Universidad Autónoma de Madrid

LIST OF 1-YEAR PhD PROJECTS

Faculty of Economics

Supervisor Info	Project Title	Project Abstract
Supervisor: Miriam Hortas Rico Email: miriam.hortas@uam.es	The drivers of urban expansion and their implications on public policy	This project investigates the drivers of urban expansion, considering demographic, socioeconomic, political, geographic, and climatic factors, with particular attention to the impacts of climate change and natural disasters. Methodologically, it employs hierarchical spatial autoregressive models to capture both inter-city spatial interactions and regional or national heterogeneity. Understanding the forces shaping urbanization is crucial, as rapid urban growth has become a defining trend with far-reaching economic and social implications. The study aims to generate evidence that can inform public policies to better manage or redirect urbanization processes, reducing their adverse consequences while fostering sustainable development. References: 1. https://doi.org/10.1080/00343404.2019.1634801 2. https://doi.org/10.1080/17421772.2016.1126674 3. https://doi.org/10.1111/jors.12145

Universidad Autónoma de Madrid

Faculty of Law

Supervisor Info	Project Title	Project Abstract
Supervisor: Manuel Cancio Melia Email: manuel.cancio@uam.es	Organized Crime and Criminal Law: Comparative Analysis	Transnational organized crime (including terrorism) poses a challenge for all legal systems around the world. However, the criminal law treatment of the issue varies greatly. Though always present in penal codes, offenses based on belonging to a criminal organization occupy a vanguard position in today's evolution of penal law systems: organized crime, and political organized crime (terrorism) is located at one of the most prominent places in the criminal policy agenda. Nevertheless, neither criminal law theory nor the actual content of criminal provisions nor the putting of theory into practice enables an adequate restriction of the interpretation of the laws against criminal organizations. A comparative analysis of the different answers of different legal systems is therefore necessary, including the empirical background and different approaches to the definition of wrongfulness and to the concrete offenses of membership or collaboration. References: Cancio Meliá, "The Wrongfulness of Crimes of Unlawful Association", New Criminal Law Review vol. 11 n. 4 (2008) 563; Cancio Meliá, "The Reform of Spain's Antiterrorist Criminal Law and the 2008 Framework Decision", in: Galli/Weyekbergh (ed.), EU counter-terrorism offences: what impact on national legislation and case-law?, éditions de l'Université Libre de Bruxelles/Institut d'Études Européennes, Brussels, 2012, 99; Cancio Meliá/Petzsche, 犯罪意义上的恐怖主义概念, in: Zhai Zhiyong, Pan Weijiang & Wang Yongqian (ed.), Beihang Law Review, Vol. 1, 2019, Beijing, ed. China University of Political Science and Law Press, 277; Walker/Llobet Anglí/Cancio Meliá (ed.), Precursor Crimes of Terrorism. The Criminalisation of Terrorism Risk in a Comparative Perspective, Edward Elgar Publishing, 2022.

