



# FENOMEN

NEWSLETTER OF THE DEPARTMENT OF PHYSICS AND NUCLEAR ENGINEERING

## NEWS

### 2010 FEN POSTDOCTORAL FELLOWSHIPS AWARDED

- The Research Commission of the Department decided to assign this year's post-doc positions to Dr. Isaac Llopis (SC-SIMBIO) and Dr. Christian Bonatto (DONLL).

### NEW RAMON Y CAJAL RESEARCHER

- Dr. Simone Pigolotti, currently at the Niels Bohr Institute (Denmark) will join the Department as a Ramon y Cajal fellow in spring 2011. He will become a member of the DONLL research group.

### EVENTS

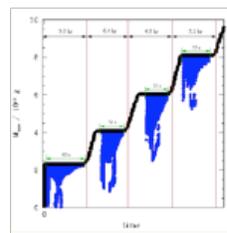
- Prof Germán J de Valcárcel, from Universitat de Valencia, gave a short course about "Cavity Quantum Optics" on May 24-28 in the Terrassa Campus.
- SIMCON collaborator Prof Daniel H. Laria, from Buenos Aires University, gave a course on "Molecular dynamics simulations with NAMD" within the Computational and Applied Physics Master programme on May and June, 2010.
- Jordi Boronat, Ferran Mazzanti, and Gregory Astrakharchik co-organized the "Correlations in Quantum Gases" workshop in Maó (Menorca) on Sept 30-Oct 2, in which Marvin Girardeau's 80th anniversary was celebrated.
- The 6th meeting of the Spanish Network of Systems Biology will take place on December 9-10, 2010, at the Institut d'Estudis Catalans in Barcelona. The meeting is co-organized by Jordi Garcia-Ojalvo.

## Recent publications

### Astrophysics

#### Explosions on neutron stars

New hydrodynamic simulations of type I X-ray bursts (thermonuclear explosions on the surface of neutron stars) have been performed by an international team led by GAA researchers J. José, F. Moreno and A.



Parikh. The work, which analyses the impact of the initial chemical composition on the light curve and on associated nucleosynthesis,

has been published in *The Astrophysical Journal Supplement* on July 2010.

### Materials science

#### Ultraslowing glass

The glass transition constitutes one of the unsolved problems of condensed matter physics and material engineering. J. C. Martínez-García and J. Ll. Tamarit from the GCM group, in collaboration with researchers from Poland, have presented clear evidence in favour of a critical-like divergent equation for liquid crystalline glass formers and orientationally disordered crystals that agrees with the latest experimental data. Their results appeared on *Physical Review E* on Sept 10, 2010.

### Nonlinear optics

#### Gain or loss materials

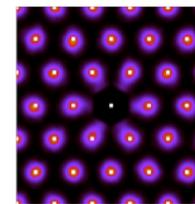
Materials with a periodic modulation of their light-transmission characteristics, like photonic crystals, are known to show unusual properties. M. Botey, R. Herrero and K. Staliunas from the DONLL group are investigating a less well-known class of artificial materials with related properties:

the gain-or-loss modulated materials. Their latest findings on the temporal and spatial light dispersion in such materials appeared on *Physical Review A* on July 2010.

### Materials Science

#### Quest for supersolidity

Supersolidity, or flow of matter in a solid without resistance, has been observed in



helium in labs throughout the world since its discovery in 2004. One possible explanation behind this phenomenon is the presence of defects, specially vacancies. Y. Lutsyshyn, G.

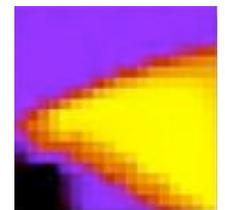
Astrakharchik, C. Cazorla, and J. Boronat from the SIMCON group found that both vacancy energy and its volume closely mimic the supersolid signal's experimental dependence on pressure. The findings, published in the Rapid Communications section of *Physical Review B* in Nov. 2010, were selected as an Editors' Suggestion of that journal.

### Nonlinear optics

#### Stochastic logic

Many nonlinear systems exist in which noise can be employed in a constructive manner. Cristina Masoller

and Jordi Zamora have provided yet another example of an optical system where this seems to be the case: they have numerically demonstrated the phenomenon



of logic stochastic resonance in a special type of lasers known as VCSELs. Their findings were published in *Optics Express* in July 2010.

