems following ionization using state-of-the-art theoretical and computational methods. The candidate will study the coupling between electronic and nuclear motion and the mechanisms driving structural rearrangement and fragmentation. The research will combine electronic-structure calculations with molecular dynamics simulations. The PhD student will receive training in molecular physics, computational chemistry, and molecular dynamics. The project will be developed in close collaboration with	

international experimental groups with access to large-scale facilities, including synchrotrons, ion accelerators, and X-ray free-electron lasers.

Proposal number 101	
Name and Surname	**Email**
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https://projects.ift.uam-csic.es/damasco/	
Title of the proposal	
The use of cosmological simulations to shed light on the nature of dark matter and to guide dark matter searches with DESI	
Abstract	
This PhD project aims to improve our understanding of dark matter (DM) clustering at the smallest scales and its implications for indirect DM searches. Using state-of-the-art numerical simulations, the research will characterize the Galactic DM subhalo population, including its abundance, internal structure, and evolution under the influence of both dark matter and baryonic components. High-resolution simulations will enable the derivation of accurate subhalo density profiles, annihilation luminosities, concentration-mass relations, and improved boost-factor models. The project will also exploit data from the DESI survey, combining spectroscopic observations, hydrodynamical simulations, and machine-learning techniques to constrain the properties and distribution of Galactic subhalos. By comparing observations with theoretical predictions, the work will enhance the interpretation of DM searches and help optimize future observational strategies, including those of DESI-II and the Vera Rubin Observatory.	

Proposal number 102	
Name and Surname	**Email**
David Gonzalez Calatayud	david.gcalatayud@uam.es
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https://combiocat.owlstown.net/	
Title of the proposal	
Metal Complexes and Porous Hybrid Materials for Next-Generation Photo- and Electrocatalysis	
Abstract	
The transition toward sustainable energy technologies requires the development of efficient catalytic materials capable of harvesting solar energy and promoting selective electrochemical transformations. Building on expertise in coordination chemistry, nanostructured materials, and advanced characterisation techniques, this project aims to develop innovative metal complexes and porous hybrid materials incorporating two-dimensional organic matrices as versatile platforms for photo- and electrocatalysis. Particular attention will be devoted to the rational design of transition-metal-based catalysts and their integration into extended 2D organic frameworks to enhance light absorption, charge separation, mass transport, and catalytic stability. Advanced structural, spectroscopic, and electron microscopy techniques will be employed to	

elucidate structure-property-performance relationships at the molecular and nanoscale levels. The resulting materials will be evaluated in key applications such as solar-driven hydrogen production, electrochemical energy conversion, and the photocatalytic degradation of emerging contaminants. By merging molecular catalyst design with functional 2D organic architectures, the project seeks to establish efficient and robust catalytic platforms for clean energy generation and environmental sustainability.

Proposal number 103	
Name and Surname	**Email**
Natalia Castejon Caballero	natalia.castejon@uam.es
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Title of the proposal	
Beyond Omega-3: Unlocking Microalgal Oxylipins for Functional Foods and Healthy Aging	
Abstract	
Microalgae are sustainable sources of omega-3 polyunsaturated fatty acids (PUFAs) and bioactive lipids with promising applications in human health. Oxylipins are oxygenated derivatives of PUFAs, particularly those derived from arachidonic acid (ARA), eicosapentaenoic acid (EPA), and docosahexaenoic acid (DHA). Certain oxylipins, including specialized pro-resolving mediators (SPMs), play key roles in inflammation resolution and have attracted interest for their potential neuroprotective effects in age-related neurodegenerative diseases, such as Alzheimer's and Parkinson's. However, the chemical diversity and biological potential of microalgal oxylipins remain largely unexplored. This PhD project aims to explore their neuroprotective potential for the development of novel functional food ingredients. Green extraction technologies, advanced fractionation, and lipidomic approaches will be combined with in vitro bioactivity assays. This research is expected to provide new insights into microalgal oxylipins, supporting their potential applications in functional foods for healthy aging. References • https://doi.org/10.1021/acs.jafc.4c03264 • https://doi.org/10.1016/j.algal.2024.103480	

Proposal number 104	
Name and Surname	**Email**
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https://sites.google.com/view/tcam/home	
Title of the proposal	
Electronic and Nuclear Dynamics in Ion–Molecule Collisions	
Abstract	
Ion–molecule collisions involve coupled electronic and nuclear dynamics leading to charge transfer, electronic excitation, ionization and molecular fragmentation. This PhD project will develop and apply theoretical methods to investigate these processes in	

low- and intermediate-energy collisions, with particular emphasis on water and related molecules.
The student will perform high-level ab initio calculations of electronic states and nonadiabatic couplings using multiconfigurational methods such as CASSCF and MRCI. These data will be incorporated into time-dependent semiclassical collision calculations to obtain state-resolved probabilities and cross sections for charge transfer and excitation, explicitly considering molecular orientation effects.
The project will also investigate the nuclear dynamics following the collision. Wave-packet propagation on coupled potential-energy surfaces will connect the initial electronic process with molecular fragmentation and fragment production. Theoretical results will be compared with available experimental measurements, providing a consistent description of ion–molecule collisions from the initial electronic transition to the subsequent nuclear dynamics. Ref: 10.1103/PhysRevLett.134.093002, 10.3390/molecules30010074.

Proposal number 105	
Name and Surname	**Email**
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www.orthotree.net	
Title of the proposal	
Deciphering the true diversity of Orthotrichaceae (mosses) in China: an integrative taxonomic approach	
Abstract	
Orthotrichaceae is a highly diverse and widespread moss family. We study its diversity, distribution, and evolution using integrative approaches, and have described over 40 new taxa (https://www.orthotree.net). We have obtained samples from unexplored regions worldwide, including China. Many recent collections remain to be studied and will enhance understanding the true Orthotrichaceae diversity in China, which is likely underestimated. The student will lead analyses of stored samples, both in MAUAM herbarium, in Chinese herbaria, and through new sampling in poorly known areas of the country. The integrative approach combines advanced biometric analyses with taxonomy based on NGS and biogeographic modeling.	

Proposal number 106	
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https://www.cbm.uam.es/blopez	
Title of the proposal	
Caracterización de variantes del transportador de glicina GlyT2 asociadas a hiperplexia humana	
Abstract	
La hiperplexia o enfermedad de sobresalto (OMIM: 149400) es una enfermedad neurológica rara que puede producir muerte súbita del recién nacido. Las mutaciones	

en el gen SLC6A5 del transportador neuronal de glicina GlyT2 humano son causa frecuente de hiperplexia. En esta tesis se identificarán y caracterizarán variantes de GlyT2 encontradas en pacientes de hiperplexia en cuanto a su efecto sobre la estructura 3D del transportador, su tráfico intracelular y su recientemente descubierto papel en el desarrollo de la neurotransmisión glicinérgica. Se identificarán acciones de rescate de los mecanismos patogénicos para diseñar futuros enfoques de terapia personalizada.

Proposal number 107	
Name and Surname	**Email**
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https://www.facebook.com/BIoActiveMeUnits	
Title of the proposal	
Emerging Dinuclear Helicates with DNA/RNA Binding Selectivity for Biomedical Applications	
Abstract	
This project aims to prepare novel coordination compounds with potential biological activity, focusing on dinuclear helicates designed to interact with DNA/RNA through enhanced non-covalent interactions. First, the synthesis will be optimized to maximize yields and control complex formation. Second, compounds stability in solution, under biologically relevant conditions, will be assessed using spectroscopic and analytical techniques. This will establish optimal conditions for investigating their interactions with different DNA/RNA structures, including supercoiled and double-stranded DNA, as well as alternative DNA/RNA structures involved in cancer, degenerative or/and inflammatory disease processes. Binding affinities will be determined to identify the most promising candidates. Ultimately, the findings may contribute to the development of novel metal-based compounds with improved selectivity towards cancer cells and other promising biological applications. References: AG Quiroga et al., Inorg. Chem. Front., 2025,12, 6191. AG Quiroga et al., Inorg. Chem. 2025, 64, 22852. AI Matesanz et al.; J. Inorg. Biochem., 2020, 203, 110875.	