Universidad Autónoma de Madrid

Faculty of Medicine

Supervisor Info	Project Title	Project Abstract
Supervisor: Maria Susana Guerra Garcia Email: susana.guerra@uam.es	"Characterization of Immune Responses to ISG15-Adjuvanted MVA-Based COVID-19 Vaccines in Mice"	Our research investigates the dual functions of ISG15 in poxvirus infection and vaccine development. We have shown that ISG15 and its variants serve as effective genetic vaccine adjuvants, boosting innate immune responses and enhancing both adaptive and memory immunity against multiple pathogens, including HIV, SARS-CoV-2, and Zika. Building on these findings, we aim to examine how ISG15 influences T and B cell activation and its potential to improve MVA-COVID-19 vaccination. By combining ISG15 with MVA vectors, we seek to strengthen the vaccine-induced immune response while also reducing potential adverse effects of SARS-CoV-2, taking advantage of ISG15's immunomodulatory properties. References: 1.García-Arriaza J, et al., 2025. ISG15 enhances immune responses in MVA vaccines against Zika & SARS-CoV-2. Vaccines, 13:696. DOI:10.3390/vaccines13070696 2.Álvarez E, et al., 2024. ISG15: immunomodulation & therapeutic potential. Vaccines, 12:153. DOI:10.3390/vaccines12020153 3.Perdiguero B, et al., 2024. Bi-cistronic B&T cell vaccine induces broad immunity against SARS-CoV-2. Vaccines, 12:1213. DOI:10.3390/vaccines12111213 4.Falqui M, et al., 2023. MVA vector expressing ISG15 boosts IFN-I & HIV-1 CD8 responses. Front Cell Infect Microbiol, 13:1187193. DOI:10.3389/fcimb.2023.1187193
Supervisor: Marta Miret Garcia Co-supervisor: Miguel Sáenz de Pipaón Marcos Email: marta.miret@uam.es	Determinants of infant cognition and behavior	Infant cognition and behavior are influenced by a range of factors, including prematurity, intrauterine growth, and nutritional status, among others. The objective of this research stay is to examine cognitive and behavioral outcomes in infants, as well as the potential determinants associated with these outcomes. The study will utilize both clinical and research databases, and will be conducted in collaboration with the Department of Psychiatry and the Department of Pediatrics at Universidad Autónoma de Madrid. References: doi: 10.1002/ijop.12892; doi: 10.1080/08870446.2021.1927030; doi: 10.1080/08870446.2018.1525492; doi: 10.1186/s12992-017-0237-5.

Universidad Autónoma de Madrid

Faculty of Philosophy

Supervisor Info	Project Title	Project Abstract
Supervisor: Antonio Sanchez Martinez Email: antonio.sanchezm@uam.es	Artisanal knowledge in Early Modern Period	This project proposes a study of craft cultures in the field of the history of scientific knowledge from a comparative perspective between China and the European world during the Late Middle Ages, the Renaissance and the early modern age. References: 1. Antonio Sánchez, “Cosmography, maritime culture, and practical knowledge in the early modern Spanish empire”, en Rodrigo Cacho Casal and Caroline Egan (eds.), The Routledge Hispanic Studies Companion to Early Modern Spanish Literature and Culture, Londres, Routledge, 2022, pp. 79-2022. 2. Henrique Leitão y Antonio Sánchez, “Zilsel’s thesis, maritime culture and Iberian science in early modern Europe”, Journal of the History of Ideas, 78, 2 (2017): 191-210. DOI:10.1353/jhi.2017.0010 3. Henrique Leitão y Antonio Sánchez, “Too much to tell: narrative styles of the first descriptions of the natural world of the Indies in sixteenth century Iberian texts”, History of Science, 55, 2 (2017): 167-186.https://doi.org/10.1177/007327531771286 4. Antonio Sánchez, “Science by Regimento: Standardising Long-distance Control and New Spaces of Knowledge in Early Modern Portuguese Cosmography”, Early Science & Medicine, 21, 2-3 (2016): 133-155.DOI: 10.1163/15733823-02123p03 https://uam.academia.edu/AntonioS%C3%A1nchez
Supervisor: Luisa Martin Rojo Email: luisa.rojo@uam.es	Discourse analysis of media representations of China in Spain	This project undertakes a discourse analysis of media representations of China in Spain, focusing on the unusually positive tone these portrayals often adopt. Unlike in many other countries, the Spanish media frequently frames China in favorable terms, which has sparked interest among scholars of Chinese discourse studies. By examining this distinctive media image, the study aims to uncover the cultural, political, and historical factors that shape Spanish attitudes toward China.A discourse analysis methodology will be applied, not limited exclusively to Western analytical models.

