Próximo seminario de la Escuela de Doctorado UAM y el Departamento de Química Física Aplicada.

Ponente: Prof. Manuel Yáñez (Depto. de Química, UAM).

Título: Una mirada cuántica a los sistemas deficitarios en electrones.

Día: 31 de octubre

Hora: 12.30

Lugar: Módulo 3, Sala de Seminarios 509, Facultad de Ciencias, UAM.

Se entregarán certificados de asistencia a todos aquellos que lo soliciten.

Una mirada cuántica a los sistemas deficitarios en electrones.

En este Año Internacional de la Cuántica, resulta oportuno recordar que, aunque los métodos de la química cuántica permiten explorar y modelar sistemas cada vez más complejos, los fenómenos que subyacen a un gran número de procesos químicos suelen manifestarse ya en sistemas muy pequeños. En particular, los sistemas deficientes en electrones presentan una química extraordinariamente singular, caracterizada por notables peculiaridades en sus enlaces y por una reactividad fuertemente condicionada por su capacidad para actuar como ácidos de Lewis. La comprensión y racionalización de estas particularidades —tanto en los enlaces como en la reactividad— constituyen una parte esencial del legado de la cuántica a la química de finales del siglo XX y de las primeras décadas del XXI. Este será el eje central de la charla: entender por qué ciertos agregados con enlaces fuertes resultan inestables frente a aquellos cuyas interacciones están dominadas por la dispersión. En la misma línea, podremos abordar preguntas que, desde la óptica de la química clásica, parecen paradójicas, como: ¿es posible transformar una base convencional en un ácido fuerte? o ¿puede un sistema molecular deficiente en electrones comportarse como un buen aceptor de protones? Finalmente, exploraremos cómo materiales que contienen este tipo de elementos podrían llegar a desempeñar un papel relevante en la lucha contra el calentamiento global que amenaza nuestro planeta.

Tercer seminario de la Escuela de Doctorado UAM y el Departamento de Química Física Aplicada.

Ponente: Prof. Jesús Tartaj (Instituto de cerámica y Vidrio, CSIC).

Título: Nuevos avances en pilas de combustible (SOFC) para la generación limpia y eficiente de electricidad.

Día: 12 de diciembre, 2025

Hora: 12.30

Lugar: Módulo 8, Sala de Grados 206, Facultad de Ciencias, UAM.

Se entregarán certificados de asistencia a todos aquellos que lo soliciten.

Nuevos avances en pilas de combustible (SOFC) para la generación limpia y eficiente de electricidad.

Fuel cells (FCs) are energy conversion devices that produce electricity with high efficiency and negligible pollution. Other advantages such as multi-fuel capability, a modular construction design and environmental compatibility make them to be considered as one of the most promising future power generation devices. In recent years, among the different types of fuel cells, the interest in solid oxide fuel cells (SOFCs) has increased enormously as a commercially viable power source. Additional advantages of this type of fuel cells are the high tolerance to impurities, and the possibility of internal reforming which leads to the possibility of using different fuel. However, many problems related to the correct use of the other components (anode, cathode, and interconnector) of the SOFC are to be present during service at the above operating conditions which also leads to many disadvantages in the selection of interconnects and sealing materials. Therefore, a lower operating temperature becomes necessary to reduce manufacturing costs and to increase their durability. For that purpose, new materials are required that can efficiently operate a lower temperature.

In this presentation it will briefly describe the different types of fuel cells, from the most conventional ones to the most recent developments and we will focus in SOFC, new materials, processing and those applications in the production of stationary electricity. A great progress is being made both in the conventional fuel cells and in the development of new types and/or concepts such as regenerative and direct alcohol fuel cells, which are significantly improving their efficiency, cost of electricity production and, also allowing the use of alternative fuels to hydrogen such as methane.

Segundo seminario de la Escuela de Doctorado UAM y el Departamento de Química Física Aplicada.

Ponente: Prof. Ferry Prins (Depto. de Física de la Materia Condensada, UAM).

Título: Visualizing Energy Transport in Nanostructured Semiconductors.

Día: 28 de noviembre, 2025

Hora: 12.30

Lugar: Módulo 8, Sala de Grados 206, Facultad de Ciencias, UAM.

Se entregarán certificados de asistencia a todos aquellos que lo soliciten.

Visualizing Energy Transport in Nanostructured Semiconductors

Nanostructured Semiconductors are a playing an increasingly dominant role for next-generation light-harvesting and light-emitting applications. In these materials, quantum confinement effects allow for enhanced control over their optoelectronic properties while reduced processing temperatures provide routes to more flexible integration. However, the reduced dimensionality and increased disorder can significantly impact the spatial dynamics of the energy carriers within the material.

