

## Thesis Defense - Entropy, Order and 2D Confinement of Hard Particles

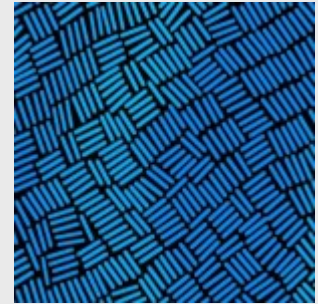
Place: Sala de Grados, Módulo 8.

When: 11:00, Tuesday, 9 May, 2017.

Program: Defense by Mr. Miguel González Pinto, [Department of Theoretical Condensed Matter Physics, Universidad Autónoma de Madrid](#).

Title: Entropy, Order and 2D Confinement of Hard Particles.

Thesis Directors: [Enrique Velasco](#) - [Department of Theoretical Condensed Matter Physics, Universidad Autónoma de Madrid](#) and [Yuri Martínez](#) - [Universidad Carlos III de Madrid](#).



**T**he work focuses on the effect of 2D confinement in systems of hard particles exhibiting liquid crystalline order. Our theoretical studies are based on Density Functional Theory (DFT) for classical fluids, in particular on the Fundamental Measure approach. We observe how the contributions of different entropic effects result in a complex competition and rich phase behaviours. Ordered phases emerge depending on the confinement and the geometry of particles: nematic (uniaxial and biaxial), columnar, smectic and crystal order. In addition, we have also studied the dynamics of pattern formation with a dynamic version of the DFT. The theoretical study is also complemented with experiments of vibrated granular rods in which ordered patterns spontaneously emerge resembling some aspects of equilibrium liquid crystals.

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## Thesis Defense - Reaching Quantum Polaritons

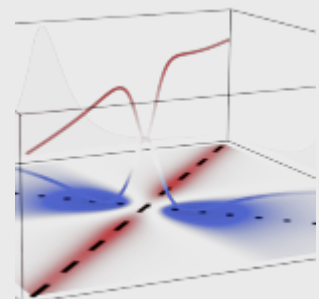
Place: Sala de Grados, Módulo 8.

When: 10:30, Tuesday, 20 December, 2016.

Program: Defense by Ms. Blanca Silva Fernández, [Department of Theoretical Condensed Matter Physics, Universidad Autónoma de Madrid](#).

Title: Reaching Quantum Polaritons.

Thesis Directors: [Fabrice Laussy](#) and [Daniele Sanvitto](#), [Department of Theoretical](#)



**T**he strong coupling between light and matter (excitons) gives rise to the so-called *exciton-polaritons*, which are the central topic of this thesis. Given their nature, they enjoy properties of both elements: low mass and high speed due to their photonic component and strong inter-particle interactions due to the excitonic one. The mixture of all these properties makes them perfect candidates for the study of some of the most interesting research areas in quantum physics such as quantum cryptography or quantum computation. However, to be deployed at the ultimate quantum limit, the genuine single-polariton regime must be achieved. Until now, this important line of research for multiple groups in the field of semiconductor quantum optics has remained an open task. In this thesis we present, in a combined theoretical and experimental effort, several approaches towards our main purpose of “reaching quantum polaritons”. In a first attempt, although still within a classical picture, we find a fundamental characterization of photon correlations when including their energy degree of freedom, thus extending and generalizing the textbook Hanbury Brown-Twiss correlations. With our second attempt, pioneering a new paradigm of exciting with quantum light, we demonstrate the long-sought regime of non-classical states of the polariton field. With these results, we believe we open a new line of research in polaritonics, to which we invite everyone!

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## Thesis Defense - Generation of Non Classical States of Light

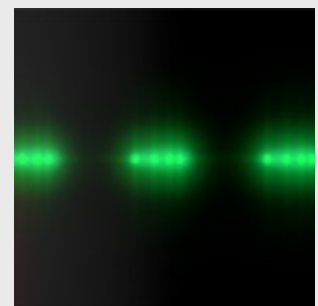
Place: Sala de Conferencias, Módulo 0.

When: 11:00, Monday, 19 December, 2016.

Program: Defense by Mr. Carlos Sánchez, [Department of Theoretical Condensed Matter Physics, Universidad Autónoma de Madrid](#).

Title: Generation of Non Classical States of Light.

Thesis Directors: Carlos Tejedor and Fabrice P. Laussy, [Department of Theoretical Condensed Matter Physics, Universidad Autónoma de Madrid](#).