Universidad Autónoma de Madrid

Faculty of Psychology

Supervisor Info	Project Title	Project Abstract
Supervisor: Luis Venancio Oceja Fernandez Email: luis.oceja@uam.es	From Legitimacy to Contestation: The Psychology of Rule Compliance and Prosocial Drive	This project investigates the psychosocial processes that connect norm compliance with prosocial motivation. Drawing on the Evaluative Model of Normative Appraisal and the concept of quixoteism, we explore how these processes can foster cooperation and legitimacy or, conversely, fuel competition and rebellion. Our approach combines experimental methods with cross-cultural designs to examine how norms and motives interact—sometimes sustaining collective well-being, sometimes threatening it. References: Oceja, L., Beramendi, M., Salgado, S., & Gavilán, P. (2023). Dissecting the dimension of protection: Caligae and Scutum in the evaluative model of normative appeals. Current Psychology, 42, 9293–9302. DOI: 10.1007/s12144-021-02209-1 Oceja, L., Villegas, M., Beramendi, M., & Salgado, S. (2016). "You should (not) do that": An Evaluative Model of Normative Appeals (EMNA). Journal of Social Psychology, 156(4), 382–396. DOI: 10.1080/00224545.2015.1111855 Villar, S., Carrera, P., & Oceja, L. (2022). From aesthetics to ethics: Testing the link between an emotional experience of awe and the motive of quixoteism on (un)ethical behavior. Motivation and Emotion, 46(4), 508–520. DOI: 10.1007/s11031-022-09935-4 Oceja, L.; Stocks, E.; Heerdink, M. et al. (2019). Revisiting the difference between instrumental and terminal values to predict (stimulating) prosocial behaviours: The transcendental-change profile. British Journal of Social Psychology, 58(3), 749-768. DOI: 10.1111/bjso.12306
Supervisor: Eduardo Estrada Alonso Email: eduardo.estrada@uam.es	Quantative Methods for Longitudinal Data in Psychology, Education and Health	Our lab develops advanced research designs and statistical techniques to study change and development over time, with applications in psychology, education, and health. We create cutting-edge tools using mixed-effect, structural equation, and state-space models, emphasizing practical use in applied research. Our goal is to make these methods accessible, supporting evidence-based practices. We welcome applicants interested in (A) developing novel statistical tools for longitudinal problems or (B) applying advanced modeling to existing longitudinal data. Students join a dynamic, collaborative team, benefit from a rich learning environment, and work closely with other PhD students at various training stages. http://dx.doi.org/10.1037/met0000215 http://dx.doi.org/10.3389/fpsyg.2021.696419 http://dx.doi.org/10.1037/dev0000716 http://dx.doi.org/10.1037/met0000615

Universidad Autónoma de Madrid

Faculty of Sciences

Supervisor Info	Project Title	Project Abstract
Supervisor: Sandra Gomez Email: sandra.gomezr@uam.es	Photoexcitation Dynamics in Molecular Systems	This one-year research stay is aimed at doctoral students, either experimentalists or theoreticians, who are investigating the photophysical or photochemical properties of molecular systems or clusters in their PhD projects. Students will join a team with expertise in nonadiabatic molecular dynamics within the framework of theoretical chemistry and computational modelling. The goal is to support researchers who wish to enhance their studies by applying advanced nonadiabatic molecular dynamics techniques and gaining time-resolved quantum or mixed dynamics computational data on their systems of interest. Throughout the stay, participants will learn and apply simulation methods that enable detailed analysis of excited-state molecular behavior, providing insights into photoreactivity, energy transfer and deactivation mechanisms. References: (1) DOI: 10.1039/D5CP02117K (2) DOI: 10.1021/acs.jctc.5c01002 (3) DOI: 10.1021/acs.jpca.5c02171 (4) DOI: 10.1063/5.0197895
Supervisor: Mercedes Regadio Garcia Co-supervisor: - Email: mercedes.regadio@uam.es	Bio-Hybrid Barriers for Enhanced Landfill Containment	Landfill barriers are passive and degrade over time, allowing leachate to escape. This research topic focuses on developing bio-hybrid liners that integrate microorganisms with inorganic matrices to form adaptive and self-healing barriers. These living systems will trap pollutants, repair damage and adjust their properties in response to evolving waste compositions and environmental conditions. By combining microbiology, materials science, and environmental engineering, landfill containment can evolve from passive waste isolation into active resource management. Performance will be evaluated through laboratory column tests, geochemical modeling, and simulations to optimize and predict long-term behavior while advancing sustainable waste management and circular economy goals References: 1. DOI: https://doi.org/10.1016/j.jenvman.2018.05.039 2. DOI: https://doi.org/10.1007/s11356-025-36412-5 3. DOI: https://doi.org/10.1080/01490451.2020.1786866 4. DOI: https://doi.org/10.1016/j.cej.2025.166611
Supervisor: Jesus Page Utrilla Co-supervisor: Rocío Gómez Lencero Email: jesus.page@uam.es	Meiotic factors in the evolution of sex chromosomes in mammals	Mammals are characterized by having highly or completely differentiated X and Y chromosomes. In species that carry sex chromosomes at terminal stages of differentiation, recombination between the X and Y chromosomes is abolished. This can compromise their transmission during meiosis. In this project, we will carry out a comparative study of the meiotic mechanisms of pairing, DNA repair and chromosome segregation in mammalian species that present sex chromosomes that have completed their differentiation or are in the final stages of this differentiation in order to understand how these chromosomes are efficiently transmitted to offspring. References: https://doi.org/10.3389/fcell.2023.1147610 https://doi.org/10.1371/journal.pgen.1010040. https://doi.org/10.3390/genes12091434