To study these effects, we employ Transient Photoluminescence Microscopy techniques which allow for a direct visualization of the excited state transport with few-nanometer and sub-nanosecond resolution. In this talk, I will highlight some of our recent efforts using this technique, with an emphasis on perovskite semiconductors of varying compositions and dimensionality. I will start the talk by giving an overview of some of the surprising effects that can be observed in these materials, particularly regarding the relationship between lattice softness and the exciton transport properties and the remarkably efficient interlayer transport.

In the last part of the talk, I will present our most recent efforts using interferometric scattering techniques to study perovskite semiconductors. The exceedingly high signal-to-noise-ratio that interferometric scattering provides allows not only for the direct imaging of charge carriers, but also for super-resolution imaging of lattice dynamics.

Cuarto seminario de la Escuela de Doctorado UAM y el Departamento de Química Física Aplicada.

Ponente: Prof. Alicia Moya Cuenca (Departamento de Química Inorgánica).

Título: "Organic-inorganic materials for photocatalytic applications"

Día: 30 de enero, 2026

Hora: 12.30

Lugar: Módulo 8, Sala de Grados 206, Facultad de Ciencias, UAM.

Se entregarán certificados de asistencia a todos aquellos que lo soliciten.

Organic-inorganic materials for photocatalytic applications

The continuous development of hybrid materials has opened new frontiers in photocatalysis, energy production, and environmental science. The core promise of these systems lies in the synergistic combination of two or more functional components, which often yields performance surpassing the sum of their individual parts. This synergy is primarily driven by optimized interfacial charge transfer, which enhances the separation of photoexcited carriers and extends their lifetimes, key requirements for efficient solar-to-chemical energy conversion.

The main challenges in this field involve the precise control of architecture, porosity, and, most critically, the nature of the hybrid interface. This talk provides a comprehensive overview of several strategies to address these challenges through the synthesis and characterization of inorganic/organic hybrid systems, including the integration of inorganic semiconductors, such as TiO_2, with various functional scaffolds, ranging from carbon nanotubes and fibers to advanced porous frameworks like Covalent Organic Frameworks (COFs) and Covalent Triazine Frameworks (CTFs). Tailoring the morphological and electronic properties of these hybrids directly s by engineering the chemical bonding and physical contact at the nanoscale leads to the optimization of charge dynamic, facilitating charge transport and transfer. Ultimately, this boosts efficiency in photocatalytic processes of high interest in energy and environmental applications such as H_2 production and the degradation of persistent water pollutants.

Quinto seminario de la Escuela de Doctorado UAM y el Departamento de Química Física Aplicada.

Ponente: Prof. Eduardo Hernández Chambers (Instituto de Ciencia de Materiales, CSIC).
eduardo.hernandez@csic.es

Título: A brief introduction to Machine Learning and some applications in Materials Science.

Día: 13 de febrero, 2026.

Hora: 12.30

Lugar: Módulo 0, Aula 207, Facultad de Ciencias, UAM.

Se entregarán certificados de asistencia a todos aquellos que lo soliciten.

A brief introduction to Machine Learning and some applications in Materials Science

In this seminar, I will provide a brief introduction to Machine Learning (ML), a sub-field of Artificial Intelligence, presenting its basic ideas at an introductory level. I will argue that Machine Learning is proving its usefulness across all ranges of human activities, including the natural sciences, and that it is rapidly being adopted as a new research tool with a tremendous potential. I will introduce the concept of Neural Networks and illustrate how they work. Finally, I will show some examples of our recent applications of ML in the context of Materials Science.

Sexto seminario de la Escuela de Doctorado UAM y el Departamento de Química Física Aplicada.

Ponente: José Sánchez Costa

Título: *Switchable Materials: The Versatility of Spin Crossover Compounds*

Día: 27 de febrero, 2026.

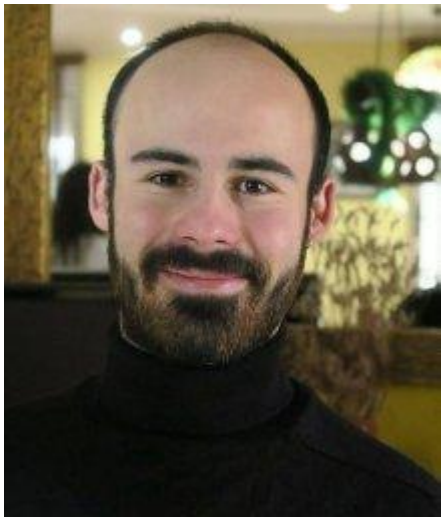
Hora: 12.30

Lugar: Módulo 0, Aula 207, Facultad de Ciencias, UAM.

