



# FENOMEN

NEWSLETTER OF THE DEPARTMENT OF PHYSICS AND NUCLEAR ENGINEERING

## NEWS

### 2008 FEN POSTDOCTORAL FELLOWSHIP AWARDED

The Research Commission of the Department has awarded financial support for a postdoctoral fellowship. The recipient of the grant this year is Dr. Yaroslav Lutsyshyn, who will work in the group of Computer Simulation in Condensed Matter, where he will study low-dimensional electronic systems.

### OPEN POSITIONS

- Two PhD and two postdoc fellowships on nuclear engineering and fusion and fission energy (javier.dies@upc.edu)
- We are currently looking for potential candidates in selected research areas who are interested in applying to a Ramon y Cajal fellowship in our Department. For details, contact us at secre-fen@fen.upc.es.

### UPCOMING EVENTS

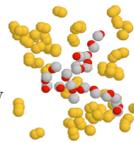
- The annual Research Retreat of the department will take place on February 6, 2009 in the Institut d'Estudis Catalans, Carrer del Carme, 47. For more information, see <http://www.fen.upc.edu>
- "XVI Conference on Nonequilibrium Stat. Mechanics & Nonlinear Physics". Punta del Este, Uruguay, December 1-5, 2008. Co-organized by Cristina Masoller. <http://medyfinol08.fisica.edu.uy>
- "Noise in Life 2009". Cambridge, UK, March 30-April 1, 2009. Co-organized by Jordi Garcia-Ojalvo. <http://www.cellsignet.org.uk/noise09>

## Recent publications

### Chemical physics

#### The supercooled state of dipolar liquids

Supercooled liquids have a strikingly slow dynamics without a clear structural cause. The ensuing glass transition is considered to result from an increase of cooperativity between the dynamics of molecules. Ricardo Palomar and Gemma Sesé have studied the case of dipolar liquids via molecular dynamics, and found that the dynamics in the supercooled state does not significantly depend on the dipolar nature of the fluid. The studied appeared in the *Journal of Chemical Physics* on Aug. 12, 2008.



### Biomedicine

#### Culturing malaria

The fight against malaria requires growing its parasite *in vitro*, a process that is not well understood yet. A group of FEN researchers from the SIMBIO group has studied, in collaboration with researchers from GlaxoSmithKline, how the geometry of the culture affects the parasite's development. The work has been published in the *Malaria Journal* on Oct. 8, 2008.

### Biological modeling

#### Web-based microbial simulation

Individual-based models of microbial systems are more difficult to analyze and communicate than traditional analytical models. Joan Carles Cañadas and a researcher from the SIMBIO group have developed a web-based simulation of yeast populations in liquid media that allows the user to explore the way in which the population reacts to changes in parameter values, initial conditions or assumptions. The model is described in the Nov. 2008 issue of the *Journal of Industrial Microbiology and Technology*.

### Complex systems

#### The emergence of language conventions

Linguistic categories (colors, animals...) are culture-dependent conventions accepted by communities without central coordination. Individuals may conceptualize the world differently, but they must reach an agreement to understand each other. FEN researcher Andrea Baronchelli and co-workers have developed a game model to show that categories may emerge simply through cultural exchange. The results were published in the *Proceedings of the National Academy of Sciences of the U.S.A.* on June 10, 2008.



### Systems biology

#### The quantized dynamics of cells

Certain cell types exhibit quantized behavior, e.g. in the distribution of cell cycles: only a discrete set of cycle times are possible. Jordi Garcia Ojalvo and collaborators from the Southwestern Medical Center in Dallas have proposed a simple mechanism for this phenomenon, in which noise plays a vital role. The work has been published in the *Proceedings of the National Academy of Sciences of the U.S.A.* on Oct. 14, 2008.

### Physical chemistry

#### Encapsulating dyes

Cyclodextrins are useful molecules that stabilize sparingly soluble organic molecules in aqueous phases. Elvira Guàrdia and Jordi Martí, with collaborators from Argentina, have used extensive molecular dynamics simulations to study the solvation dynamics of the dye Coumarin 153 after encapsulation by  $\beta$ -cyclodextrins. The work was published in the *Journal of Physical Chemistry B* on July 2, 2008.

## Our postdocs

### Núria Domedel Puig, biologist

“Since I was primarily trained as a biologist, working in a physics department is a very challenging and exciting task. Prof. Jordi Garcia Ojalvo and I are working on a project funded by the Red Española de Esclerosis Múltiple. We study the cellular response to interferon beta (IFN $\beta$ ), a widely used drug against this disease. Our collaborators from the Universidad de Navarra, headed by Dr. Pablo Villoslada, generate time series data from human blood samples that we then analyse. The goal is to build a mathematical model that reproduces IFN $\beta$  signalling. We wish to gain insight into how IFN $\beta$  treatment alters cellular behaviours, and why some patients fail to respond to this treatment.”



