**Connecting Science,
Understanding Complexity**

IFISC ANNUAL REPORT 2011

Universitat de les
Illes Balears
UIB

CSIC
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INDEX

1. ■ PRESENTATION AND RESEARCH LINES

IFISC (Institute for Cross-Disciplinary Physics and Complex Systems) is a joint research Institute of the University of the Balearic Islands (UIB) and the Spanish National Research Council (CSIC) created in 2007 building upon the former Cross-Disciplinary Physics Department of IMEDEA (Mediterranean Institute for Advance Studies) dating from 1995. Its creation foresees that important avenues of scientific development occur at the borders of established fields. As statement of purpose it aims at developing **interdisciplinary** and **strategic** research from the established practices of physicists.

By **interdisciplinary** research we mean the general attitude of willing to transfer knowledge, concepts and methods across the borders between well established disciplines. By **strategic** research we mean focusing in advanced studies in fields with strong future potential, avoiding incremental research as well as the "basic-applied" polarization. We therefore search for windows of opportunity in emerging areas beyond the traditional subjects that defined Physics in the twentieth century.The backbone of IFISC´S research that unifies, percolates, and is the basis of the rest of activities is the study of generic phenomena in **Nonlinear Physics and Complex Systems**, with strong methodological components from Statistical Physics, Dynamical Systems, Computational Methods and Quantum Mechanics. From this source of concepts and ideas, the researchers face the challenge of cooperatively defining and updating specific research lines and projects within a flexible and changing framework.

3

1.1 IFISC RESEARCH LINES

In the evolving scheme associated with the programmatic orientation of IFISC there is a unifying transverse line of exploratory research on Complex Systems: Statistical and Nonlinear Physics. In addition, for the strategic plan 2010-13 IFISC has identified five lines with a subject defined by the system under study and representing cross-disciplinary interfaces of Physics with other established discipline.

**COMPLEX SYSTEMS:
STATISTICAL AND NONLINEAR PHYSICS**

QUANTUM PHYSICS: PHOTONS, ELECTRONS AND INFORMATION

NONLINEAR OPTICS AND DYNAMICS OF OPTOELECTRONIC DEVICES

FLUID DYNAMICS, BIOFLUIDS, AND GEOPHYSICAL FLUIDS

BIOLOGICAL PHYSICS AND NONLINEAR PHENOMENA IN ECOLOGY AND PHYSIOLOGY

DYNAMICS AND COLLECTIVE PHENOMENA OF SOCIAL SYSTEMS
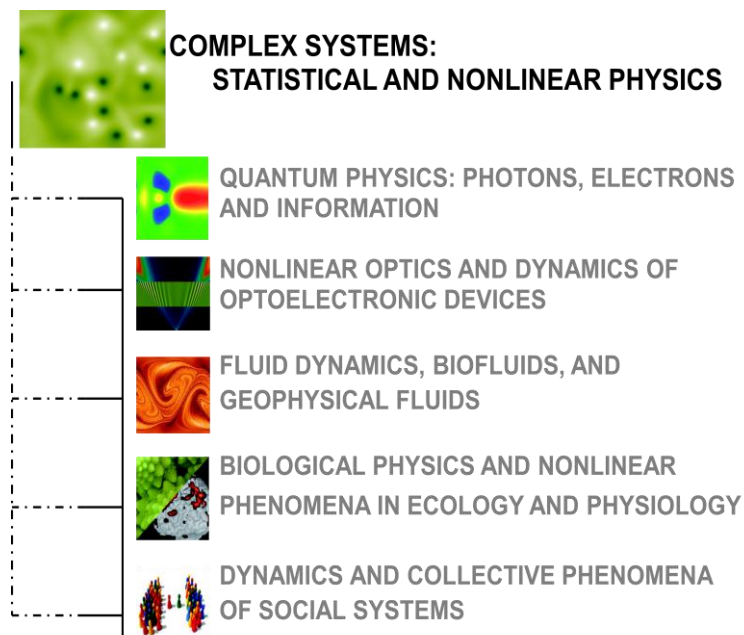
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COMPLEX SYSTEMS. NONLINEAR AND STATISTICAL PHYSICS