Proposal number 108	
Name and Surname	**Email**
Diego Llusia Genique	diego.llusia@uam.es
web	
https://scholar.google.es/citations?hl=es&user=YnKh3d4AAAAJ&view_op=list_works&sortby=pubdate	
Title of the proposal	
Bioacoustics and artificial intelligence: new tools for monitoring anuran communities	
Abstract	
Frogs and AI: the project will aim at developing new technologies to monitor Asian frogs, increasing our capacity to study these endangered animal group and better understand	

their behaviour, ecology and conservation needs. In the last two decades, the study of biodiversity has undergone a remarkable change. Acoustic monitoring is revolutionizing traditional surveys and expanding how we investigate communities and animal behaviour. By using automated acoustic sensors and artificial intelligence, we will enable scalable, non-invasive frog monitoring and provide novel tools to study ecological dynamics at large time and spatial scales. This project aims to develop and apply these techniques for Asian frogs, by (i) reviewing state-of-the-art; (ii) generating datasets of species calls; (iii) developing AI models for automated call detection and classification; and (iv) implementing them in global change research. The PhD student will be highly trained in bioacoustics and artificial intelligence, an emerging field in ecology.

Proposal number 109	
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Maria Cristina Gutierrez Sanchez	cristina.gutierrezs@uam.es
web	
https://portalcientifico.uam.es/es/ipublic/researcher/281321	
Title of the proposal	
Development of Electrochemical Biosensors Based on Advanced Nanomaterials for Biomarker Detection.	
Abstract	
Biomarkers, whether of biological or non-biological origin, including volatile organic compounds (VOCs), are essential indicators for identifying physiological and pathological changes and play a key role in disease diagnosis, prognosis, and monitoring. The development of electrochemical biosensors based on advanced nanomaterials has significantly improved detection technologies, enabling faster, more sensitive, and selective biomarker identification. These improvements are attributed to the physicochemical properties of nanomaterials, including high electrical conductivity, large specific surface area, and functionalization capabilities, which enhance electron transfer and analyte interactions. Consequently, these biosensors offer improved analytical performance and can detect very low analyte concentrations. Furthermore, their integration into sensing platforms facilitates the development of portable, affordable devices suitable for early diagnosis and point-of-care testing. Overall, these advances promote progress in personalized medicine and disease monitoring, establishing nanomaterial-based electrochemical biosensors as promising tools for biomedical research and clinical diagnostics.	

Proposal number 110	
Name and Surname	**Email**
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web	
Investigación en Tecnologías Ambientales y Catalíticas Avanzadas (ITACA)	
Title of the proposal	
Scale-up of Iron-Based Photoassisted Nitrate Reduction: From Batch to Continuous-Flow Reactor Design for Drinking Water Treatment	

Abstract
Nitrate (NO_3^-) contamination of groundwater and surface water is a major public health concern shared by Spain and China, both countries facing severe diffuse pollution from intensive agricultural activities. The Investigación en Tecnologías Ambientales y Catalíticas Avanzadas (ITACA) Group at UAM has developed and patented a novel iron/oxalic acid photoassisted process that selectively converts NO_3^- into harmless N_2 gas under UV irradiation, with well-established reaction kinetics and mechanism. The proposed doctoral project will focus on the scale-up of this process from batch laboratory conditions to continuous-flow reactor configurations, optimising photon efficiency, reactor design, and operating conditions using Spanish groundwater matrices. This bilateral framework offers a strong scientific complementarity between both institutions, addressing a water quality challenge of global relevance and contributing to sustainable drinking water treatment solutions aligned with UN SDG 6.

Proposal number 111	
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https://campusys.es/	
Title of the proposal	
Attosecond Molecular Dynamics	
Abstract	
Since the first attosecond experiments performed in molecules, the field of attosecond science has grown exponentially. As a result, it is nowadays possible to follow in real time the “fast” motion of electrons in molecules and understand how this affects the “slower” motion of atomic nuclei and viceversa. In addition, the role of pulse-induced coherences in the ensuing molecular dynamics is receiving a considerable attention, since they may offer new opportunities to control chemical reactions and open new scenarios for quantum information technologies. The project aims at theoretically describing the coupled electron–nuclear dynamics of molecules upon interaction with atto- and few-femtosecond pulses, at frequencies ranging from the UV-Vis to the X-rays. The focus will be the exploration of novel pump–probe schemes to initiate and monitor these ultrafast molecular dynamics, and the simulation of associated time-resolved signals for the interpretation of current experiments.	

Proposal number 112	
Name and Surname	**Email**
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https://www.facebook.com/BIoActiveMeUnits	
Title of the proposal	
Innovative Pt(IV) Cancer Prodrugs: Achieving Intracellular Control via Regulated Speciation and Kinetics	

Abstract
This project focuses on developing innovative Platinum(IV) cancer prodrugs to overcome the limitations of cisplatin and carboplatin therapies. While Pt(IV) complexes are compelling candidates for drug innovation, understanding their precise in vivo activation and intracellular speciation remains a critical challenge in drug design. This research proposes an alternative strategy to achieve strict chemical control within cells. By utilizing active, unconventional Pt(II) units with mixed ligands, we will reduce substitution lability along the trans-axis, effectively circumventing undesired speciation. We will first investigate the specific mechanisms of action, chemical kinetics, and pharmacological characteristics of these agents. These steps are crucial to selecting the most promising candidates validated in anticancer models (in vitro). Chen, S., et al. (2024). Inorganic Chemistry Frontiers, 11(11), 3085–3118. Kowoll, C.,et al. (2019). Angewandte Chemie International Edition, 58(22), 7464–7469.A.G Quiroga, A.G et al. (2025). Inorganic Chemistry Frontiers, (12), 6191–6203.

Proposal number 113	
Name and Surname	**Email**
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https://fuam.es/grupos/biotecnologia-basada-en-vectores-herpesvirales-y-lentivirales/	
Title of the proposal	
HSV-1 Gene Transfer Vectors	
Abstract	
Gene transfer vectors hold an enormous potential in diverse applications such as nanofabrication of new materials, engineering cells and organisms with novel functions, and molecular medicine. In this biotechnological revolution, herpesvirus amplicon vectors, devoid of all viral genes, are one of the most promising platforms since they can carry up to 10 times larger genomic cargo than other viral vectors and have negligible toxicity. However, extensive use of this increased coding capacity in biotechnology is currently limited by the difficulty of their largescale production without their contamination with viral genomes. Thus, together with our collaborations to advance herpesvirus vector-mediated therapies in cancer, neurogenic bladder dysfunction and skin diseases, we are using mathematical modelling and fluorescently labelled mutant viruses to identify key parameters of herpesvirus vector growth dynamics to devise scaleable strategies for amplicon vector production.	