*Núria Domedel Puig obtained her PhD in Bioinformatics from Birkbeck College (University of London, UK) in June 2008. She has joined the Department financed by the Red Española de Esclerosis Múltiple (REEM).*

### Ioannis Skarmoutsos, phys. chemist

“I joined the Department on April 2008, and since then I have started my research in collaboration with Prof. Elvira Guardia. In general, my impressions about the hospitality and the labor environment in DFEN are excellent. My research focuses mainly on the determination of the local structural effects and related dynamics in supercritical fluids (SCFs), by employing molecular dynamics simulation.

It is well-known that SCFs exhibit solvent properties which may be varied from gaslike to liquidlike values with small changes in pressure or temperature. The origin of this peculiar behavior of SCFs has been attributed to density inhomogeneities in such systems. Our main goal is to reveal the microscopic mechanisms responsible for the static and dynamic behavior of these inhomogeneities, and their interconnection with dynamic properties of SCFs.

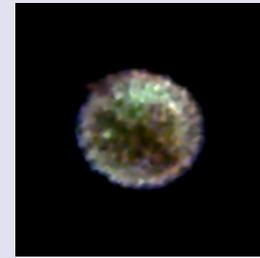


*Ioannis Skarmoutsos obtained his PhD in chemistry from the National and Kapodistrian University of Athens (Greece) in 2007 and is in Barcelona since April 2008. He is currently a postdoctoral fellow, financed partly by our Department.*

### Side Note

## Instant replay of a supernova explosion

X-ray spectra from the Chandra and XMM-Newton Observatories have allowed to characterize for the first time the energetics and the explosion mechanism of a supernova (SNR 0509-67.5), some 400 years after the



Source: NASA/CXC/Rutgers/J.Warren

event. Eduard Bravo participated in the study, which has been published in *The Astrophysical Journal* on June 20, 2008. The results have been confirmed by the optical detection of the light echo of the supernova explosion. For more information, see [http://chandra.harvard.edu/press/08\\_releases/press\\_032008.html](http://chandra.harvard.edu/press/08_releases/press_032008.html)

## VISITING SCHOLARS

- Sebastian Busch, Univ. München, Germany
- René Céolin, Univ. Paris 5, France
- Gabriel Cuello, Inst. Laue Langevin, France
- Michael Elowitz, Caltech, USA
- Dan Gauthier, Duke, USA
- Falk Lederer, Univ. Jena, Germany
- Aldo Romero, Mexico
- Luis Roso, Univ. Salamanca
- Osvaldo Rosso, Univ. Newcastle, Australia
- James Sharpe, CRG, Barcelona
- Steven Shore, Univ. Pisa, Italy
- Vincent Tatischeff, Orsay, France
- Maria Susana Torre, UNICEN, Argentina

## RESEARCH PROJECTS

The Ministerio de Ciencia e Innovación has granted these projects to FEN:

- “Propiedades físicas de dimeros cristal líquido confinados en estructuras micro-nano porosas funcionalizadas” (resp: David O. López), ref. MAT2008-01372

- “Superfluidity and condensation of Bose-Einstein in ultrafast matter” (resp. Jordi Boronat), ref. FIS2008-04403
- “Dinámica en sólidos orientacionalmente desordenados” (resp: Josep Ll. Tamarit), ref. FIS2008-00837

## FEN AT ESF

The following activities organized by FEN researchers have been sponsored by the European Science Foundation:

- The ESF Exploratory Workshop on “Glassy liquids under pressure: fundamentals and applications” took place in Ustron, Poland last year, co-organized by Josep Lluís Tamarit. The proceedings have just appeared in the *Journal of Physics: Condensed Matter*.
- The ESF has recently selected a transnational research project focused on the origin of the elements and the nuclear history of the Universe, entitled Euro-GENESIS. The project is coordinated by FEN researcher Jordi José, and involves groups from Germany, Italy, Greece, Belgium, USA, and France.

## OUTSTANDING PHD AWARDS

The UPC has awarded the 2008 Outstanding PhD Awards in the fields of Applied Sciences and Industrial Engineering, respectively, to the following FEN PhD students:

- Marco Masia, “Solvation dynamics and ion transport in conventional solvents and plasticizers”, advisor: Rosend Rey
- Jerónimo García, “Study of electron heat transport in LHD and TJ-II”, advisor: Javier Dies

## Edited by

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