VII Workshop del GISC

18 de febrero de 2011
Escuela de Ingeniería Aeronáutica y del Espacio. U.P.M.

Programa

09:30-10:00	**Esteban Moro**, UC3M *Twitter y política: Información, opinión y ¿Predicción?*
10:00-10:30	**Daniele Vilone**, UC3M *The role of topology in the evolution of cooperation*
10:30-11:00	**Jelena Grujic**, UC3M *Replicator dynamics for the iterated prisoner's dilemma with three types of players*
11:00-11:30	Café
11:30-12:00	**Saúl Ares**, Max Planck Institute for Complex Systems, Dresden *Continuum theory of coupled oscillators with delayed coupling*
12:00-12:30	**Javier Muñoz**, University College, Dublín *Integrating multiple signals into cellular decisions...*
12:30-13:00	**Antonio Rodríguez**, UPM *Scale invariant probabilistic model having two dimensional q−Gaussians...*
13:00-15:00	Comida
15:00-15:30	**Christopher Gaul**, UCM *Bogoliubov excitation of disordered Bose-Einstein condesates*
15:30-16:00	**Javier Munarritz**, UCM *Directional Plasmonic Nano-Antennae*
16:00-16:30	Café
16:30-17:00	**Pablo Rodríguez**, UCM *Formalismo de Multiscattering del Efecto Casimir.*
17:00-17:30	**Sara Cuenda**, UAM *Simple rules govern finite-size effects in scale-free networks*

Lugar

Sala Torres Quevedo
Escuela de Ingeniería Aeronáutica y del Espacio
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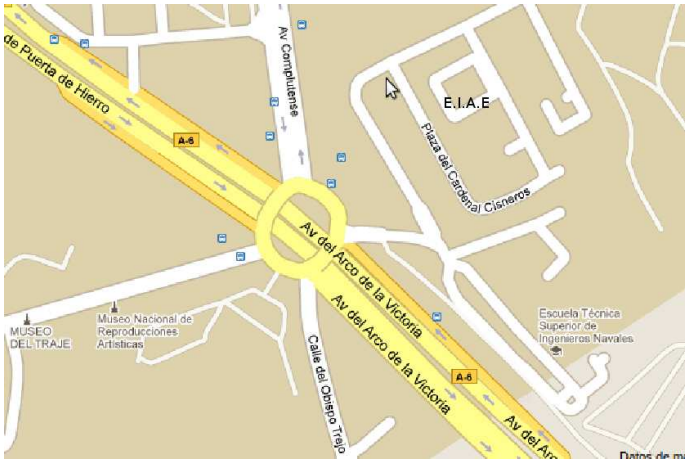

Participantes

1.	Mario Amado	UCM
2.	Saúl Ares	MPIPKS, Dresden
3.	Ricardo Brito	UCM
4.	Sara Cuenda	UAM
5.	Rodolfo Cuerno	UC3M
6.	José A. Cuesta	UC3M
7.	Francisco Domínguez-Adame	UCM
8.	Christopher Gaul	UCM
9.	Clara González-Santander	UCM
10.	Jelena Grujic	UC3M
11.	Luis A. Martínez	UC3M
12.	Yuri Martínez Ratón	UC3M
13.	Giovanna Miritello	UC3M
14.	Esteban Moro	UC3M
15.	Javier Munarritz	UCM
16.	Javier Muñoz	UCD, Dublín
17.	Carlos Rascón	UC3M
18.	Edgar Roldán	UCM
19.	Pablo Rodríguez	UCM
20.	Juan M. Rodríguez Parrondo	UCM
21.	Antonio Rodríguez	UPM
22.	Ángel Sánchez	UC3M
23.	Daniele Vilone	UC3M
24.	Edoardo Vivo	UC3M

Cena

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Charlas

Twitter y política: Información, opinión y ¿Predicción?

Esteban Moro UC3M

Internet, la Web 2.0 y las redes sociales están introduciendo silenciosa e imparablemente un cambio en el paradigma cultural tradicional. La nueva "sociedad red", es una sociedad nueva gracias a la revolución tecnológica, el volumen de información accesible y la estructura social conectada en red. Esta Red, con sus herramientas de búsqueda, clasificación, valoración y difusión de la información junto con su facilidad y versatilidad para establecer vínculos entre las personas, está provocando fuertes cambios en todos los sectores, entre ellos, en el universo de la política. Twitter, dada su naturaleza pública, permite analizar el carácter de la información y de las relaciones sociales lo que hacen de ella una de las mayores fuentes pública de propagación de la información en tiempo real. Analizando la actividad en Twitter en las últimas elecciones catalanas observamos cómo las opiniones políticas y la información política que circula por Twitter no es caótica, tiene estructura y se organiza en comunidades que tienen relación con cada uno de los partidos políticos que se presentaron a las elecciones. Estudiando el tamaño y propiedades de dichas comunidades y métricas agregadas de menciones y de reenvíos de tweets, discutimos la posibilidad de utilizar Twitter como una nueva manera de medir la opinión política.