Proposal number 114	
Name and Surname	**Email**
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https://www.cial.uam-csic.es/investigacion/departamentos/departamento-de-produccion-y-caracterizacion-de-nuevos-alimentos/grupo-de-ingredientes-alimentarios-saludables/	

Title of the proposal
Nutritional, environmental, and technological strategies for modulating the health-related properties of edible insects
Abstract
Edible insects are emerging in Europe as a promising source of sustainable nutrients and bioactive compounds. However, the factors determining their nutritional and health-promoting properties remain largely unexplored. Understanding how these characteristics can be modulated through rearing and processing strategies represents a challenge for the development of next-generation insect-based products. This PhD, within the national MOBIMIENTO (PID2025-168531OB-I00) and European DiBaN (101162517) projects, will explore how diet, rearing conditions and technological processing influence insect composition and bioactivity, aiming to develop innovative solutions to improve human, animal and plant/soil health under the One Health concept. The student will work on insect production, chemical characterization and bioactivity assessment using advanced environmentally friendly technologies, covering dietary interventions, optimization of rearing and processing conditions and insect-based bioconversion of agrifood by-products. The candidate will join the INGREEN group at the Food Science Research Institute (CIAL, CSIC-UAM), one of the Spanish leading food research centers.

Proposal number 115	
Name and Surname	**Email**
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https://www.cbm.uam.es/index.php/scientific-programs/interactions-with-the-environment/microbes-in-health-and-welfare/biotechnology-and-genetics-of-extreme-thermophiles/	
Title of the proposal	
Engineering a Two-Hybrid System in Thermus thermophilus for the Identification and Evolution of Thermoresistant Protein Interactions	
Abstract	
Designing thermostable protein-protein interactions at temperatures above 60°C remains a major challenge in biotechnology. Such interactions are of considerable applied interest because they could enable the development of highly robust diagnostic reagents, next-generation therapeutic proteins, and industrial biocatalysts. The overall objective of this project is to establish the first versatile two-hybrid platform operating in the thermophilic bacterium Thermus thermophilus for the detection, quantification, selection, and evolution of thermostable protein-protein interactions. The resulting complementation will generate easily measurable outputs, such as fluorescence, antibiotic resistance or enzymatic activity enabling both quantitative analysis and high-throughput selection of interacting protein pairs under thermophilic conditions. Once established, the platform will be applied to the evolution of thermostable binding by many proteins of biotechnological interest including, nanobodies, DARPins, peptide-binding domains, and AI-designed binders generated using state-of-the-art	

computational approaches. The most interesting binders will be studied for their possible application in biotechnology.

Proposal number 116	
Name and Surname	**Email**
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Title of the proposal	
Orbitronics: moving beyond spin	
Abstract	
Current electronic technologies exploit the electron's spin, but they depend on heavy metals and rare earth elements with a high environmental impact. This project proposes an emerging and more sustainable alternative: the use of the electron's orbital angular momentum, which can be even more efficient than spin. The student will explore the generation, diffusion, and interaction of orbital moments in magnetic devices based on light materials (Cu,Ti,Cr,C), learn how to distinguish orbit effects from spin, and investigate them in real devices.	

Proposal number 117	
Name and Surname	**Email**
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web	
https://catalyst-enabling-synthetic-chemistry.com/	
Title of the proposal	
Computational and Experimental Studies on Sustainable C–H Functionalization via First-Row Transition Metal Catalysis	
Abstract	
This PhD project builds on our group's pioneering work in C–H functionalization using palladium catalysis and the (2-pyridyl)sulfonyl directing group, achieving precise and remote C–H activation in complex molecules such as peptides.[1] Expanding this expertise, we now explore cobalt catalysis, a fast-growing, sustainable field offering novel reactivity and selectivity.[2] Our recent discovery of Co–Ag bimetallic mechanisms opens unprecedented pathways for β-C(sp^3)–H activation.[3] The project aims to elucidate these mechanisms and develop asymmetric cobalt-catalyzed reactions. It offers international students multidisciplinary training in organic synthesis, organometallic chemistry, and DFT modeling within a dynamic research environment, preparing them for impactful careers in sustainable catalysis and molecular innovation.	

Proposal number 118	
Name and Surname	**Email**
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https://catalyst-enabling-synthetic-chemistry.com/	

Title of the proposal
New approaches to porphyrin and BODIPY–peptide conjugates
Abstract
Cyclic peptides have emerged as versatile chemical scaffolds for the development of molecular imaging agents applicable to a broad range of biological studies. Recently, our research group established a methodology for synthesizing cyclic peptides via the 1,3-dipolar cycloaddition reaction. Some of the resulting fluorescent derivatives exhibit efficient cellular internalization and predominant localization within mitochondria. Building on these findings, we plan to extend this approach to conjugate BODIPY or porphyrinoid fragments to the cyclopeptide backbone. This strategy is expected to yield novel molecules with enhanced optical properties, which will be evaluated as potential therapeutic agents for photodynamic therapy.

Proposal number 119	
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https://www.uam.es/ciencias/facultad/departamentos/ingenieria-quimica	
Title of the proposal	
Advanced Bimetallic Catalysts for Formic Acid Dehydrogenation: From Catalyst Design to 3D-Printed Structures and Process Scale-Up	
Abstract	
This research will focus on the development and study of bimetallic catalysts for formic acid dehydrogenation in both liquid and gas phases. Different metal loadings and combinations, as well as metal incorporation methods, will be investigated to identify suitable cocatalysts that reduce the amount of Pd required while optimising catalytic performance. Based on the selected catalysts, structured catalysts will be fabricated using 3D printing. The effects of different reaction variables will be evaluated, together with the stability of selected catalysts. The research will also include kinetic studies and process modelling to support the scale-up of the process. This research project offers an excellent opportunity to gain hands-on experience in materials preparation and chemical reaction engineering in Spain. The work will be carried out in an international scientific environment alongside researchers from different countries, cultural exchange, and the development of communication and interpersonal skills within a welcoming and multicultural academic community.	

Proposal number 120	
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Title of the proposal	
Orbitronics: moving beyond spin	

Abstract
Current electronic technologies exploit the electron's spin, but they depend on heavy metals and rare earth elements with a high environmental impact. This project proposes an emerging and more sustainable alternative: the use of the electron's orbital angular momentum, which can be even more efficient than spin. The student will explore the generation, diffusion, and interaction of orbital moments in magnetic devices based on light materials (Cu,Ti,Cr,C), learn how to distinguish orbit effects from spin, and investigate them in real devices.

Proposal number 121	
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https://www.cbm.uam.es/index.php/scientific-programs/genome-dynamics-and-function/genome-decoding/genetics-and-cell-biology-of-cancer-t-cell-lymphoblastic-neoplasms/	
Title of the proposal	
Proposal of personalized treatments for high-risk pediatric T-ALL patients.	
Abstract	
A substantial proportion of pediatric T-ALL patients fail treatment or relapse, highlighting the need for early identification of high-risk cases. We have recently developed two transcriptional biomarkers detectable at diagnosis: one predicts poor response to therapy, characterized by high minimal residual disease (MRD) (doi: 10.1002/1878-0261.70234), and the other identifies patients at risk of adverse outcomes despite low MRD after induction therapy (doi: 10.1111/bjh.70118). We hypothesize that these biomarkers not only predict prognosis but may also reveal specific therapeutic vulnerabilities. Using clinical and transcriptomic data from 1,335 pediatric T-ALL patients, we are conducting in silico drug prioritization to identify compounds with the highest predicted efficacy for each biomarker-defined subgroup. This project aims to validate candidate therapies in cellular models, elucidate the molecular mechanisms underlying drug sensitivity, and ultimately enable personalized treatment strategies for high-risk patients. Future stages will include functional precision medicine approaches using patient samples and patient-derived xenograft models.	