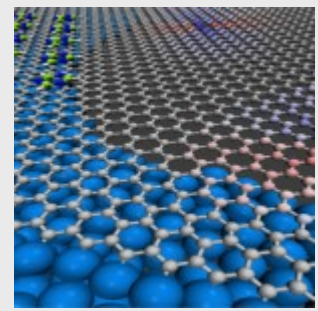


**I**n this Thesis, I study how to manipulate light-matter interaction in order to design emitters of novel quantum states of light, an essential ingredient for numerous

quantum technologies. The most prominent example is a family of sources that emit all of its light in terms of N-photon bundles, i.e., packets composed of a fixed number of photons, therefore substituting the essential building block of light, the photon, by a group of them. This is done by bringing together two limits of light-matter interaction, in which matter, consisting of few energy levels, is coupled either to a strong coherent field (essentially classical) or to a field dominated by quantum fluctuations. In the laboratory, the union of both regimes can be done by combining intense lasers and optical resonators.

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### Thesis Defense – Characterizing Real-life Graphene Through The Latest First-principles Methodological Developments



Place: 01.00.IC.307 Conference Hall (Módulo 0)

When: 12:00, Friday, 15 April, 2016.

Program: Defense by Ms. Lucía Rodrigo Insausti, [Department of Theoretical Condensed Matter Physics](#), Universidad Autónoma de Madrid.

Title: Characterizing Real-life Graphene Through The Latest First-principles Methodological Developments

Thesis Director: Rubén Pérez and Pablo Pou Bell, [Department of Theoretical Condensed Matter Physics](#), Universidad Autónoma de Madrid.

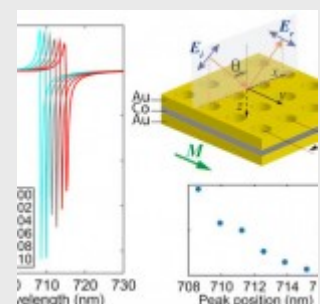
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### Thesis Defense – Theoretical Description of Wave Propagation in Magnetoplasmonic Nanostructures

Place: Seminar room, module 5, Facultad de Ciencias, Universidad Autónoma de Madrid.

When: 12:00, Friday, 12 February, 2016.

Program: Defense by Ms. Blanca Caballero García, Department of Theoretical Condensed Matter Physics, Universidad Autónoma de Madrid.



Title: Theoretical Description of Wave Propagation in Magnetoplasmonic Nanostructures

Thesis Director: Antonio García Martín [Institute of Microelectronics of Madrid, CNM-CSIC](#) and Juan Carlos Cuevas [Department of Theoretical Condensed Matter Physics](#), Universidad Autónoma de Madrid.

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## Thesis Defense - Dynamics of the Formation of Rings of Protein Filaments

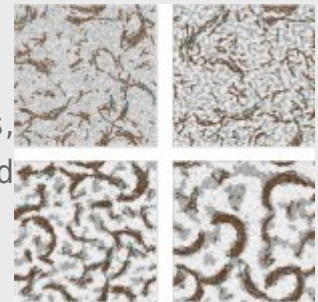
Place: Seminar room, module 8, Facultad de Ciencias.

When: 11:30AM, Friday, 21st November, 2014.

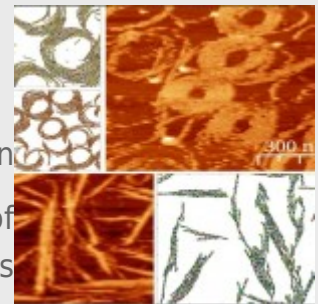
Program: Defense by Mr. Pablo González de Prado Salas, Department of Theoretical Condensed Matter Physics, Universidad Autónoma de Madrid.

Title: Dynamics of the Formation of Rings of Protein Filaments.

Thesis Director: [Pedro Tarazona](#)

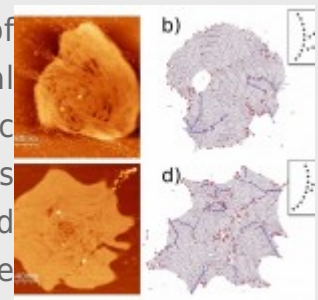


**F**tsZ is a protein found in prokaryotes, and it plays an essential role in cell division. It is one of the main components of the Z-ring, the structure responsible for the constriction forces needed to split the cell in two. The details of this important process are still poorly understood.



We have used modelling and Montecarlo simulations of FtsZ filaments on a fine-grained lattice (where monomers occupy several lattice points, allowing for subtle movement).