Complex systems, a central paradigm at IFISC, are characterized by emergent and collective phenomena of many interacting units. Fundamental understanding of these systems comes from Statistical Physics together with the Theory of Dynamical Systems, which includes the study of chaos and the effect of fluctuations and random events on systems evolution. Generic phenomena under consideration include synchronization, phase transitions, nonequilibrium instabilities, spatiotemporal pattern formation, or dynamics and evolution of complex networks.

Computing Lab

The main tool for intensive calculations is the Nuredduna system intended for High Thoughput Computing. Nuredduna includes a cluster designed and build at IFISC using out-of-the-shelf components from the personal computer market which at the present has 250 computational cores. The Nuredduna system also includes an IBM iDataplex cluster with 540 computational cores within the Grid-CSIC initiative to promote e-science. Other computational tools at IFISC include several servers and a fully integrated network consisting on about 50 desktops and a similar number of laptops.

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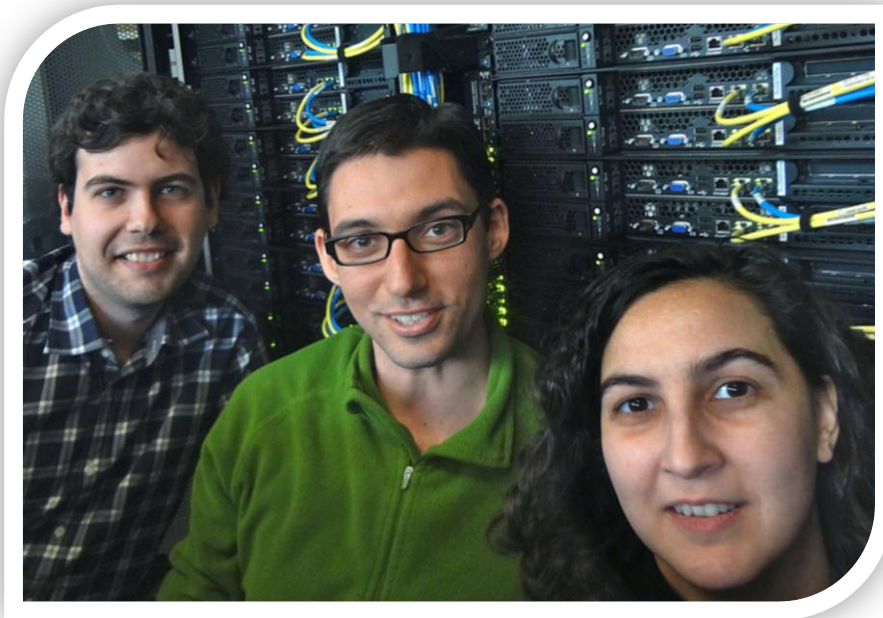
Electronics Lab