Proposal number 122	
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https://www.cbm.uam.es/index.php/programas-cientificos/procesos-fisiologicos-y-patologicos/redes-metabolicas-y-senalizadoras-en-la-enfermedad/senalizacion-mitocondrial-del-calcio-y-senalizacion-de-insulina-leptina-en-envejecimiento/?lang=es	
Title of the proposal	
Role of citrin in calcium regulation of liver metabolism and oxidative stress	

Abstract
Citrin Deficiency (CD) is a rare inherited metabolic disorder caused by mutations in SLC25A13, encoding citrin, a mitochondrial aspartate-glutamate carrier essential for the urea cycle, glucose metabolism, and cellular redox balance. Patients develop hypoglycaemia, hyperammonaemia, citrullinaemia, dyslipidaemia, and signs of oxidative stress, but the molecular mechanisms underlying the disease remain poorly understood. This project will investigate two major unanswered questions: how citrin contributes to Ca^{2+}-dependent metabolic regulation in the liver, and how citrin dysfunction leads to oxidative damage. Using a novel mouse model lacking both mitochondrial aspartate-glutamate carriers in hepatocytes, the candidate will study primary liver cells and in vivo models through respirometry, metabolic biosensors, and biochemical assays. The work will explore the role of citrin in regulating mitochondrial respiration, gluconeogenesis, ureagenesis, and redox homeostasis. The project offers advanced training in metabolism, mitochondrial biology, and liver disease, contributing to a better understanding of CD pathogenesis and the identification of potential therapeutic targets.

Proposal number 123	
Name and Surname	**Email**
Antonio Quesada del Corral	antonio.quesada@uam.es
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Title of the proposal	
Microbial colonization in Antarctica. Studies on viability and Advanced Data Science	
Abstract	
MICROAIRPOLAR is a multidisciplinary project focused on understanding how microorganisms travel through the air in polar regions and can colonize the recently deglaciated areas. Empirical results with genetic-driven experiments and numerical models simulate microbial colonization scenarios and help identify potential interplanetary transport route networks. To trace the origin of microorganisms, the project develops machine learning algorithms for mixed finite and infinite-dimensional data using functional data analysis. This research is crucial for studying invasive microbial species in deglaciated areas affected by climate change, with implications for biogeography, environmental and human health. This project is part of the international initiative Antarctica InSync.	

Proposal number 124	
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https://nuria-torrado.webnode.es/ https://www.uam.es/uam/investigacion/grupos-de-investigacion/detalle/f1-126	
Title of the proposal	
Opening the Black Box: Kernel Methods for Interpretable and Trustworthy AI	

Abstract
Trustworthy artificial intelligence requires both accurate predictions and a deeper understanding of how machine learning models generate them. This PhD project will harness the mathematical structure of orthogonal polynomial kernels to reveal how kernel-based models produce their predictions. Building on established kernel constructions, it will investigate the contributions of individual variables, their interactions, and the mathematical mechanisms shaping model behavior. Combining orthogonal expansions, reproducing kernel Hilbert space theory, and computational methods, the research will develop tools supporting explainable and trustworthy AI while assessing model stability and predictive performance. These insights will also guide the analysis and development of new orthogonal polynomial kernels. The proposed methods will be evaluated through reproducible classification and regression experiments across diverse domains, including system reliability. We welcome motivated candidates with backgrounds in statistics, applied mathematics, data science, computer science, or engineering who seek to connect rigorous mathematical research with real-world challenges in artificial intelligence.

Proposal number 125	
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https://portalcientifico.uam.es/es/ipublic/researcher/258518	
Title of the proposal	
Solar facility effects on vertebrate predator and prey populations	
Abstract	
Energy transition is a must to minimize climate change effects, and solar energy is key for that. The doctoral project aims to improve the understanding of how Solar Facilities (SFs) affect vertebrate populations, with a special focus on the establishment of prey populations and their interactions with predators within them. This will be done through the development of synthetic models based on functional characters as well as different inter-populations and energy/trophic relations of vertebrates. Base data will come from research under development, official monitoring reports from SFs in Spain and bibliography, and there is potential to search for collaboration with Chinese researchers or administrations to improve the cross-regional generality of results. The final objective of the study goes far beyond applied research, as it aims to make specific recommendations on how SFs can be made more sustainable, both in terms of ecological impacts and energy production.	

Proposal number 126	
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https://members.ifimac.uam.es/atomelix/	
Title of the proposal	
Theory and simulation of exciton-magnon-photon coupling for quantum information	

Universidad Autónoma de Madrid

Abstract
The interaction between electronic excitations and magnetic order provides a route to probing and controlling quantum materials with light. In magnetic semiconductors, excitonic resonances enable optical determination of antiferromagnetic spin orientation and magnetic control of negative refraction, demonstrating the sensitivity of bound electron–hole states to their magnetic environment. Experiments in CrSBr further reveal magnon-mediated interactions between excitons, excitonic torques acting on magnetic dynamics, and microwave-to-optical conversion through magnon–exciton coupling. Complementary studies of spin-split electronic structure and light-driven magnetic switching in altermagnets broaden the motivation for understanding optical access to compensated magnetic systems. These developments raise a microscopic question: how does the interaction between optically active excitons and collective spin excitations emerge from their constituent electrons and holes? The student will address this question through a common first-principles electronic description of excitons and magnons interacting with light.

Proposal number 127	
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https://portalcientifico.uam.es/es/ipublic/researcher/260693	
Title of the proposal	
Optical manipulation beyond the optical trapping	
Abstract	
The manipulation of objects using light evolved from an exceptional new technique worthy of the 2018 Nobel Prize into a standard technique used in laboratories around the world. This technique is commonly used for trapping microparticles (J. Phys. Photonics, 2023, 5, 022501). However, other possibilities are presently emerging, such as nanoscopic, gravitational-like, induced interactions; magnetic monopole generation; and collective active diffusion. This thesis proposal will focus on the theoretical and computational study of these new fields and will benefit from the close collaboration with experimental partners working with the thesis supervisor. Scattering Forces from the Curl of the Spin Angular Momentum of a Light Field, Silvia Albaladejo, Manuel I. Marqués, Marine Laroche and Juan José Sáenz, Phys. Rev. Lett. 102, 113602 (2009) DOI: https://doi.org/10.1103/PhysRevLett.102.113602 Giant Enhanced Diffusion of Gold Nanoparticles in Optical Vortex Fields, Silvia Albaladejo, Manuel I. Marqués,Frank Scheffold and Juan Jose Sáenz, Nano Lett. (2009), 9, 10, 3527–3531 DOI: https://doi.org/10.1021/nl901745a Light Induced Inverse-Square Law Interactions between Nanoparticles: “Mock Gravity” at the Nanoscale J. Luis-Hita1, M. I. Marqués, R. Delgado-Buscalioni, N. de Sousa, L. S. Froufe-Pérez, F. Scheffold and J. J. Sáenz Phys. Rev. Lett. 123, 143201 (2019), DOI: https://doi.org/10.1103/PhysRevLett.123.143201 Magneto-optical Particles in Isotropic Spinning Fields Mimic Magnetic Monopoles Manuel I. Marqués, Shulamit Edelstein, Pedro A. Serena, Beatriz Castillo López de

Universidad Autónoma de Madrid

Larrinzar and Antonio Garcia-Martín, Phys. Rev. Lett. 133, 046901(2024) DOI: https://doi.org/10.1103/PhysRevLett.133.046901

Proposal number 128	
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https://portalcientifico.uam.es/en/ipublic/researcher/261839	
Title of the proposal	
Impact of Molecular Crowding and Protein Aggregation within Virus-Based Nanocontainers	
Abstract	
Molecular crowding and confinement are fundamental features of the cellular environment that can alter protein structure, function, and stability, while also promoting aggregation processes associated with neurodegenerative diseases. This project uses bacteriophage P22 capsids as model nanocontainers to encapsulate green fluorescent proteins (GFPs) and investigate, under highly controlled conditions, how increasing protein density affects their behavior. By varying the number of encapsulated GFP molecules, we will assess the relationship between confinement, protein aggregation, and fluorescence emission. To this end, bulk characterization techniques, including SEC-MALS and UV-visible spectroscopy, will be combined with single-particle approaches such as atomic force microscopy (AFM) and fluorescence lifetime imaging microscopy (FLIM), enabling the analysis of individual particles. Experimental results will be complemented by coarse-grained molecular dynamics simulations to develop predictive models of molecular crowding effects. This approach will provide new insights into the fundamental mechanisms governing cellular organization and protein aggregation in complex biological systems.	