		https://doi.org/10.1371/journal.pgen.1008959
Supervisor: Maria Cristina Gutierrez Sanchez Co-supervisor: Emiliano Martinez Periñan Email: cristina.gutierrezs@uam.es	Integration of Advanced Nanomaterials in Electroanalytical Sensors for the Development of Biomedical Devices.	The integration of advanced nanomaterials into electroanalytical sensors has revolutionized the development of biomedical devices, improving their sensitivity, selectivity, and rapid response. Thanks to their unique properties, such as high surface area, electrical conductivity, and functionalization capabilities, nanomaterials enable the detection of biomarkers at ultra-low concentrations, facilitating early and accurate diagnoses. These sensors offer portable, cost-effective, and efficient platforms for point-of-care monitoring, driving advances in personalized medicine and preventive healthcare. Furthermore, their versatility favors the creation of multifunctional devices with applications in diverse clinical areas, significantly contributing to the advancement of modern biomedical technologies. References: https://doi.org/10.1016/j.talanta.2023.124614 https://doi.org/10.1016/j.snb.2021.130096 https://doi.org/10.1007/s12274-020-3030-3 https://doi.org/10.1016/j.carbon.2019.12.053
Supervisor: Emiliano Martinez Periñan Co-supervisor: Maria Cristina Gutierrez Sanchez Email: emiliano.martinez@uam.es	Covalent Organic Frameworks-Based Nanomaterials for Oxygen Reduction Reactions (ORR) electrocatalysts development.	Oxygen reduction reaction (ORR) is an essential process in different areas such as biological respiration, energy conversion, and hydrogen peroxide generation. Platinum group metal (PGM) based electrocatalysts have been traditionally used to electrocatalyzed ORR. Platinum reserves and production worldwide are very limited nowadays. Another drawback is the high amounts of electrocatalyst needed in the fabrication of cathode electrodes, increasing the cost. As an alternative to ORR electrocatalysts, covalent organic frameworks (COFs) are emerging as a powerful alternative. The project will design new COFs materials and the development of metal free ORR electrocatalysts and their application in fuel cell design. References: https://doi.org/10.1002/anie.202313940 https://doi.org/10.1002/smll.202402082 https://doi.org/10.1021/acssuschemeng.2c05826 https://doi.org/10.1039/C9CC06479F
Supervisor: Maria Asuncion Quintanilla Gomez Co-supervisor: Carmen B. Molina Caballero Email: asun.quintanilla@uam.es	Clean Hydrogen Production from Formic Acid as a Carrier	The doctoral research focuses on advancing formic acid (FA) as a sustainable liquid organic hydrogen carrier (LOHC) within a closed-loop system that couples hydrogen production with CO_2 capture and reuse. The project tackles three main challenges: (i) catalyst design via additive manufacturing to ensure durable hydrogen generation under near-ambient conditions; (ii) development of eco-friendly CO_2 capture methods using ionic liquid (IL) sorbents; and (iii) recycling the recovered CO_2 back into FA, closing the hydrogen carrier cycle. The PhD student will contribute to one of these areas depending on the project's stage at their incorporation. References: https://doi.org /10.1016/j.apcatb.2022.121802 https://doi.org/10.1039/d3ta05644a https://doi.org/10.1016/j.cattod.2024.114828