The Nonlinear Electronics Lab focuses on the application of nonlinear dynamics to a variety of topics including synchronization of chaotic systems and information processing based on delay-coupled dynamical systems. The Nonlinear Electronics Lab currently offers a diversity of circuits for the demonstration of chaos and bifurcation phenomena (Chua oscillator), chaos synchronization (Rossler oscillator), and the study of networks with delay-coupled nonlinear elements for information processing (Mackey-Glass oscillators).
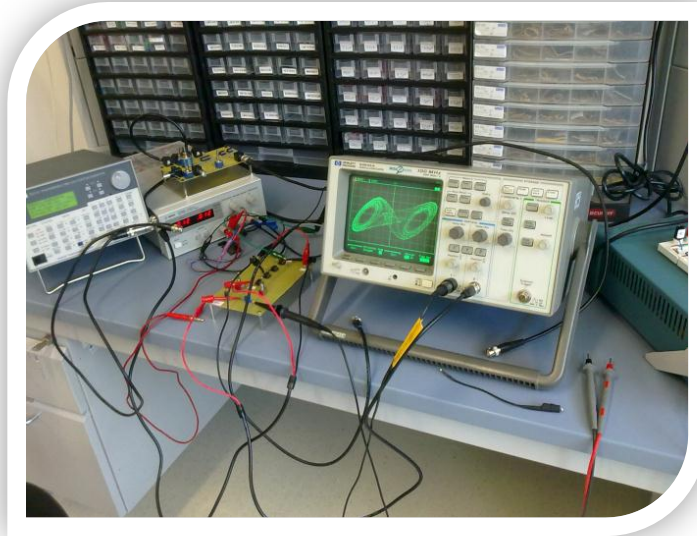
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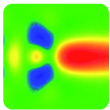
QUANTUM PHYSICS: PHOTONS, ELECTRONS AND INFORMATION

Very small systems (nanoscience) and light-matter interaction (quantum optics) share a common background in Quantum Physics. These are subjects of interest in fundamental research and also in view of new technologies, such as quantum devices and quantum computers. In particular, the possibility to overcome the limitations imposed by classical physics leads to new ways to manage the information (quantum information). The research at IFISC focuses on the theoretical study of specific topics within these timely lines.

Charge and spin transport (nanoelectronics and spintronics) are studied in semiconductor nanostructures, including quantum dots and wires. The possibility to control photonic properties, such as quantum correlations and entanglement in light beams, are studied in nonlinear optical devices, cold atoms and lasers. General properties shared by these systems are studied in the context of quantum information.

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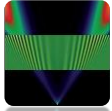
NONLINEAR OPTICS AND DYNAMICS OF OPTOELECTRONIC DEVICES

The general topic of this line is the study of the light-matter nonlinear interaction and its consequences and potential for applications in emerging photonics technologies. We study the complex dynamics and the generation of non homogeneous spatial light distributions (pattern formation) in photonic sources such as semiconductor lasers and in optical cavities filled with nonlinear media. Experimental studies include the utilization of complex laser dynamics for encrypted communication, key exchange, generation of random bit sequences and information processing.

Photonics lab

Since 2009 a Photonics Laboratory of high standards has been established. The lab is equipped with a Faraday cage for electromagnetic shielding and houses several experiments of delay-coupled lasers using the latest technology to characterize the laser emission with multi-Gigahertz bandwidth: in the temporal domain via fast detectors and 16 GHz real-time oscilloscope, and in the spectral domain via a 14 GHz real-time spectrum analyzer. In addition, high-resolution optical characterization can be performed via different spectrometers, and laser modulation can be implemented with arbitrary waveforms up to 9.6 GHz bandwidth.

6
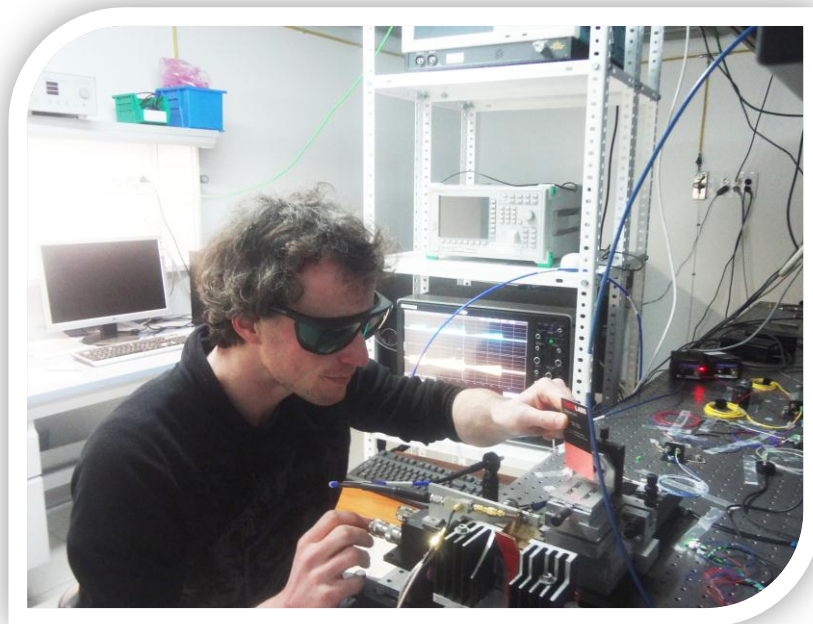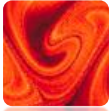
FLUID DYNAMICS, BIOFLUIDS, AND GEOPHYSICAL FLUIDS