Proposal number 129	
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https://www.cbm.uam.es/index.php/programas-cientificos/interacciones-con-el-entorno/microorganismos-en-la-salud-y-el-bienestar/bioingenieria-de-enzimas-de-levaduras-para-generar-compuestos-bioactivos/?lang=es	
Title of the proposal	
Synergistic inhaled antivirals: in silico screening and design of a dual-action mucosal barrier against respiratory viruses	
Abstract	
To counter seasonal and pandemic respiratory threats, this proposal aims to create a paradigm shift using an innovative, broad-spectrum inhaled antiviral platform. This approach combines naturally derived polyphenols and microbial polymers to neutralize viruses directly in the lungs. The backbone of this PhD research project lies in its novel inhalation delivery route. This specific method delivers high therapeutic concentrations directly to the respiratory	

mucosa, avoiding the common limits of systemic absorption. Following a large-scale computer screening (in silico), a dual-action system will be fully developed: sulfated polysaccharides will act as molecular decoys to trap viruses, while optimized flavonoids will block viral entry and reduce tissue inflammation. Finally, this high-potential project at UAM will establish a highly versatile therapeutic platform. By acting independently of specific viral strains, this doctoral thesis project provides a critical, first-line defense essential for preventing future global pandemic outbreaks.

Proposal number 130	
Name and Surname	**Email**
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https://orcid.org/0000-0001-7986-3527	
Title of the proposal	
Metabolic Reprogramming of γδ T Cells in Cancer	
Abstract	
Our recent study published in Nature established the γδ T-cell receptor (TCRγδ) as a critical regulator of γδ T-cell identity and tissue surveillance. Building on this discovery, this PhD project will investigate how TCRγδ signalling shapes the metabolic adaptation, tissue localisation and antitumour functions of γδ T cells. Using state-of-the-art approaches, including single-cell transcriptomics, flow cytometry and functional metabolic profiling, the project will explore how γδ T cells adapt to the tumour microenvironment and how receptor-dependent signals influence their recognition and elimination of cancer cells. A particular focus will be placed on identifying metabolic pathways and innate immune receptors that determine γδ T-cell fitness and functional plasticity. By integrating mechanistic studies with translational approaches using human γδ T cells, this research aims to uncover new strategies to enhance γδ T-cell-based cancer immunotherapy and establish a foundation for future therapeutic innovation.	

Proposal number 131	
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https://www.uam.es/ciencias/facultad/dpto-biologia/gomez-lencero-rocio	
Title of the proposal	
Mechanisms of germ cell communication and centrosome function: from spermatogenesis to human male infertility	
Abstract	
This project investigates the molecular mechanisms regulating cell communication during mammalian spermatogenesis, focusing on the role of primary cilia, centrosomes, and associated signaling pathways in spermatocyte differentiation, meiotic progression, and sperm formation.	

Universidad Autónoma de Madrid

Using the mouse as our primary experimental model, we will combine genetically modified mouse lines, molecular and cell biology approaches, and advanced imaging techniques to understand how these structures and signaling mechanisms coordinate germ cell development. A major translational component will extend our research to human spermatogenesis and male infertility. Through established collaborations with hospitals and human biobanks, we will investigate the involvement of primary cilia and centrosome dysfunction in human reproductive disorders, exploring their potential as biomarkers of impaired fertility. By bridging fundamental and clinical research, this project aims to improve our understanding of male infertility and contribute to future diagnostic and therapeutic advances in reproductive medicine.

Proposal number 132	
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https://www.uam.es/uam/investigacion/grupos-de-investigacion/detalle/f1-84	
Title of the proposal	
Molecular Design of Organic Electrode Materials for Rechargeable Metal-Ion Batteries	
Abstract	
This PhD project aims to develop and understand organic electrode materials for rechargeable metal-ion batteries. The research will investigate how molecular functionalisation and metal coordination affect redox potential, metal interaction, charge-storage mechanisms, and electrochemical stability. A combination of materials synthesis, structural and chemical characterisation, and electrochemical techniques will be used to establish relationships between molecular structure and battery performance. The project will include the preparation of functionalised and metal-coordinated organic compounds, their evaluation as electrode materials, and mechanistic studies using complementary spectroscopic and electrochemical approaches. The ultimate goal is to derive molecular design principles for the development of efficient, tunable, and more sustainable organic electrodes for multivalent energy-storage systems.	

Proposal number 133	
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https://portalcientifico.uam.es/es/ipublic/researcher/263795	
Title of the proposal	
Atom-by-Atom Nanocatalysts for a Green Hydrogen Future	
Abstract	
Efficient green hydrogen production and storage require active, affordable, and sustainable catalysts. This PhD project will explore an innovative strategy to design nanocatalysts atom by atom and observe, in operando, how reactions occur on their	

surfaces. Using variable-temperature scanning tunnelling microscopy, thermal desorption spectroscopy, and ultrahigh-vacuum techniques, the student will investigate aluminium–silicon nanoparticles made from abundant elements that could replace costly platinum-group metals. Their size, composition, electronic charge, and defect density will be tuned at the atomic level through lithium doping, controlled oxidation, and ion bombardment. The goal is to identify atomic configurations that minimise the energy required to split water while enabling hydrogen storage and release near room temperature. The project offers advanced experimental training at the frontiers of nanoscience, catalysis, and materials physics, while addressing a major global challenge: developing cleaner, safer, and more accessible technologies for a sustainable hydrogen-powered future.

Proposal number 134	
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https://nanobig.eu/	
Title of the proposal	
Multifunctional Luminescent Nanoparticles for Macrophage-Targeted Cancer Immunotherapy and Early Treatment Response Prediction	
Abstract	
Cancer immunotherapy faces major challenges, including tumour-mediated immune suppression and the lack of reliable tools for early treatment response assessment. This 48-month PhD project aims to develop multifunctional lanthanide-doped nanoparticles (LanNPs) combining therapeutic delivery of miRNA and near-infrared (NIR) luminescence nanothermometry to enable macrophage reprogramming and real-time monitoring of anticancer immune responses. First, LanNPs will be synthesised, functionalised and optimised for microRNA delivery and temperature sensing. Their capacity to induce pro-inflammatory, antitumour macrophage phenotypes will be investigated in vitro using cellular and immunological assays. Subsequently, the most promising formulations will be evaluated in preclinical tumour models to assess macrophage activation, tumour inflammation and therapeutic efficacy. Finally, temperature profiles, nanoparticle distribution and immune response data will be integrated to identify biomarkers predictive of treatment outcomes. This multidisciplinary research aims to establish a novel theranostic platform for personalised cancer immunotherapy and early prediction of therapeutic response.	

Proposal number 135	
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Title of the proposal	
Neuroprotective potential of edible and medicinal mushrooms in degenerative brain diseases	

Abstract
The project aims to evaluate the effects of potentially beneficial fungal compounds against neurodegenerative diseases. Specifically, the candidate will investigate the role of these compounds as protective or delaying agents against inflammation, oxidative stress, and the accumulation of advanced glycation end products in neurons and glial cells. The project also considers the impact of gastrointestinal digestion on the permeability of these compounds and their ability to cross the blood–brain barrier, two critical factors determining their neuroprotective potential. By elucidating these mechanisms, the project seeks to identify novel neuroprotective strategies derived from fungal bioactives with potential preventive or therapeutic applications.

