Recent publications

**Biomedicine**

**Fighting malaria *in silico***

To find a cure for malaria, scientists must first learn to cultivate effectively the parasite that causes it, *Plasmodium falciparum*. However, this has proven to be a difficult task. Researchers from our department have developed a simulation tool, named INDIVidual DIScrete SIMulation protocol (INDISIM), that qualitatively reproduces the behavior of erythrocytes infected with the parasite, and will thus help in the design of new drugs. The work has been performed by the group of Antoni Giró in collaboration with researchers from GlaxoSmithKlein, and was published in the *Journal of Theoretical Biology* on June 2, 2007.

**Materials Science**

**The fragility of metallic alloys***

Bulk-metallic-glass alloys have many interesting structural applications. However, their production via melt casting is strongly limited by their glass-forming ability. One of the principal factors affecting this ability is the nature of the corresponding supercooled liquid. In collaboration with colleagues from the University of Cambridge, Eloi Pineda has found that the liquid fragility of the Ca-Mg-Cu alloy is correlated with its elastic properties, similarly to what happens in general glasses. This observation could lead to a powerful criterion to choose candidate compositions for new bulk metallic glasses. It was published in the *Journal of Alloys and Compounds* on May 31, 2007.

**Meteorology**

**The tailwind of butterflies***

The group of Marta Alarcón, in collaboration with researchers from CEA, has studied the migration patterns of the painted lady butterfly, *Vanessa Cardui*, on its trip to north-eastern Spain, finding that this migration is aided by African wind currents. The work was published in the *Journal of Animal Ecology* in September 2007.

**Materials Science**

**Understanding the glass transition***

Several features in the transition of materials to the glassy state are still a mystery. One of them is the Johari-Goldstein β relaxation, a secondary spectral peak in the material's susceptibility. Luis Carlos Pardo, together with colleagues from the University of Augsburg, has thoroughly characterized this feature in benzophenone by means of broadband dielectric spectroscopy. The results were published in the *Physical Review E* on September 28, 2007.

**Nonlinear Dynamics**

**Silencing oscillators***

Coupled nonlinear oscillators usually synchronize their rhythms, as Christian Huygens discovered in 1665. However, under certain conditions the oscillations are killed by coupling. Ekkehard Ullner and Jordi Garcia Ojalvo, in collaboration with scientists from Moscow and Essex, have found a route towards oscillation silencing that relies of phase-repulsive coupling. The work appeared in *Physical Review Letters* on October 2, 2007.
Highly cited papers

Jordi José and Margarita Hernanz
“Nucleosynthesis in classical nova: CO vs. ONe white dwarfs”,
“This paper presents 14 hydrodynamic simulations of classical nova explosions and their nucleosynthesis. The study emphasizes the expected contribution of novae to the Galactic chemical abundance pattern as well as a thorough analysis of the synthesis of radioactive species of interest for gamma-ray astronomy (such as $^7\text{Li}$, $^{22}\text{Na}$, or $^{26}\text{Al}$). The multidisciplinarity of this work has raised significant interest in different areas, including cosmochemistry (origin of presolar meteoritic grains), galactic chemical evolution, experimental nuclear physics, observational astronomy (nova light curves and optical spectra), or high-energy astrophysics, among others. This study is quoted in the review paper “Astrophysics in 1998”, by V. Trimble (Univ. California at Irvine).”
Jordi, José, associate professor at FEN

Meteorology Award

This year’s International Award of Meteorology Edward Fontes’ has been bestowed on Carina Serra and Xavier Lana, together with colleagues from the Applied Physics Department of the UPC and the University of Barcelona, by the Catalan Association of Meteorology (ACAM). The Award has recognised the work entitled “Statistical Distributions of the Daily Rainfall Regime in Catalonia (Northeastern Spain) for the years 1950-2000”, published in 2005 on the International Journal of Climatology of the Royal Meteorological Society of Great Britain (vol. 25, pages 1381-1403).

FEN at ITER

The Nuclear Engineering Research Group, led by Javier Dies, is responsible of two projects associated with the safety of the ITER reactor that is being built in Cadarache, France. The projects are:
- Loss of plasma control event evaluations related to the Generic Site Safety Report.
- ITER safety studies: passive plasma termination for Beryllium evaporation in LOCA transients.

NEW DOCTORAL STUDENTS

- Anna Calvo: “Security of nuclear fusion Broader approach”
- David Camacho: “Ultrafast optics and coherent quantum control”
- Jordi Casanova: “Multidimensional studies of stellar explosions”
- Lorena Espinar: “Optical control of gene regulation”
- Rafael Levic: “High-pressure properties of orientationally disordered phases”
- Julio C. Martinez: “Homogeneity and heterogeneity in the supercooled and glass state”
- Manel Martinez Cid: “Assessment of economic and technical risks in nuclear plants”
- Oleg Osychenko: “Path integral Monte Carlo methods for fermions”
- Jose Carlos Rivas: “Security of the nuclear fusion reactor ITER”
- Vito Roppo: “Linear and nonlinear effects in photonic crystals”
- Riccardo Rota: “Ground-state path integral Monte Carlo with higher-order actions”
- Muriel Rovira: “Short-range order in orientationally disordered phases”
- Jonás Sala: “Confinement effects in the structure and dynamical properties of water via molecular dynamics studies”

NEW MEC RESEARCH PROJECTS

In its latest call, the Ministerio de Educación y Ciencia granted the following research projects:
- “Multidimensional Modeling of Stellar Explosions: Novae, X-Ray Bursts, and Thermonuclear Supernovae” (resp: Jordi José), ref. AYA2007-66256
- “Procesos dinámicos en sistemas físicos auto-ensamblados” (resp: Romulando Pastor-Satorras), ref. FIS2007-66485-C02-01
- “Individual-based Modelling (IBM) de sistemas microbiológicos para el desarrollo sostenible: medio ambiente, seguridad alimentaria y salud” (resp: Antoni Giró), ref. CGL2007-65142/BOS
- “Estudio de convertidores de energía de baja tensión para reducción de costes y mejora de fiabilidad de sistemas de generación eólica” (inv. FEN: Carme Hervada), ref. ENE2007-67033-C03-00

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Side Note
Characterizing art with synchrotron radiation

The group of Trinitat Pradell has applied synchrotron radiation for the characterization of romanesque wall paintings. The small size of the radiation beam provides detailed compositional profiles from the different chromatic and preparation layers of the paintings. The results obtained indicate a clear connection between the paintings found in the Occitanian church of of Saint Eulàlia d’Unha in the Vall d’Aran (central Pyrenees) and the Catalan Romanesque paintings from the south bound of the Pyrenees. The article was published online in Applied Physics A on August 28, 2007.