FENOMEN

NEWSLETTER OF THE DEPARTMENT OF PHYSICS AND NUCLEAR ENGINEERING

NEWS

2009 POSTDOCTORAL FELLOWSHIPS

Two postdoctoral positions in all areas of physics are available. The positions will be co-financed by the Department and by the host research group. The application deadline is June 15th, and a decision will be made by June 30th. Interested candidates should contact a research group of the Department within their area of expertise. A list of research groups can be found at http://www.fen.upc.edu

UPCOMING EVENTS

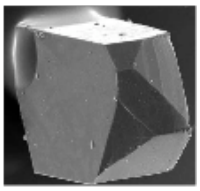
- Symposium on "Neutron and X-ray Scattering Techniques and their applications in Biosciences". ETSEIB, Barcelona, May 22nd, 2009. Co-organized by Luis Carlos Pardo, the UAB and SETN. http://www.icmab.es/setn/BIONyX
- "International Workshop on Structural and Mechanical Properties of Metallic Glasses" (IWMG09). Castelldefels Campus. June 17-19, 2009. Trinitat Pradell and Eloi Pineda participate in the organization. http://mie.esab.upc.es/iwmg09
- "2nd National Meeting on Infrared Micro-spectroscopy with Synchrotron Radiation" (MIRAS 2009). Synchrotron ALBA, Cerdanyola del Vallès, September 9, 2009. Co-organized by Trinitat Pradell and other UPC colleagues. http://mie.esab.upc.es/miras09
- Workshop on "Synchronization and Multiscale Complex Dynamics in the Brain" (BSYNC09). Max-Planck Institute for the Physics of Complex Systems, Dresden, November 2-6 2009. Co-organized by Jordi Garcia Ojalvo, the UIB and MPI. http://www.mpipks-dresden.mpg.de/~bsync09/

Recent publications

Materials Science

The hunt for stable progesterone

The ability of molecules to condense in more than one phase is known as 'crystalline polymorphism'. The existence of this structural diversity becomes highly relevant during the pharmaceutical characterization of drugs. Researchers from the Group of Characterization of Materials (GCM) have obtained the pressure-temperature phase diagram of the hormone progesterone. Their work, which will help finding the progesterone's most stable polymorph, is being published in the May 2009 issue of the *Journal of Pharmaceutical Sciences*.



Nuclear Engineering

The boron issue

Safety control at nuclear power plants is of fundamental importance. In this context, researchers from the Group of Energy and Radiation Studies (GREENER), have created a new model for simulating boron transport in pressurized water reactors. The model was implemented in the Relap5 code and explicitly accounts for physical diffusion. It has been tested simulating an experiment of the SETH/OCDE project and applied to a hypothetic accidental scenario in the Ascó nuclear power plant. The study was published in *Nuclear Engineering and Design* in April 2009.

Nonlinear Dynamics

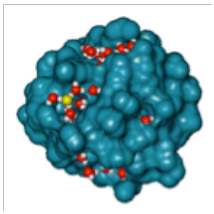
Noisy rocking

It is possible to induce bistable phase locking of nonlinear oscillators via deterministic harmonic driving through a method known as 'rocking'. Kestutis Staliunas and collaborators have now shown that bistability can also be achieved by stochastic driving. They obtained these results with the Stuart-Landau model, a minimal model of limit-cycle oscillators, and verified their predictions experimentally with a nonlinear electronic circuit. The work was published in *Physical Review Letters* on Jan. 9, 2009.

Chemical Physics

Trapped water nanodroplets

The behavior of water nanodroplets trapped in non-ionic reverse micelles is different than that of bulk water molecules. Having previously studied the structural features of trapped water, Jordi Martí and Elvira Guàrdia have now investigated the dynamical aspects of water molecules trapped in micelles. To that end they have employed molecular dynamics simulations. They have considered the cases of both pure water and water with an excess proton. The work has been published in the journal *Physical Chemistry Chemical Physics* on January 21, 2009.



Systems Biology

The right decision

Decision making in cells can be compromised by the intrinsic stochasticity of biochemical reactions. Cell-cell communication constitutes a coupling mechanism that effectively reduces the effect of this noise in cell populations. On that basis, Jordi Garcia Ojalvo and co-workers have proposed that this effect can be used by growing multicellular systems to time the moment in which decisions are made. The study was published in the journal *PLoS ONE* on March 13, 2009.