Fluid flow is a natural process occurring in a huge range of scales, from blood capillaries to atmospheric weather systems. It is also widely spread in technological settings, being its understanding crucial to aircraft design or materials production, for example.

We concentrate in two research directions: on the one hand we study basic processes in fluid flow such as stirring, mixing, chemical or biological reactivity, instabilities, pattern formation, motion of non-ideal tracers, etc. The point of view of chaotic advection is a convenient starting point, and Lyapunov methods are thoroughly used. On the other hand, we apply these concepts and methods to geophysical settings, mostly in ocean dynamics: transport modelling, plankton patchiness, Lagrangian coherent structures, etc. Numerical simulation as well as the output from satellite sensors are the main sources of data used here.
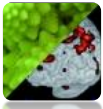
BIOLOGICAL PHYSICS AND NONLINEAR PHENOMENA IN ECOLOGY AND PHYSIOLOGY

The general topic of this line is the study of some biological systems, mostly under the prism of modern Systems Biology, i.e. from the tenet that most observed behaviors in living systems stem from complex, emergent interactions among its constituents. Present research topics include modeling and simulation of neuronal systems, with special emphasis in stochastic effects and synchronization properties, drug transport and absorption, population dynamics, phylogenetic networks and ecological structure and dynamics, including growth, aggregation processes and spatial effects, with special focus on clonal plants and savannahs. Methods of complex network analysis, stochastic simulations, and the theory of nonlinear dynamical systems, such as delayed coupled systems, are used thoroughly.

7

DYNAMICS AND COLLECTIVE PHENOMENA OF SOCIAL SYSTEMS

Social systems are prominent examples of complex systems. Concepts, tools and models aiming at identifying generic mechanisms underlying collective phenomena in these systems are developed with the use of Game Theory, Statistical Physics, Agent Based Models and Complex Networks Theory. Cooperation, cultural conflicts and problems of social consensus are examples of phenomena under study. New emphasis is on data driven research on socio-technical systems, including the impact of ICT, and in particular online social networks.

