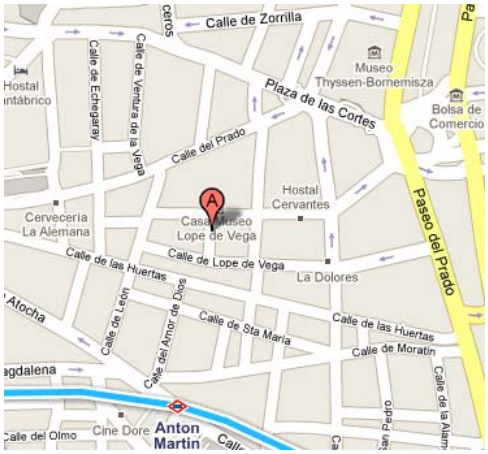
Workshop GISC 2010.

February, 19th.
Universidad Complutense de Madrid. Aula de Grados (1ª Planta).

PROGRAM

9:30-10:00	Mario Castro
10:00-10:30	Luis Dinis
10:30-11:00	Edgar Roldán
11:00-11:30	Coffee break
11:30-12:00	Mario Amado
12:00-12:30	Clara González-Santander
12:30-13:00	Andrey Malyshev
13:00-15:00	Lunch
15:00-15:30	Alberto Robledo
15:30-16:00	Pablo Rodríguez
16:00-16:30	Ricardo Brito
16:30-17:00	Coffee break
17:00-17:30	Esteban Moro
17:30-18:00	Daniele Vilone
18:00-18:30	Jelena Grujic

20:30 DINNER at SIDRERIA ZERAIN, C/ Quevedo, 3. Metro Antón Martín 36.50 € (VAT inc.)



PARTICIPANTS

1. Mario Amado (UCM)*
2. Saul Ares (MPIPKS, Dresden)*
3. Stefano Bianco (UCIIIM)
4. Ricardo Brito (UCM)*
5. Mario Castro (UPCO)*
6. Sara Cuenda (UAM)*
7. Rodolfo Cuerno (UCIIIM)*
8. Jose Cuesta (UCIIIM)*
9. Elena Díaz (UCM)
10. Luis Dinis (UCM and Institute Curie, Paris)*
11. Francisco Domínguez-Adame (UCM)*
12. Clara González-Santander (UCM)*
13. Jelena Grujic (UCIIIM)
14. Jose A. Capitan (UCIIIM)*
15. Andrey Malyshev (UCM)*
16. Yuri Martinez-Raton (UCIIIM)*
17. Giovanna Miritello (UCIIIM)
18. Esteban Moro (UCIIIM)
19. Javier Munárriz (UCM)*
20. Javier Muñoz García (Univ. College, Dublín)*
21. Svetozar Nesic (UCIIIM)
22. Juan MR Parrondo (UCM)*
23. Carlos Rascón (UCIIIM)
24. Alberto Robledo (UNAM, México UCIIIM)
25. Pablo Rodríguez (UCM)
26. Édgar Roldán (UCM)*
27. Anxo Sánchez (UCIIIM)
28. Daniele Vilone (UCIIIM)*
29. Edoardo Vivo (UCIIIM)

* People attending the dinner at Zeraín.

ABSTRACTS

Quantum phase transitions in graphene
Mario Amado
UCM

In graphene, the conventional integer quantum Hall quantization for the conductivity is shifted by a half integer due to the twice smaller degeneracy of the n=0 Landau level. At very high magnetic fields and with high quality samples more plateaus not in expected sequence have been observed. These new plateaus cannot be understood only by using the Landau quantization alone and their origin is under a considerable debate. Different measurements have demonstrated that the longitudinal resistance may either decrease or increase at \nu~0 by decreasing the sample's temperature fueling the debate concerning the existence and origin of an insulator phase near the Dirac point. Recently we have obtained experimental evidences of a metal-insulator transition between filling factors \nu=-2 to \nu=0 by tuning the magnetic field. Using the standard scaling theory analysis we have obtained the critical exponent of the transition \kappa=0.57, in agreement with the metal-insulator transition in usual 2 dimensional electron gasses. We also observe that both the Hall conductivity and resistance remain quantized deep into the insulating phase suggesting that we are in the quantized Hall insulator regime.

Segregation in a vertically vibrated granular mixture: effects of the restitution coefficient
Ricardo Brito
UCM

I will show some segregation effects occurring in mixtures of granular particles. The usual vibration is a vertical one in the presence of gravity, giving rise to the so-called Brazil Nut effect. However, such segregation is present in horizontally vibrated mixtures as well. In this talk I will focus on the role of the collisional dissipation in the segregation effect, and how the dissipation can invert the usual Brazil Nut segregation.

Physicist approach to immunology
Mario Castro
UPCO

Immunology is a surprisingly young discipline in Biology. The main dogmas in the field have been established in the last three decades. As a consequence only in the last years both mathematicians and physicists have begun to provide some theoretical approaches to the main questions arising from experiments. In this talk, some preliminary heuristic calculations and estimates will be used to shed some light to one of the central problems in immunology: antigen recognition. Thus, using methods borrowed from statistical mechanics, some hypothesis are formulated and validated using current experimental data available. Also some new ideas as the concept of a biological temperature to characterize cell motility will be presented.