## Our postdocs

### Alistar Ottochian, materials scientist

“I have been in the Group of Characterization of Materials since May 2010, as a Molecular Dynamic simulator. Under the supervision of Prof. Josep Lluís Tamarit and Prof. Luis Carlos Pardo, my project is about understanding the microscopical mechanisms that drive the molecular relaxation in the plastic phase. This specific state of matter is characterized by strong translational and weak orientational order. In relation to my interest on disordered systems, this work is a great opportunity to apply my previous knowledge of polymeric liquids in the field of plastic crystals. Despite their own particularities, these two research fields can be considered as complementary aspects of the same natural disorder in the matter. The knowledge on these fundamental mechanisms of the matter is an essential ingredient in the technology of new and eco-compatible materials.”



*Alistar Ottochian obtained his PhD in applied physics from the Università di Pisa in April 2010. He joined our department in May 2010 as a postdoctoral grant funded by FEN.*

### Isaac Llopis, biophysicist

“I joined the MOSIMBIO group to work with Dr. C. Prats and Dr. D. López in the study of the dynamics of *Mycobacterium tuberculosis* colonies in liquid and solid cultures. The objective of the research is to better understand the morphology and growth of the bacteria in different scenarios, in the context of medical and pharmaceutical research. This should serve to improve the current in vitro cultures and to better interpret the behavior of these infectious bacteria inside the human body. Some hot topics in this field are to facilitate laboratory data analysis and interpretation, to quantify the relationship between the formation of clumps in the liquid cultures and the roughness of the colonies, and to predict how these phenomena affect the monitoring of the infection course, as well as the dynamics in vivo. This work is being carried out in collaboration with the UTE (Unitat de Tuberculosi Experimental, Hospital Germans Trias i Pujol, Universitat Autònoma de Barcelona), an experimental group directed by Dr. P. J. Cardona.”



*Isaac Llopis obtained his PhD in physics from the Universitat de Barcelona in 2008. He became a FEN postdoc in November 2010. Previously he had been in FEN as a teaching assistant since 2008.*

### Side Note

#### FEN under exam

The Research Activity of the FEN Department has been evaluated by an external Review Panel composed by five experts, one for a different area of expertise of the department:

- Prof. Jaume Casademunt (Chair) – UB, Spain; Statistical and Non-Linear Physics, and Biophysics
- Prof. Larry R. Nittler – Carnegie Institution, Washington, USA; Cosmochemistry and Astrophysics
- Prof. Sylwester J. Rzoska – University of Silesia, Poland; Physics of Materials and Condensed Matter
- Prof. Jordi Mompart – UAB, Spain; Non-Linear Optics & Quantum Physics
- Prof. Lluís Font – UAB, Spain; Nuclear Physics

The evaluation has been performed through interviews with the heads of the FEN research groups, and extracting information from UPC databases. The resulting document highlights the activities of the FEN within UPC, and outlines key aspects to research groups such as publication level, international impact, teaching load, and origin of PhD students.

## MORE NEWS

- Josep Lluís Tamarit has been nominated member of the College 6 (Structure and dynamics of liquids and glasses) at the Institute Laue-Langevin (Grenoble, France) on June, 2010.

## SEMINARS

- Lubos Mitas (North Carolina State University), gave a seminar on Sept 10 titled “Ground and excited wave functions nodal structures and pairing effects by quantum Monte Carlo methods”. He was invited by Jordi Boronat from the SIMCON.

- The Nuclear Engineering section invited Prof Sergey Smolentsev from UCLA to give a seminar on Sept 20. He spoke about “MHD/Thermofluid Studies for Fusion Applications”.
- Simone Pigolotti (Niels Bohr Institute, Denmark) gave a seminar on July 6 titled “Symbolic dynamics of biological oscillations”.

## BOOKS

- Jordi García-Ojalvo and Núria Domedel-Puig have contributed the chapter ‘Systems biology of Multiple Sclerosis’ to the ‘Multiple Sclerosis Treatise’ published by Marge Editors.
- Members of the GCM have contributed two chapters to the book ‘Metastable Systems under Pressure’, by Springer.

## PHD THESES

- Jordi Ferrer Savall. FEN advisors: Daniel López Codina and Joaquim Valls Ribas (June 21, 2010)
- Rubén M Cabezón. FEN advisor: Domingo García (April 21, 2010)

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