		https://doi.org/10.1016/j.ijhydene.2025.151197
Supervisor: Pablo Burset Atienza Co-supervisor: Rafael Sánchez Rodrigo Email: pablo.burset@uam.es	Electron Interferometry in Quantum Hall-Superconductor Nanostructures	In this theory project we explore electron interferometry in quantum Hall-superconductor nanostructures as a platform for coherent quantum circuits [1] and engineered topological phases [2]. Interferometers are build using chiral edge channels as electron waveguides and quantum point contacts as beam splitters. Then, propagating charges act as flying qubits encoding information in their quantum state. Extending scattering approaches we describe time-dependent Andreev processes, thermoelectric transport [3,4], and emergent topological phases. By designing interferometric circuits we aim to detect entangled electron pairs, probe topological superconductivity, and optimize flying qubit architectures, thus paving the way for future hybrid topological-superconductor quantum technologies. References: [1]. https://doi.org/10.48550/arXiv.2312.13145 [2]. https://doi.org/10.48550/arXiv.2507.14074 [3]. https://doi.org/10.1002/andp.202500197 [4]. https://doi.org/10.1103/PhysRevLett.134.186301
Supervisor: Jose Manuel Moreno Maroto Email: josemanuel.moreno@uam.es	Sustainable materials for advanced applications	A predoctoral candidate will join a young, dynamic, and highly productive research team with excellent conditions for both independent and collaborative work. Supervised by Professors José Manuel Moreno and Raúl Fernández, the candidate will contribute to ongoing research on sustainable materials with advanced properties—such as zeolites, lightweight aggregates, geopolymers, and magnesium phosphate cements—produced from different raw materials, such as waste and clays. The candidate will have the opportunity to select and further develop one of these research lines whitin his/her doctoral thesis. References: doi: 10.1523/JNEUROSCI.0711-20.2020.
Supervisor: Felix Juan Zamora Abanades Email: felix.zamora@uam.es	Nanostructured COFs and MOFs: Controlled Assembly and Functional Applications	We propose a one-year research project for a PhD student focused on covalent organic frameworks (COFs) synthesized via monomer substitution in the gel phase. Conducted in collaboration with Prof. Weiwei Zhang (ECUST, Shanghai) and extended to KAUST and NUS, the project provides a strong international framework. Research will target the controlled preparation of nanoparticles of COFs, MOFs, and COF–MOF composites, using a layer-by-layer assembly method for porous architectures. Their physico-chemical properties will be studied, including sorption (with synergistic effects), catalysis, and selective adsorption of water and air contaminants. Students will gain advanced training in chemistry, nanomaterials, FIB-SEM, and membrane science. References: 1) Carlos Franco, David Rodríguez-San-Miguel, Alessandro Sorrenti, Semih Sevim, Ramon Pons, Ana E. Platero-Prats, Marko Pavlovic, Istvan Szilágyi, M. Luisa Ruiz Gonzalez, José M. González-Calbet, Davide Bochicchio, Luca Pesce, Giovanni M. Pavan, Inhar Imaz, Mary Cano-Sarabia, Daniel Maspoch, Salvador Pané, Andrew J. deMello, Felix. Zamora*, Josep Puigmartí-Luis*. Synthesis of sub-20 nanometer covalent organic frameworks colloids in water. J. Am. Chem. Soc. 2020, 142, 7, 3540-3547. DOI: 10.1021/jacs.9b12389 2) Jesús Á. Martín-Illán, José Antonio Suárez, Julio Gómez-Herrero, Pablo Ares, Daniel Gallego-Fuente, Youdong Cheng, Dan Zhao, Daniel Maspoch and Félix Zamora*. Ultra-