Se entregarán certificados de asistencia a todos aquellos que lo soliciten.

Switchable materials are key components in the development of responsive and adaptive technologies. Among them, spin crossover (SCO) compounds are particularly attractive due to their ability to reversibly switch between different electronic spin states under external stimuli such as temperature, pressure, light, or chemical environment. This switching process is accompanied by marked changes in magnetic, optical, electrical, and structural properties, enabling the same material to be exploited across multiple application areas. As a result, SCO compounds constitute highly versatile platforms for applications ranging from sensing and data storage to smart materials and optoelectronic devices.

Séptimo seminario de la Escuela de Doctorado UAM y el Departamento de Química Física Aplicada.



Ponente: Saül García Orrit
Título: Ultrafast Spectroscopic Characterization of Nanographene-Based Conjugates

Día: 27 de marzo, 2026.

Hora: 12.30

Lugar: Módulo 0, Aula 207, Facultad de Ciencias, UAM.

Se entregarán certificados de asistencia a todos aquellos que lo soliciten.

Título: Ultrafast Spectroscopic Characterization of Nanographene-Based Conjugates

The use of graphene as a semiconductor has remained challenging along the last decades. Different methods have been developed to create materials that preserve the properties of graphene but contain a semiconductor-like gap, as could be the oxidation of graphene or the synthesis of nanographenes (NGs). NGs offer the possibility of introducing and tuning the gap energy by controlling the NGs' length, shape or by introducing metal or heteroatoms in their core. This makes them a very versatile and promising material, with potential applications.

Ultrafast spectroscopic techniques have been deployed to study the excited state dynamics of panchromatic porphyrin-nanographene conjugates [1,2] in order to further develop highly efficient light-harvesting architectures. These techniques have also been able to provide the characterization of a novel optical gain nanographene (HBPO) with a PLQY 80% as a gain media for lasing applications [3].

[1] S. Garcia-Orrit, V. Vega-Mayoral, Q. Chen, G. Serra, G. M. Paternò, E. Cánovas, A. Narita, K. Müllen, M. Tommasini, J. Cabanillas-González, Small 2023, 19, 2301596.
[2] S. Garcia-Orrit, V. Vega-Mayoral, Q. Chen, G. Serra, M. Guizzardi, V. Romano, S. Dal Conte, G. Cerullo, L. Di Mario, M. Kot, M. A. Loi, A. Narita, K. Müllen, M. Tommasini, and J. Cabanillas-González, J. Phys. Chem. Lett. 2024, 15, 10366−10374
[3] Y. Gu, V. Vega-Mayoral, S. Garcia-Orrit, D. Schollmeyer, A. Narita, J. Cabanillas-González, Z. Qiu, K. Müllen, Angew. Chem. Int. Ed. 2022, 61, e202201088; Angew. Chem. 2022, 134, e202201088.

Octavo seminario de la Escuela de Doctorado UAM y el Departamento de Química Física Aplicada.

Ponente: Prof. Antonio J. Martínez-Galera (Departamento de Física de Materiales, Universidad Autónoma de Madrid, Madrid E-28049, Spain)

Título: Atomic-Scale Imaging and Nanomanipulation of Low-Dimensional Materials with Scanning Tunneling Microscopy

Día: 24 de abril, 2026.

Hora: 12.30

Lugar: Módulo 0, Aula 207, Facultad de Ciencias, UAM.

Se entregarán certificados de asistencia a todos aquellos que lo soliciten.

Título: Atomic-Scale Imaging and Nanomanipulation of Low-Dimensional Materials with Scanning Tunneling Microscopy

Departamento de Física de Materiales, Universidad Autónoma de Madrid, Madrid E-28049, Spain

Condensed Matter Physics Center (IFIMAC), Universidad Autónoma de Madrid, Madrid E-28049, Spain

Instituto Nicolás Cabrera, Universidad Autónoma de Madrid, Madrid E-28049, Spain

The Scanning Tunneling Microscope (STM) is a powerful instrument that enables the visualization of matter with atomic resolution. Beyond imaging, this versatile and widely used tool in surface science has also proven capable of manipulating matter at the nanometer scale. In this presentation, firstly, I will present experimental STM studies focused on the atomic-scale characterization of two-dimensional (2D) materials, including graphene, boron nitride, and bismuthene. Afterwards, I will present experimental work in which the microscope tip is employed as a tool for the controlled nanomanipulation of nanoparticles and 2D materials.