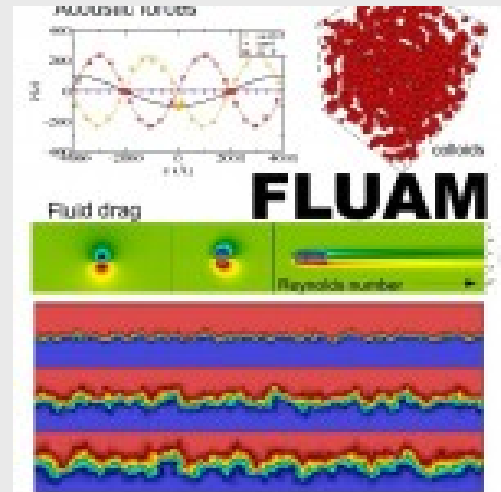
We compare the results with atomic force microscopy images of FtsZ on flat surfaces, with the aim of identifying the essential interactions among proteins that result in the very dynamic aggregates that are found in the experiments. In this thesis project we have focused on the role played by filament torsion and we have explored the importance of controlled anchoring to the membrane with the help of FtsZ mutants.



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## Thesis Defense - Minimal Models for Finite Particles in Fluctuating Hydrodynamics

Tuesday, 25th February 2014, 12.00



Place: Sala de seminarios módulo 5 (5ª planta), Facultad de Ciencias.

Program: Defense by Mr. Florencio Balboa Usabiaga, Department of Theoretical Condensed Matter Physics, Universidad Autónoma de Madrid.

Title: Minimal models for finite particles in fluctuating hydrodynamics

Thesis Director: [Rafael Delgado Buscalioni](#)

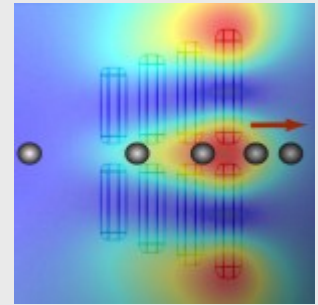
**T**his thesis has been devoted to the development of numerical methods to resolve the dynamics of fluids and immersed solute particles in scales above 100 nanometers, where thermal fluctuations are important. Solving fluctuating hydrodynamics requires ensuring thermodynamic consistency (the equilibrium distribution is canonical) and to that end we have used the Augmented Langevin Formalism which, consistently with the Fokker-Planck equation, furnishes the extra forces (stochastic and thermal drifts) required for the fluctuation-dissipation balance to hold. The fluid equations (Navier-Stokes-Landau-Lipshitz) have been discretized by the finite volume method using a staggered grid. In general the algorithms developed are of second order accuracy and very efficient, due to the use of semi-implicit schemes which permit usage of Fast-Fourier-Transform. The formalism has been generalized to the different hydrodynamic regimes naturally arising from the fluid separation of time scales: compressible or incompressible flows, at large or low Reynolds numbers and either inertial or viscous dominated. On the other hand, we have developed minimal resolution models to describe the dynamics of immersed particles using the Immersed Boundary method and the no-slip constraint to derive the hydrodynamic force to the particles. This idea permits to describe the particle physical properties (mass, volume, compressibility, inertia) and can be extended to deal with the Brownian limit up to the turbulent regime. To name two applications, inertia is essential to describe the acoustic forces arising from ultrasound devices, and conservative particle-particle interactions can be added to analyze the structure-dynamic relation in flowing colloidal dispersions. The thesis brings a novel, fast and versatile tool for particle hydrodynamics, named as FLUAM. It has been written in CUDA for computations in fast graphic cards (GPU's). As initial

applications, among others, we have studied giant concentration fluctuations under microgravity, acoustic tweezers, the limit of the classical Stokes-Einstein relation and the dynamics polymers under shear.

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## Thesis Defense - Frontiers in Plasmonics: Transformation Optics, Magnetic Plasmons, Brownian Ratchets and Quantum Phenomena

Friday, 13th December 2013, 12.00



Place: Sala de conferencias de la Facultad de Ciencias (Módulo 0).

Program: Defense by Ms. Paloma Arroyo Huidobro (Departamento de Física Teórica de la Materia Condensada Universidad Autónoma de Madrid).

Title: Frontiers in Plasmonics: Transformation Optics, Magnetic Plasmons, Brownian Ratchets and Quantum Phenomena

Thesis Director: [Francisco J. García Vidal](#)

Thesis Committee: Juan José Sáenz (UAM), Lukas Novotny (ETH-Zurich), Romain Quidant (ICFO), Javier Aizpurua (CSIC-UPV/EHU and DIPC) y Hernán Míguez (ICMSE, CSIC).

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