		Large Free-Standing Imine-based Covalent Organic Framework Membranes Fabricated via Compression. Adv. Sci. 2022, 2104643. DOI: 10.1002/advs.202104643 3) Ke Tian Tan, Samrat Ghosh, Zhiyong Wang, Fuxiang Wen, David Rodríguez-San-Miguel, Jie Feng, Ning Huang, Wei Wang, Felix Zamora, Xinliang Feng, Arne Thomas, Donglin Jiang. Covalent organic frameworks. Nat.Rev. Prim. Meth. 3:1 (2023) DOI: 10.1038/s43586-022-00181-z 4) Sergio Royuela, Semih Sevim, Guillermo Hernanz, David Rodríguez-San-Miguel, Carlos Franco, Salvador Pané, Josep Puigmartí-Luis* and Félix Zamora* 3D Printing of Covalent Organic Frameworks: A Microfluidic-Based System to Manufacture Binder-Free Macroscopic Monoliths. Adv. Funct. Mater. 2023, 2314634. DOI: 10.1002/adfm.202314634. Orcid Code: 0000-0001-7529-5120 WEB PAGE: www.nanomater.es
Supervisor: Alicia Moya Cuenca Co-supervisor: Rubén Mas Ballesté Email: alicia.moya@uam.es	Light into fuels: Inorganic–Organic Hybrid Photocatalysts for clean Energy Solutions	This project develops advanced hybrid photocatalysts by integrating well-known inorganic semiconductors with pre-designed photoactive porous organic frameworks. These light-driven systems aim to boost solar-to-energy conversion efficiency, opening pathways for renewable fuel production and clean energy storage. Their innovative hybrid design exploits synergistic effects to overcome current limitations in photocatalysis. Results can potentially impact sustainable energy technologies and climate change mitigation. The work will be conducted within a collaborative and internationally recognized research team with strong scientific output, providing an excellent platform for academic career development. References: DOI: 10.1039/D4NR05363J DOI: 10.1073/10.1016/j.carbon.2022.07.053. DOI: 10.1039/C9NR07716B. DOI: 10.1016/j.apcatb.2020.118613.
Supervisor: Laura Contreras Balsa Email: laura.contreras@uam.es	Modeling Stress-Triggered Progression of Citrin Deficiency in Mice	Mutations in CITRIN/SLC25A13, the main hepatic aspartate–glutamate carrier, cause Citrin Deficiency (CD), a rare disorder with three age-dependent forms of varying severity. The most severe, adolescent/adult CD (AACD), affects only about 20% of patients. It is hypothesized that individuals enter a compensatory phase after the neonatal stage, progressing to AACD only under hepatic stress. This project will use knockout mouse models to investigate stress-induced decompensation, identify metabolic and molecular triggers, and uncover compensatory mechanisms. The results will enhance understanding of CD progression and support early diagnosis and targeted therapies. References: Doi: 10.1016/j.ymgmr.2023.100967

		doi: 10.1016/j.bbamcr.2023.119468. Doi: 10.1002/jimd.12768
Supervisor: Sergio Diaz-tendero Victoria Co-supervisor: Fernando Aguilar-Galindo Rodríguez Email: sergio.diaztendero@uam.es	Dynamics of complex molecular systems under ionizing radiation	This project focuses on the theoretical study of complex molecular systems exposed to ionizing radiation. We propose the use of computing codes based on quantum chemistry methods and molecular modeling, in high-performance computing facilities. Specifically, the project aims to perform molecular dynamics simulations of these systems and to explore their potential energy surfaces, thereby obtaining interesting information such as the evolution of excited and ionized molecules, as well as useful energy data. The project is designed to explain the fragmentation mechanisms observed in experiments involving collisions of ions/electrons/photons with molecules. References: https://doi.org/10.1038/s41467-024-49671-6 https://doi.org/10.1126/sciadv.abg9080 https://doi.org/10.1038/s41467-020-17653-z https://doi.org/10.1038/s41467-019-10571-9
Supervisor: Fabrice Leardini Email: fabrice.leardini@uam.es	Advanced materials for hydrogen production and storage	The ambition of this project is to develop innovative ideas to be used for hydrogen generation by water electrolysis or photo-electrolysis and for solid-state hydrogen storage applications. My research group works on the synthesis and characterization of advanced materials for these applications using a plethora of experimental techniques, including arc melting, reactive milling, chemical vapor deposition and solid gas reactions under different atmospheres. The main characterization techniques include volumetric measurements, thermal desorption spectroscopy, x-ray diffraction, electrochemical methods and optical measurements. We have three active research projects (one of them of “PathFinder” call) and a wide network of collaborators in Europe. References: https://doi.org/10.1021/acsami.4c07404 https://doi.org/10.1021/acsami.3c02192 DOI: 10.1002/adsu.201900043 DOI: 10.1021/jp501964r
Supervisor: Noelia Alonso Morales Co-supervisor: Miguel Angel Gilarranz Redondo Email: noelia.alonso@uam.es	Graphene oxide and nanocarbon material-based membranes for contaminants nanofiltration	Emerging contaminants threaten global water security and public health, driving demand for advanced filtration technologies. In response, nanocarbon-based membranes—especially those incorporating graphene oxide, hybrid architectures and composite materials—are gaining prominence in the development of advanced water treatment technologies. These membranes have tunable physicochemical properties that enable precise molecular-level pollutant removal. This research project will focus on the fabrication of GO-based conductive membranes designed to enhance filtration efficiency and reduce membrane fouling. This innovative approach represents a significant advancement in membrane science with emphasis on strategic lines such as clean water solutions and functional nanomaterials. References: DOI: 10.1016/j.cej.2022.137807