The role of topology in the evolution of cooperation

Daniele Vilone UC3M

The evolution of cooperation in systems of interacting agents is a very debated issue: in particular, the influence of the population structure (described by a network) on the emergence of the cooperation has been widely studied in the last two decades. Several social dilemmas have been considered (Prisoner's Dilemma Game, Stag Hunt, Snowdrift) as well as different kinds of networks: regular lattices, random networks, etc. I present a detailed numerical analysis of the impact of different topologies (euclidean, small-world, Erdos-Renyi and scale-free networks) on the behaviour of a population playing the Prisoner's Dilemma game. At variance with the studies carried up to date, I analyse the dynamical evolution of both the strategies of the players (cooperation and defection) and their updating rules (unconditional imitation, replicator, and Moran); therefore, the system evolve to naturally select the fittest strategy and update mechanism. The results support two main conclusions. First, the shortcuts introduced in a small-world topology have a dramatic effect on the emergence of cooperation and the competition of rules; and, second, increasing the heterogeneity of the network favours probabilistic updating rules against unconditional imitation leading, as a consequence, to a more cooperative global behaviour.

Replicator dynamics for the iterated prisoner's dilemma with three types of players

Jelena Grujic UC3M

We have recently performed an experiment to test the emergence of cooperation in the presence of an underlying structure [Grujic et al., PLoS ONE 5(11): e13749 (2010)]. Human subjects played a PD with each of their neighbors in a 13x13 square lattice. The results show that the population consisted of cooperators and defectors, who respectively cooperate or defect with high probability regardless of their and their neighbors' previous actions, and conditional cooperators, whose behavior does depend on those previous actions. Here we take a first step towards an evolutionary explanation of the experimental results. Specifically, we use replicator dynamics to describe the evolution of a set of strategies that mimics the observations, in a simplified context consisting of a well-mixed population of players confronted in iterated Prisoner's Dilemma games. The dynamics exhibits two attractors: one for a population consisting only of defectors, and an interior point with population frequencies comparable to those observed in the experiment. The former has a much smaller basin of

attraction than the latter, which therefore becomes the most probable evolutionary outcome. This is the first hint that the experiment may be amenable to an evolutionarily explanation.

Continuum theory of coupled oscillators with delayed coupling

Saúl Ares Max Planck Institute for Complex Systems, Dresden

Extended systems of interacting oscillators can generate complex spatiotemporal patterns. Due to intrinsic lags in signal production, propagation, and processing, the interaction between oscillators is often delayed. For example in cellular systems, slow complex kinetics introduces a time delay in intercellular coupling. Using a generic description based on coupled phase oscillators, we study the effects of delayed coupling on patterning and timing. We derive a continuum approximation for a system of coupled phase oscillators in which the coupling between neighboring cells is delayed. The resulting equation shares features with the celebrated KPZ and Kuramoto-Sivashinsky models. As an application, we use the continuum approximation of a discrete theory of vertebrate segmentation to compare theory and spatial gene expression patterns.

Integrating multiple signals into cellular decisions by networks of protein modification cycles

Javier Muñoz García University College, Dublín

Cell responses to internal and external stimuli are governed by protein interactions. The enzymatic activity and biological function of proteins is modulated by reversible post-translational modifications such as phosphorylation, acetylation, methylation, ubiquitination, sumoylation, etc. Here we present a general model of protein modifications and show that these systems can integrate multiple input signals into digital-like responses, representing robust cellular decisions. Consequently, proteins modified by multiple enzymes can function as complex switches, playing a similar role in cellular information processing as neurons in the brain. We develop an analytical approach for constructing the phase diagram of such systems from the structure of the protein modification network, determining how switching between distinct responses take place. This method can be applied to a broad class of protein modification systems and provides an alternative to numerical approaches that give limited insight when the number of unknown parameters is large.

Scale invariant probabilistic model having two dimensional $q-$Gaussians as $N \to \infty$ limiting distribution

Antonio Rodríguez UPM

It has been recently introduced [A. Rodríguez *et. al*, JSTAT P09006 (2008)] and further generalized [R. Hanel *et. al*, Eur. Phys. J. B **72**, 263 (2009)] a family of one dimensional scale-invariant probabilistic models characterized by a real number $\nu > 0$ having one dimensional $q-$Gaussians as $N \to \infty$ limiting distributions based on the so called Leibniz triangle, and on the Pascal triangle. The model consisted of a set of N *equal, long-range-correlated binary* random variables —corresponding to the binomial distribution in the uncorrelated case— in which scale-invariant correlations were introduced.