Proposal number 136	
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Title of the proposal	
CO_2 for High-Value Organo-Compounds Production through Electroreduction	
Abstract	
Electrochemical CO_2 reduction offers a promising route to convert captured carbon and renewable electricity into valuable chemicals and fuels. However, improving product selectivity and catalytic efficiency remains challenging. This PhD project will investigate electrodeposition strategies to develop tailored electrocatalysts and explore three-dimensional (3D) electrode architectures for CO_2 conversion in zero-gap electrolyzers. The influence of electrode composition, morphology, and architecture on local reaction microenvironments, mass transport, and product efficiency will be investigated. Electrochemical performance will be evaluated in a zero-gap flow cell, and reaction products identified and quantified using gas chromatography coupled with mass spectrometry, flame ionization and thermal conductivity detectors (GC-MS/FID/TCD). Experimental studies will be complemented by theoretical modelling to elucidate reaction pathways and identify factors governing catalytic performance. This integrated approach aims to advance efficient and selective CO_2 electroreduction for high-value chemical production. Related publications: 10.3390/ma18010105; 10.3390/molecules28041951; 10.1016/j.jcou.2021.101878	

Proposal number 137	
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Ecología y Conservación de Ecosistemas Terrestres (TEG-UAM) https://www.uam.es/uam/investigacion/grupos-de-investigacion/detalle/f1-81	
Title of the proposal	
Life after death in a rapidly warming world	

Abstract
Animal mortality is pervasive, but vertebrates continue to shape processes after death. Carcasses provide ephemeral resources that support organisms, drive nutrient cycling, connect trophic levels, and influence disease dynamics. However, climate warming may disrupt these functions by changing mortality patterns and accelerating carrion decomposition. Faster breakdown could alter resource availability and reorganize species interactions, triggering cascading effects across ecological networks. This project asks how warming-driven changes in carrion decomposition reshape multispecies networks and whether these effects propagate across trophic levels. Combining field experiments along thermal gradients with species monitoring and DNA metabarcoding, we will track how temperature influences carcass use, interaction structure, and community assembly. By linking decomposition dynamics to network architecture, this research will reveal how warming reorganizes carrion-based communities and whether more complex networks exhibit different responses to thermal stress. Ultimately, this project will advance understanding of how climate change reshapes ecological interactions and ecosystem functioning, providing new insights into biodiversity conservation and ecosystem resilience in a rapidly warming world.

Proposal number 138	
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https://www.cbm.uam.es/index.php/scientific-programs/genome-dynamics-and-function/genome-decoding/regulation-of-mrna-translation-in-eukaryotes-and-its-implications-for-organismal-life/	
Title of the proposal	
Understanding ribosome dynamics and their influence on translation control and stress sensing. Implications in cellular homeostasis	
Abstract	
The aim of this project is to study how ribosomal flux regulates translation outputs and cell fate, and its role in sensing and signaling stress in eukaryotic cells and model organisms. We will study how translation initiation and elongation are coordinated through feedback loops to determine ribosomal flux at both global and mRNA-specific levels using genome-wide techniques as ribosome profiling and real time measurements of reporter genes. We are particularly interested in the systematic identification of endogenous (e.g. oncogene activation) and exogenous insults (UV, alkylating agents, etc.) that induce ribosome collisions and activate the ribotoxic stress response (RSR), using a biosensor recently developed in our laboratory (RiboCollSensor) coupled to a high throughput screening platform. We will also study the existence of bidirectional connections among ribosomal flux and those major pathways (mTOR) involved in nutrient sensing and cell survival.	

Proposal number 139	
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Title of the proposal	
Evolutionary analysis of chromosome synapsis and recombination in mammalian meiosis	
Abstract	
Our group is devoted to the study of meiosis in mammals under an evolutionary perspective, in both model (mice) and non-model species (either eutherians, marsupials or monotremes). The project will be focused on the study of synapsis and recombination. Previous results in our laboratory have uncovered a variability in the timing of synaptonemal complex assembly in different species, and our hypothesis is that these differences can modulate the frequency and location of recombination events. The experimental approach will comprise the study of specifically chosen mouse models and mammalian species, through morphological analysis of meiosis (immunofluorescence) and molecular tools, as well as organotypic cultures and proteomic analyses. Some of the species will offer the opportunity to study the behavior of weird sex chromosomes, particularly pairing and segregation, which will be important to understand the transmission and evolution of these chromosomes in mammals.	

Proposal number 140	
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Title of the proposal	
Modelling Degradation and Transport Processes in Materials for Sustainable Hydrogen Production	
Abstract	
The transition towards sustainable energy systems requires advanced materials capable of enabling efficient and durable green hydrogen production. This PhD project will develop a multiscale theoretical framework to investigate electrochemical processes in solid oxide electrolysis cells (SOECs), with a particular focus on air electrodes, fuel electrodes, and electrode/electrolyte interfaces. Using state-of-the-art density functional theory (DFT), molecular dynamics simulations, and kinetic modelling, the candidate will explore reaction mechanisms, diffusion pathways, surface processes, and degradation phenomena under realistic operating conditions. Special attention will be devoted to cation segregation, interfacial charge transfer, defect chemistry, and the role of functional interlayers in enhancing long-term stability and electrochemical performance. Computational results will be integrated with experimental characterization performed by project partners, enabling the development of predictive models linking atomic-scale processes with cell performance. The project	

offers the opportunity to contribute to next-generation hydrogen technologies within a multidisciplinary research consortium.

Proposal number 141	
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https://www.uam.es/uam/investigacion/grupos-de-investigacion/detalle/f1-84	
Title of the proposal	
From Molecular Design to Green Hydrogen: Unraveling Structure-Performance Relationships in Advanced Anion Exchange Membranes for Alkaline Electrolyzers	
Abstract	
This PhD project will be integrated into an ongoing research line focused on the development of advanced membranes for alkaline water electrolyzers. Building on our recent publication, “Advancing green hydrogen: next-generation AEMs with reduced hydrogen crossover” (Energy Materials), and benefiting from the research framework provided by the project Advanced Membrane Synthesis and AI-Driven Optimization for Green Hydrogen Production (H2AMIGO), led by the supervisor as Principal Investigator, the thesis aims to develop and evaluate novel polymeric anion exchange membranes (AEMs) for green hydrogen production. Different polymer backbones, crosslinking strategies, and quaternization agents will be investigated to tailor membrane physicochemical properties and electrochemical performance. The synthesized membranes will be comprehensively characterized and tested in a laboratory-scale alkaline electrolyzer. By systematically correlating polymer structure, membrane functionalization, and device performance, the project seeks to establish fundamental structure-property-performance relationships that guide the rational design of next-generation AEMs for efficient and safe green hydrogen production.	

Proposal number 142	
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https://www.uam.es/uam/investigacion/grupos-de-investigacion/detalle/f1-608	
Title of the proposal	
Nanodimensional Material Architectures for Next-Generation Energy Storage	
Abstract	
This thesis investigates nanodimensional material architectures to enhance the performance and stability of energy storage systems. Two families of composites will be developed, based on silicon nanostructures and on oxide nanoparticles, each combined with two-dimensional materials (graphene, transition metal dichalcogenides, MXenes) and/or carbon nanotubes. Composition, defects and morphology will be precisely controlled to optimize ionic and electronic transport and accommodate mechanical stresses. Structure and interfaces will be characterized by FESEM, HRTEM and STEM, while electrochemical measurements and post-mortem AFM in glovebox will reveal degradation mechanisms. Ion beam analysis (RBS, NRA, ERDA) at the CMAM	

accelerator will provide depth-resolved quantification of lithium, oxygen and light elements, complemented by synchrotron experiments under operating conditions. The research aims to link synthesis parameters and dimensionality with electro-chemo-mechanical behavior, guiding the design of robust, high-energy and long-lifetime energy storage systems. References: https://doi.org/10.3390/nano14231911; 10.1002/batt.202500167; 10.1016/j.ensm.2024.103658; 10.3390/nano10030515 Supervisor: Carmen Morant Zacares c.morant@uam.es Co-supervisor: Celia Polop Jorda celia.polop@uam.es