		DOI: 10.1016/j.eti.2025.104017 DOI: 10.1016/j.jiec.2025.05.050 DOI: 10.1016/j.seppur.2024.130261
Supervisor: Daniel Jaque García Email: daniel.jaque@uam.es	Pressure dependent afterglow luminescence of molecule-doped SiO microparticles	We investigate the pressure-dependent afterglow luminescence of molecule-doped SiO microparticles to explore their potential in optical sensing and gain deeper insight into afterglow mechanisms. By analyzing changes in emission intensity, spectral features, and decay behavior under varying pressure conditions, we aim to establish how mechanical stress influences luminescent performance. The findings will support the development of pressure-sensitive materials and contribute to understanding the physical processes behind persistent luminescence in doped oxide systems.
Supervisor: Weiguang Cui Email: weiguang.cui@uam.es	Rotation filaments with NewAthena -- a theoretical prediction	Understanding the dynamics of filaments in the circumgalactic medium (CGM) is crucial for tracing the flow of baryons into and out of halos, especially galaxy clusters, and for constraining models of galaxy formation and evolution. These filamentary structures act as conduits for the accretion of gas from the cosmic web, while also interacting with feedback-driven outflows and the surrounding hot halo. Despite their significance, the detailed kinematics and internal structure of CGM filaments remain poorly constrained due to observational limitations. The X-ray Integral Field Unit (X-IFU) on board the NewAthena telescope offers a transformative opportunity to resolve the velocity structure of these filaments via emission lines from metals with unprecedented spectral and spatial precision. This study defines three primary objectives to leverage the X-IFU's capabilities for filament dynamical studies: 1. We identify the most suitable emission lines—based on our hydrodynamic simulations. 2. We aim to characterise the large-scale dynamics and internal velocity gradients of CGM filaments, exploring the physical drivers of motion such as gravitational infall, turbulence, and interaction with feedback processes. 3. We will investigate the detectability of rotational motion within filaments, evaluating how angular momentum transfer manifests observationally and how this can be constrained within the instrument's spatial and spectral limits. By addressing these questions, this work will establish a framework for using X-IFU observations to unravel the kinematic signatures of baryon flows in galaxy halos and their connection to the cosmic web – one unique and ambitious task that NewAthena can achieve. References: doi:10.1093/mnras/sty2111 doi:10.1093/mnras/stad2394 doi:10.1093/mnras/stad3208
Supervisor: Javier del Pino Gutierrez Co-supervisor: Faculty of Sciences Email: Miguel Bello Gamboa	Understanding nonlinear, driven-dissipative resonator networks	Gaining a deeper understanding of nonlinear, driven-dissipative resonator networks is essential for the progress of quantum simulation and quantum technologies. These systems show non-Markovianity, phase transitions and topological effects beyond equilibrium physics. In the quantum regime of e.g. light-matter platforms, the coexistence of finite-dimensional atomic modes and infinite-dimensional photonic ones makes exact treatment difficult: studies have mostly explored the few-excitation limit or limited to mean-field approximations for many excitations.During this 1-year stay, the visitor will help build an integrated toolbox to bridge this gap, exploring variational and tensor-network states that capture quantum correlations and dissipation beyond mean field. This work will contribute to the consolidation of a multi-scale toolbox within the

		group and prepare the ground for a broader programme on nonequilibrium quantum phases.