Our postdocs

Yaroslav Lutsyshyn, atomic physicist

"I am studying solid helium together with Prof. Jordi Boronat. Helium solids were found to have some of their mass decouple during motion at very low temperatures, as if flowing without resistance through the rest of the crystal. This effect is believed be in its origin of the same nature as superfluidity. However, existing theories do not match the experiments by a long stretch. This makes these systems a prime candidate for treatment with exact quantum Monte Carlo methods that we are using. I am enjoying the group's immense expertise in this field and splendid computational resources. With this work we will be able to shed light onto properties of solid helium, and perhaps even on the origin of the supersolid behavior itself. "

Yaroslav Lutsyshyn obtained his PhD in Physics from the University of Minnesota (USA) in 2008 and joined the Department in November last year. He is currently a postdoctoral fellow, funded partly by our Department.

Glòria Sala, astrophysicist

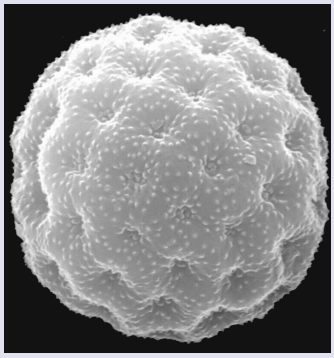
"In the long timescales of the evolution of the Universe, explosive events like X-ray bursts and classical novae are some of the few processes that occur in a human lifetime, some seconds or minutes in the first case and days in the second one. Both X-ray bursts and classical novae are thermonuclear explosions on top of compact stars in binary systems. Since I joined the Astronomy and Astrophysics Group at EUETIB in September 2008 I felt warmly welcome. We bring together the theoretical simulations done by Jordi José and his group with my observational expertise acquired at the Max-Planck Institute for Extraterrestrial Physics. We compare the UPC models with old and new observational data of X-ray bursts and classical novae".

Glòria Sala Cladellas obtained her PhD (by the Universitat de Barcelona) at the Institut d'Estudis Espacials de Catalunya (CSIC-ICE) in 2004. She was a postdoc fellow at the Max-Planck-Institute for extraterrestrial Physics in Garching, Germany, from 2005 to September 2008, when she joined the GAA group at UPC funded by the Juan de la Cierva program.

Side Note

Long-range pollen flights

Some pollen particles collected in Catalonia probably come from as far away as Germany and Italy. This is one of the results of a study performed by Marta Alarcón, in collaboration with David Pino (Department of Applied Physics of UPC), Jordina Belmonte (UAB) and Anna Avila (CREAF). The work, which has considered a 25-year data record of *Fagus sylvatica* pollen, could help understand the genetic diversity of the beech in the Pirineus, and interpret some fossil records. Understanding pollen dispersal is specially relevant due to its link with allergies. The results were published in *The International Journal of Biometeorology* in September 2008.



VISITING SCHOLARS

- Dmitry N. Chigrin, Univ. Wuppertal
- Anuj Parikh, Technical Univ. Munich
- Solomon Saltiel, University of Sofia
- Evgenii Volkov, Lebedev Physical Institute, Moscow

RECENT EVENTS

- The 60th birthday of the eminent theoretical physicist Siu A. Chin was celebrated at Campus Nord of the UPC in March 26-29, 2009, with the symposium "Higher-order actions and their applications in many-body, few-body, classical problems", organized by Jordi Boronat.
- The potential of the Underground Laboratory of Canfranc (Huesca) for research in nuclear astrophysics was discussed at an international workshop organized by Jordi José at the Escola Industrial (EUETIB) in Feb. 19-20, 2009.

PHD THESES

The following FEN PhD students have recently graduated:

- Paul Cusmin. Advisors: David O. López and Josep Salud, March 11, 2009
- Andrés Gómez. Advisor: Francisco Calviño, April 17, 2009
- Cristina Martínez. Advisors: Carme Torrent and Jordi García-Ojalvo, January 30, 2009

NEW RESEARCH GROUP

A new research group of the Department has been approved by the UPC: the research group in Physical Properties of Materials (GRPFM). The group is formed by Sergio Diez, Gonçal Fernández, Joan Font, David O. López, and Joaquim Muntasell, and is coordinated by Josep Salud.

MORE NEWS

- Romualdo Pastor has been selected as a researcher of the prestigious program ICREA-Academia in its 2009 edition. This program will allow Prof. Pastor to concentrate his academic activity in research tasks for five years.
- The American Physical Society has named Jordi Garcia Ojalvo an Outstanding Referee in the 2009 edition of this program.

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