Proposal number 143	
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https://scholar.google.com/citations?user=0p9Dye4AAAAJ&hl=es	
Title of the proposal	
Physical virology of individual virus particles: mechanics, uncoating and genome release	
Abstract	
Virus particles must balance genome protection during transmission with the ability to release nucleic acids at the right time and place (uncoating). This project studies virus uncoating under native (liquid) conditions using single-molecule techniques: Atomic Force Microscopy and Total Internal Reflection Microscopy. We will measure mechanical properties of individual virus particles, induce disassembly in vitro, and monitor genome release at the nanoscale in real time. Two contrasting viruses are investigated. Human adenovirus (hAdV) has a proteinaceous icosahedral capsid enclosing a genome complexed with proteins that play key roles during delivery. Saccharolobus solfataricus ovoid virus (solOV) infects archaea thriving in extreme acidic environments (~70°C); its lipid-based pleomorphic capsid packages the genome in two orientations with potential consequences for delivery. Comparing these viruses will provide fundamental biophysical insights inaccessible to conventional biochemical and structural virology approaches.	

Proposal number 144	
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Title of the proposal	
Cellular and multi-omics responses to coffee and cocoa by-product ingredients in models of prematurity	
Abstract	
Coffee pulp and cocoa shell will be processed by optimized green extraction using design of experiments (DoE), and the resulting fractions characterized by UHPLC–MS	

coupled with chemometric profiling. Selected fractions will be tested in macrophages (THP-1), microglia (BV2) and neuronal cells (P19) to examine inflammatory signaling, neuronal differentiation and modulation in gene and protein expression (RT-qPCR, immunoblotting). In a in vivo model of prematurity, diet supplementation-associated responses will be characterized by RNA sequencing (RNA-seq), targeted protein analyses and immunohistochemistry of selected brain regions, . Untargeted metabolomics of plasma and brain tissue and gut microbiota profiling (16S rRNA sequencing) will identify metabolic and microbial shifts associated with treatment. Advanced chemometric cross-platform analyses will relate extract composition and cellular responses to tissue-specific molecular profiles, circulating metabolites and microbiota features. These molecular signatures will be compared with behavioral outcomes generated in parallel to explore molecular correlates of neurodevelopmental phenotypes.

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(1) 10.1016/j.seppur.2021.118779; (2) 10.1002/mnfr.201801413; (3) 10.3390/nu17050885; (4) 10.1016/j.bbi.2024.10.023

Proposal number 145	
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https://www.uam.es/uam/investigacion/grupos-de-investigacion/detalle/f1-645	
Title of the proposal	
Hydrogen production from the thermocatalytic decomposition of ammonia in the aqueous phase	
Abstract	

Hydrogen production from the thermocatalytic decomposition of ammonia in the aqueous phase is an emerging strategy to generate clean fuel with reduced carbon emissions. The storage and transport of H2 remain major challenges for the hydrogen economy because of its low volumetric energy density. Ammonia, a hydrogen-rich compound that is easily liquefied, can serve as an efficient carrier and storage medium. Its catalytic decomposition in water offers a promising alternative to conventional hydrogen production routes, as it can be performed under relatively mild conditions and integrated with existing systems. The process relies on advanced catalysts to enhance conversion, enabling sustainable hydrogen generation for energy applications and contributing to a greener energy landscape. Moreover, operating in the aqueous phase could allow ammonia-rich aqueous streams, such as wastewater, to be valorized directly without prior ammonia separation.

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https://doi.org/10.1016/j.cej.2023.146860,
https://doi.org/10.1016/j.biortech.2024.130572

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Title of the proposal	
Bio-Based Solvents for Sewage Sludge Remediation and Agricultural Valorisation: Extraction Processes, Modelling and Environmental Assessment	
Abstract	
This doctoral project will explore the potential of bio-based solvents for reducing the presence of organic contaminants in sewage sludge intended for agricultural valorisation. The research will focus on developing and assessing extraction-based treatment strategies that combine environmental effectiveness with sustainability. Experimental work will investigate the influence of operating conditions and sludge characteristics on process performance, using appropriate analytical techniques to evaluate contaminant removal. The resulting data will support the study of extraction behaviour and the development of mathematical models to describe and predict treatment efficiency. Particular attention will be paid to the interaction between solvents and the sludge matrix, as well as to the environmental implications of the treatment. The project will also assess the presence of residual solvents and the potential toxicity of treated sludge, with the aim of identifying conditions that could facilitate its safe agricultural use and contribute to circular economy approaches in wastewater management.	

Proposal number 147	
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Title of the proposal	
Development of a Closed-Loop Formic Acid Technology as a Sustainable Liquid Organic Hydrogen Carrier	
Abstract	
This doctoral thesis aims to develop and validate a technology for the use of formic acid (FA) as a sustainable liquid organic hydrogen carrier (LOHC) for the safe storage and transport of hydrogen. The research focuses on three main challenges: (i) catalyst design via additive manufacturing, developing 3D-printed bimetallic Pd-based catalysts on activated carbon to ensure durable hydrogen generation under near-ambient conditions; (ii) development of eco-friendly CO2 capture methods using ionic liquid (IL) sorbents, yielding high-purity hydrogen and CO2 streams; and (iii) recycling the recovered CO2 back into FA, closing the hydrogen carrier cycle. The PhD student will carry out both laboratory work and process simulation and design studies, gaining interdisciplinary training in catalytic chemical reactions, separation processes and process engineering.	

Proposal number 148	
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Title of the proposal	
Nonlinear thermal control in hybrid quantum devices	
Abstract	
Nonlinear effects are crucial for designing key components of quantum technology like rectifiers, diodes, and transistors. While often overlooked, neglecting nonlinearities can result in violations of gauge invariance or in the omission of quantum-coherent effects. This thesis will theoretically address nonlinearities in charge and heat currents, focusing in multiterminal coherent conductors. Building on our extension of nonlinear theories for weakly interacting conductors [1], we aim to study more complex systems with interactions and hybrid junctions including superconductors [2,3]. Our goal is to define quantum-coherent thermal diodes and transistors and optimize quantum heat engines [4]. [1] J. Balduque, R. Sánchez, “Scattering Theory of Thermal and Bipolar Thermoelectric Diodes.” Phys. Rev. Lett. 134, 186301 (2025). https://doi.org/10.1103/PhysRevLett.134.186301 [2]. L. Arrachea, A. Braggio, P. Burset, E. J. H. Lee, A. Levy Yeyati, and R. Sánchez, “Thermoelectric Processes of Quantum Normal-Superconductor Interfaces.”ANNALEN DER PHYSIK (2025): e00197. https://doi.org/10.1002/andp.202500197 [3] Ignacio Sardinero, Jorge Cayao, Keiji Yada, Yukio Tanaka, and Pablo Burset, “Josephson Effect in Fibonacci Superconductors from Topological Supragap States”, Phys. Rev. Lett. 136, 186002 (2026). https://doi.org/10.1103/6m6b-y3yv [4] S. Mojtaba Tabatabaei, David Sánchez, Alfredo Levy Yeyati, and Rafael Sánchez, “Nonlocal quantum heat engines made of hybrid superconducting devices”, Phys. Rev. B 106, 115419 (2022) https://doi.org/10.1103/PhysRevB.106.115419	

Proposal number 149	
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Title of the proposal	
Toward First-Principles Prediction of Tandem Mass Spectra Using Machine Learning Interatomic Potentials	
Abstract	
Predicting tandem mass spectra (MS/MS) directly from molecular structure remains a major challenge in computational mass spectrometry. Molecular dynamics simulations provide a physically grounded approach to studying fragmentation mechanisms, but the computational cost of quantum chemical methods limits their applicability. This project aims to explore machine learning interatomic potentials (MLIPs) as an alternative for simulating gas-phase fragmentation of protonated organic molecules. Particular attention will be paid to the challenges associated with charge localization, proton	

transfer, and bond-breaking processes. The research will involve evaluating pretrained MLIPs, exploring strategies to improve their accuracy for reactive charged systems, and developing molecular dynamics protocols to sample competing fragmentation pathways. Predictions will be validated against quantum chemical calculations and experimental MS/MS spectra. The ultimate goal is to establish the potential and limitations of MLIP-based molecular dynamics for predictive computational mass spectrometry, with applications in metabolomics and environmental analysis.