Universidad Autónoma de Madrid

Faculty of Education Sciences

Supervisor Info	Project Title	Project Abstract
Supervisor: Javier Manuel Valle Lopez Email: jm.valle@uam.es	Implementation of the competency-based teaching paradigm in China. Supranational perspective and comparative analysis with the Spanish case.	The thesis will address the way in which the Chinese education system, at its different levels, is integrating competency-based teaching. It will also do so by analysing whether such implementation is carried out in the light of supranational trends, that is, the recommendations determined in this regard by international organisations such as UNESCO, the OECD or the EU. On the other hand, a comparative study will be carried out with the case of the Spanish education system to establish the convergences and divergences in both cases and try to extract mutual "good practices" that allow improving the implementation of competency-based teaching in both countries. References: 1. Valle, J.M.; Piñana, E. y Manso, J. (2024). Aprendizaje competencial. Teoría, práctica y ejemplos para hacerlo realidad en el aula. Madrid: Khaf. 2. Valle López, J.M. y Bastías, L.S. (2024). Educación supranacional: ¿realmente existe? Análisis bibliométrico de las publicaciones relativas a políticas educativas supranacionales. Journal of Supranational Policies of Education, 19, pp. 110-129. DOI: https://doi.org/10.15366/jospoe2024.19.006 3. Valle, J.M. y Piñana, E. (2023). El paradigma competencial en el marco de una educación integral. Fundación Europea Sociedad y Educación. ISBN: 978-84-09-54434-9. 4. Valle, J.M. y Sanchez-Urán Díaz, L. (2023). Organismos Internacionales y Políticas educativas basadas en evidencias: la evidente relación. Revista de Educación, 400. Abril – Junio, 2023, pp. 107-132. Ministerio de Educación y Formación Profesional
Supervisor: Marta Martinez Rodriguez Email: marta.martinezr@uam.es	Cognitive (intelligence and aptitudes) and Non-Cognitive (personality and well-being) factors in the prediction of Academic Performance (COG-NON COG).	In this project, we aim to study which cognitive factors (intelligence, musical ability, and creativity) and non-cognitive factors (personality, well-being, discomfort, motivation, study habits, and emotional intelligence) predict Academic Performance (A) in primary and secondary school students over a three-year period. The design will be implemented simultaneously in all three schools. References: https://doi.org/10.1016/j.lindif.2024.102536 https://doi.org/10.5406/19398298.138.1.05

Universidad Autónoma de Madrid

Polytechnic School

Supervisor Info	Project Title	Project Abstract
Supervisor: Alejandro Bellogin Kouki Email: alejandro.bellogin@uam.es	Analyzing sustainability aspects in context-aware recommender systems	The increasing integration of Artificial Intelligence (AI) technologies, particularly Recommender Systems (RS), into daily life necessitates a shift in focus from mere performance metrics (such as accuracy and personalization) toward a holistic assessment of societal impact. The sustainability profile of any recommender system must be analyzed through two distinct, yet interconnected, lenses: impact of the system (Footprint) addressing the internal resource consumption and impact via the system (Influence) by examining the external effects of the recommendations toward more sustainable choices. Context-Aware Recommender Systems (CARS) are an evolution of traditional RS, designed to generate more relevant recommendations by adapting them to the specific contextual situation of the user, incorporating factors such as time, location, or device. This project will tackle the existing challenges and explore techniques to address sustainability objectives within CARS. References: * https://doi.org/10.1007/s11257-020-09258-4 * https://doi.org/10.1016/j.ipm.2022.103115. * https://doi.org/10.1007/s10462-024-10939-4. * https://doi.org/10.1145/3705328.3748151.