In this contribution we generalize the model by allowing the N discrete random variables to take on three different values —hence the trinomial distribution is obtained in the uncorrelated limit—. In addition, we introduce the so called Pascal pyramid, as well as what we may call the *Leibniz pyramid* (generalization of the Leibniz triangle), given by $r^{(1)}_{N,n,m} = \frac{2}{(N+2)(N+1)\binom{N}{n,m}}$. Certain subpyramids of the Leibniz pyramid provide us with a family of models characterized by a real number $\nu \geq 0$, given by $r^{(\nu)}_{N,n,m} = \frac{B(n+\nu,m+\nu)B(n+m+2\nu,N-n-m+\nu)}{B(\nu,\nu)B(\nu,2\nu)}$, which follow the *generalized Leibniz rule*: $r^{(\nu)}_{N,n,m} + r^{(\nu)}_{N,n+1,m-1} + r^{(\nu)}_{N,n,m-1} = r^{(\nu)}_{N-1,n,m-1}$, responsible for the scale-invariant character of the correlations. We have strong indications that under an appropiate change of variables, the limiting $N \to \infty$ probability distribution of the model is a two-dimensional $q-$Gaussian with $q_\nu = \frac{\nu-2}{\nu-1}$.

Bogoliubov excitation of disordered Bose-Einstein condesates
Christopher Gaul UCM

Experiments with Bose-Einstein condensates of dilute atomic gases have opened unprecedented possibilities for studying the interplay of quantum statistics, interaction, and disorder. Here, we set up a Bogoliubov theory describing a repulsively interacting Bose-Einstein condensate in presence of an external disorder potential. The first effect of the disorder potential is deforming the condensate on the mean-field level. We then address the question, how the excitation spectrum and Bose-Einstein condensation itself are affected. By a saddle-point expansion of the many-body Hamiltonian around the deformed mean-field ground state, we find the Hamiltonian for the quantum fluctuations, the starting point for our disorder perturbation theory. We compute (i) the renormalized excitation dispersion relation, i.e., the speed of sound and mean free paths, as well as (ii) the quantum depletion of the condensate, i.e. the fraction of particles outside the condensate mode. Refs.: G. Gaul and C.A. Müller arXiv:1009.5448, arXiv:1101.4781

Directional Plasmonic Nano-Antennae
Javier Munarriz UCM

An array of metal nanoparticles close to an interface between two dielectrics acts as an antenna, reemiting the incoming visible wave light, creating a complex, highly directional pattern for the far field, which might be easily tuned modifying the geometrical parameters of the system. Our goal is to show that a strongly anisotropic polar response can be obtained, and show that the behavior can be qualitatively understood as an interplay between the retardation effects associated to the geometry.

Multiscattering del Efecto Casimir
Pablo Rodríguez UCM

Recientemente, Emig et. al. desarrollaron un modelo de multiscattering del efecto Casimir. Tras una descripción de dicho modelo presentaré una serie de resultados derivados del mismo, como es la energía entre dos cilindros no paralelos, la energía entre 2 esferas en presencia de un plano, que nos permite comprobar que las energías de Casimir no cumplen el principio de superposición, la derivación de la Pairwise Summation Approximation, que es una aproximación muy usada en cálculos de energía de Casimir, pero no justificada hasta hace poco y, por último, la aparición de repulsiones y puntos de equilibrio estables cuando se estudia la energía de Casimir entre aislantes topológicos.

Simple rules govern finite-size effects in scale-free networks
Sara Cuenda UAM

The growing network with preferential attachment proposed by Barabási and Albert introduced a simple, effective model of networks that would lead to a power-law distribution of the degree of nodes. The results of this model should be understood within the limit of large networks, as some investigations showed the existence of finite-size effects that make the distribution of the degree of nodes depart from the power-law. These works show/predict a cut-off degree from which distributions of finite networks created with this model stop from behaving as power-laws, and acknowledge the influence of the initial nodes from which the network grows in the final result. However, a general prediction of the degree distributions of finite networks in terms of the initial nodes has not been made so far. In this work we give an intuitive though general explanation of this effects using two different approaches: with the same mean-field approximation used by Barabási and Albert, and using the probability distribution of the degree of each node. Numerical simulations show that both approaches success in their predictions (within the limits of their own approximations) simply by considering the initial nodes of the network when counting the number of nodes for every degree.