Proposal number 150	
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Title of the proposal	
Understanding and Predicting Product Selectivity in Reactions with Post-Transition-State Bifurcations	
Abstract	
Understanding the factors controlling product selectivity is a fundamental challenge in theoretical chemistry. In reactions involving post-transition-state bifurcations (PTSBs), a single transition state leads to multiple products without intervening energy barriers, making conventional transition-state theory insufficient to predict product distributions. This project aims to investigate the molecular mechanisms governing selectivity in such reactions using ab initio molecular dynamics simulations. We will explore how molecular structure, potential energy surface topology, vibrational mode coupling, initial energy distribution, and atomic momenta influence the branching between competing reaction pathways. By systematically comparing different molecular systems and reaction conditions, we seek to identify general principles underlying non-statistical reaction dynamics. The ultimate goal is to develop a mechanistic framework for understanding and predicting product selectivity in reactions involving bifurcating potential energy surfaces, contributing to a broader understanding of chemical reactivity beyond conventional statistical models.	

Proposal number 151	
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Title of the proposal	
Thermoelectricity in Hybrid Superconductor–Semiconductor Devices	
Abstract	
Hybrid superconductor–semiconductor devices offer a versatile platform for exploring how superconducting correlations shape charge and heat transport. Building on our work on Joule spectroscopy (Ibabe et al., Nat. Commun., 2023; Ibabe et al., Nano Lett., 2024) and recent theoretical developments (Arrachea et al., Ann. Phys., 2025), this PhD project will investigate thermoelectric effects and nonequilibrium heating in hybrid devices. Experiments will explore how heat and charge transport depend on device	

geometry, gate voltage, magnetic field, and superconducting state, using Joule spectroscopy to probe energy relaxation and heat dissipation. In parallel, theoretical modelling will investigate transport across normal–superconductor interfaces, focusing on Andreev processes, particle–hole asymmetry, and the mechanisms underlying thermoelectric response. By connecting experiments with microscopic theory, the project aims to identify new signatures of hybrid-device physics and clarify the interplay between superconductivity and energy transport. The thesis combines experimental nanodevice physics with theoretical modelling, offering training in low-temperature measurements, data analysis, and quantum transport.

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Title of the proposal	
Noise-Protected Quantum Circuits Based on Hybrid Superconductor–Semiconductor Devices	
Abstract	
Hybrid superconductor–semiconductor devices provide a promising platform for developing superconducting quantum circuits that exploit the rich physics of Andreev bound states. Building on our recent demonstration of a gatemon operating in the ultrastrong-coupling regime (Casal Iglesias et al., arXiv:2603.19438), this PhD project will explore new circuit architectures that integrate Andreev physics with superconducting quantum technologies. The established experimental platform opens opportunities to investigate alternative qubit designs, guided by theoretical proposals and modelling. A central goal is to understand how circuit design and the properties of Andreev states can be harnessed to reduce sensitivity to environmental noise while retaining controllability and strong coupling to microwave fields. The project will combine hybrid-device fabrication and circuit quantum electrodynamics (cQED) measurements with theoretical modelling of hybrid superconducting quantum circuits. This research will contribute to the development of novel superconducting qubits and more robust quantum architectures.	

Proposal number 153	
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Title of the proposal	
Multiscale Molecular Modeling of PPO-Inhibiting Herbicides: From Membrane Permeation to Photodynamic Damage	
Abstract	
This doctoral project aims to elucidate the molecular mechanism of action of protoporphyrinogen IX oxidase (PPO)-inhibiting herbicides through an integrated	

multiscale computational approach. The study will investigate the complete pathway from herbicide membrane permeation and enzyme inhibition to the photodynamic processes responsible for cellular damage. Molecular dynamics simulations and free-energy calculations will characterize herbicide partitioning across lipid membranes, binding to PPO, and the effects of resistance-associated mutations. The accumulation and membrane localization of protoporphyrin IX will be examined alongside its excited-state properties using time-dependent density functional theory and advanced electronic structure methods. Particular attention will be devoted to triplet-state formation, singlet oxygen generation, and subsequent lipid peroxidation, investigated through QM/MM simulations. By integrating molecular recognition, membrane biophysics, and excited-state photochemistry, this research seeks to establish quantitative relationships between herbicide structure, enzyme inhibition, and light-dependent toxicity, providing mechanistic insights relevant to herbicide design and resistance management in agricultural systems.

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Title of the proposal	
Bioactivity of Marine-Derived Phospholipids and Lysophospholipids as Modulators of Inflammation, Neurodegeneration and Allergic Response	
Abstract	
Phospholipids (PLs) and lysophospholipids (LPLs) are membrane components and signalling molecules involved in inflammation, immunity and neural function. Marine PLs are rich in bioavailable omega-3 fatty acids (EPA, DHA). This thesis will evaluate the bioactivity of marine PL and LPL fractions, enzymatically produced and characterised by LC-MS/MS lipidomics. Anti-inflammatory, neuroprotective, anti-allergic and immunomodulatory activities will be assessed in relevant cellular models, including immune and neural cells exposed to inflammatory, oxidative or allergenic stimuli. Active fractions will be validated with in vivo models in C. elegans neurodegeneration models and murine models of inflammation and allergic sensitisation. The fractions, especially DHA-enriched LPLs, are expected to reduce pro-inflammatory cytokines and NF-κB activation, protect neuronal cells, attenuate mast cell degranulation and lower Th2 responses. This work will support marine PLs and LPLs as candidate ingredients for nutraceuticals targeting inflammatory, neurodegenerative and allergic disorders. Keywords: marine phospholipids; lysophospholipids; omega-3 PUFA; DHA; inflammation; neuroprotection; allergy; immunomodulation	

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Title of the proposal
Expanding photoacustics (sensing & imaging) deep into near-infrared biological transparency windows
Abstract
The project proposes investigation on nanoparticles-heaters optically triggered in NIR-II and NIR-III transparency windows for photoacoustic imaging (PAI), with high light-heat conversion efficiency, absorbing in those windows that minimize the attenuation of the excitation beam, thus allowing deep organs to be reached by way of PAI. Another relevant goal is using tissues phantom of different compositions, -thus rendering different optical behaviors in terms of both absorption and scattering-, to sharpen and advance of the PAI technique. PAI grants a penetration depth comparable to that of ultrasound imaging techniques is obtained, while at the same time a spatial resolution comparable to that of purely optical imaging techniques can be achieved. PAI will be applied to allow discrimination of the composition of the analyzed organism thanks to the fact that each component absorbs light in different ranges of wavelengths and can therefore be selectively excited (e.g. hemoglobin in the visible or melanin in the ultraviolet and near infrared), plus absorption of excitation light with sensitivity close to 100% (sensitivity is defined here as the ratio of the “minimum” change in the photoacoustic signal with respect to the “minimum” change in the optical absorption coefficient), two orders of magnitude greater than those of confocal microscopy and optical coherence tomography. Moreover the detected PAI signal is intrinsically free of background and speckle