Fluctuation-dissipation theorem in linear systems with general correlated noise

Luis Dinis
Inst. Curie - UCM

The Generalized Fluctuation-Dissipation theorem as described by Prost, Joanny and Parrondo in PRL 103, 090601 (2009) only applies in principle to systems with markovian dynamics. Nevertheless, as explained therein, the theorem can be applied to a linear system with an exponentially correlated noise by adding an additional degree of freedom leading to markovian dynamics and then using an appropriate change of variables. In this talk I will explain how the fluctuation-dissipation theorem can be recovered in a system described by a linear Langevin equation with a general non-white noise. We can always describe the (decaying) correlation function of the noise as an infinite sum of decaying exponentials, by use of the Laplace transform. For any fixed frequency of the noise we can add an additional degree of freedom leading again to markovian dynamics. Building on the ideas in the mentioned paper, we can find the change of variables which will reinstate the FDT.

A solvable model of exciton states in a quantum wire

Clara González-Santander
UCM

An exactly solvable model is introduced for calculating the exciton state and the binding energy as a function of the radius of the quantum wire within the envelope-function approximation. In the calculation, we replace the actual Coulomb interaction between the electron and the hole by a Gaussian non-local separable potential and obtain closed expressions for both the envelope-function and the binding energy.

Humans exhibit diverse behavior when playing a Prisoner's Dilemma in a large network

Jelena Grujic
UCIIIM

Although defection is evolutionarily selected in well-mixed populations playing Prisoner's Dilemma, theoretical models show that depending on how strategies are updated, cooperation can emerge in spatially or socially structured populations. Here we report on experiments with human subjects on a large network. The most striking result is that players do not follow a single behavioral pattern: We find a high percentage of pure or almost pure defectors and a sensibly smaller one of pure or almost pure cooperators which cannot cluster. The remaining players are more or less prone to cooperate depending on the amount of cooperators in their neighborhood. This heterogeneity of behavior leads to a low (albeit nonzero) level of cooperation. Theoretical models need to incorporate and hopefully explain this behavioral diversity.

Optical bistability in nanoscale hybrid metal-semiconductor artificial molecules

Andrey Malyshev
UCM

We consider a hybrid system comprising a semiconductor quantum dot (SQD) and a nobel metal nanoparticle (MNP). Such a dimer can be considered as the simplest hybrid artificial nano molecule. When the system is excited optically, the dipole moment of the excitonic transition in the SQD generates additional electric field at the MNP, which is superposed with the external field. The induced dipole moment of the MNP generates an additional electric field at the SQD, providing a feedback. Thus, the presence of the MNP leads to a self-action of the excitonic transition dipole moment, which can give rise to a variety of new optical properties. In particular, if the coupling between two particles is strong, the self-action (feedback) can be large enough to result in optical bistability. The fact that both the SQD and the MNP can sustain high electric fields suggests such possible applications of the artificial molecules as all-optical switch and optical memory at nanoscale.

Universality on the dynamics of social relationship

Esteban Moro
UCIIIM

We present a study of the dynamics of the conversations by mobile phone of millions of persons during time periods of months to years. In particular we observe that most of the conversations are localized in time, while a minority of them are stable over time. Using this separation between those conversations we investigate the main properties of the stable relationships and also the topological features of the social network if the stable/unstable nature of the relationships/conversations is taken into account.

Routes to chaos in Condensed Matter Physics and in Complex Systems

Alberto Robledo
Univ. Nacional Autónoma de México y UCIIIM

We present an overview of recent advances connecting routes to chaos in low-dimensional nonlinear systems (for the cases of intermittency and period-doubling) with the localization transition in disordered systems, with Zipf and Benford laws, with renewal stochastic processes, and with the Central Limit Theorem for determinable variables.

Dissipation and information in stochastic processes

Édgar Roldán
UCM

The relationship between average work dissipation and irreversibility has been widely analyzed via the fluctuation theorems. In this talk, it is shown that the dissipation of stochastic processes in stationary regime can be estimated with the information of a single realization. The relative entropy is introduced as an estimator of the average work, explaining how it can be calculated for several dynamics (markovian, nth order markovian and hidden Markov chains). Finally, the use of partial information of the process in the relative entropy calculation is proved to give a lower bound of the dissipation for our examples. A discrete flashing ratchet is studied as a paradigm of stochastic discrete process in stationary regime.

Casimir energy in classical and quantum systems

Pablo Rodriguez
UCM

Casimir effect is usually considered as a pure quantum effect which causes, for example, the attraction between two uncharged plates. In this talk we are going to argue that Casimir effect is an ubiquitous effect in the Nature, whose origin are the fluctuations over a medium. We will give some examples of Casimir effect in quantum and classical systems.

The peace mediator effect in small groups

Daniele Vilone
UCIIIM

Recent approaches of statistical mechanics in multi-agent system modeling of opinion formation have proved to be able to capture the interesting dynamics and the correct parameters governing the evolution of each individual. Into this context, we propose a new model of opinion dynamics made of interacting individuals, the agents, each bearing two dynamical variables (respectively, the “opinion” and the “affinity”) self-consistently adjusted during time evolution. We also define two special classes of interacting entities, both acting for a peace mediation process but via different ways of action: the “diplomats” and the “auctoritates”. The behavior of the system is investigated and discussed by means of both a theoretical and a numerical approach. The effectiveness of such peace mediators in promoting final consensus is discussed.