1.2 STRUCTURE CHART

8
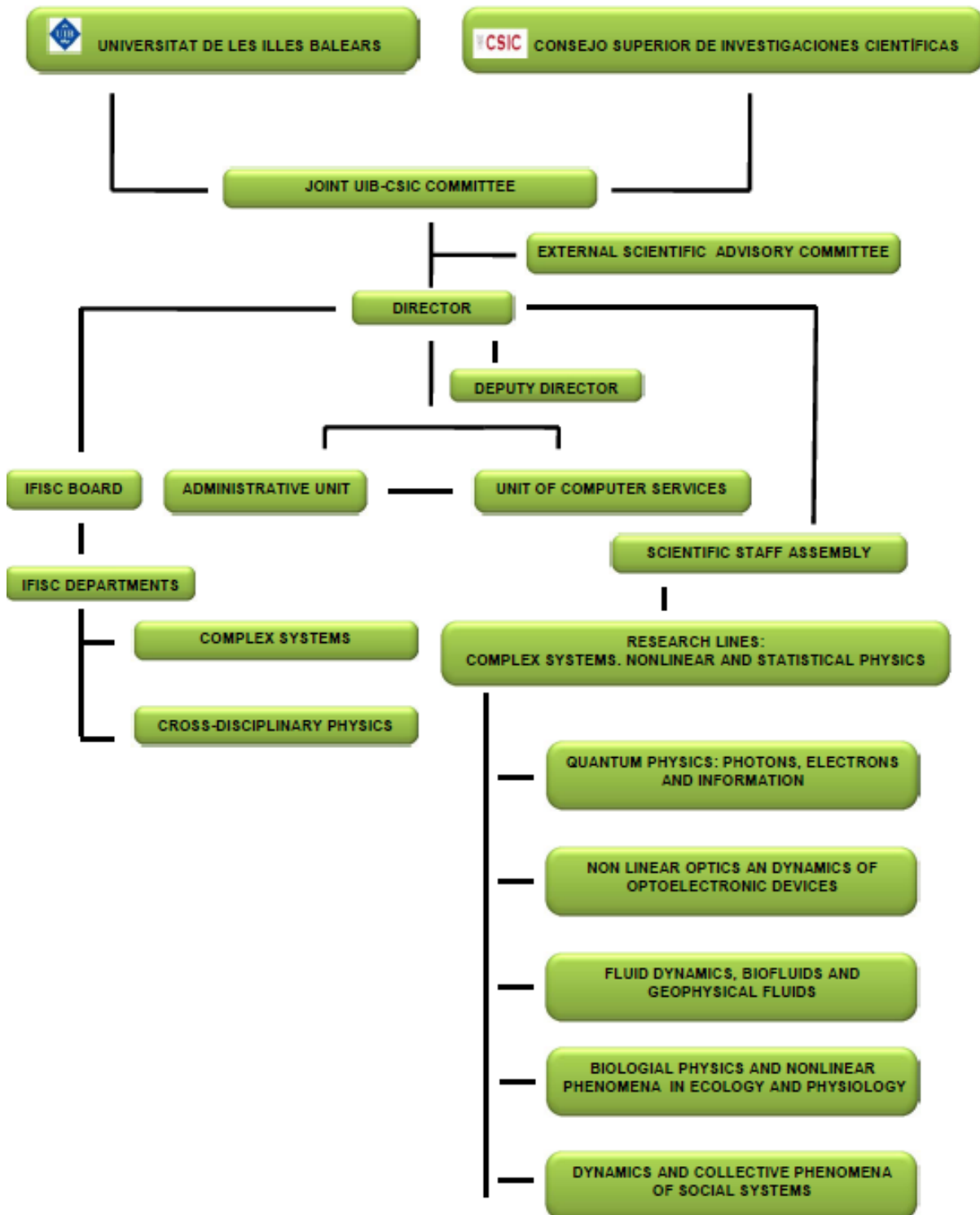
1.3 SOME REPRESENTATIVE RESEARCH RESULTS OF 2011

Information processing using a single dynamical node as complex system

This pioneering paper introduces a concept and demonstrates in modeling and experiments, how delay-dynamical systems can be employed to perform information processing. The approach simplifies the neuro-inspired concept of reservoir computing drastically, thereby facilitating its technological implementation. Two computationally hard tasks, comprising speech recognition and time series prediction tasks are successfully demonstrated.

Neuro-inspired concepts of computation are a key theme in contemporary science. Driving-forces include the quest to better understand how the brain processes information and the ever-growing demand for more efficient information processing methods. A major hindrance for the practical implementation of neuro-inspired concepts has been their high hardware demands.

We demonstrate in experiment and modeling, how a simple dynamical system performs efficient information processing, implementing the concept of reservoir computing. This unveils powerful and so far unused capabilities of nonlinear dynamical systems. A single nonlinear oscillator with delayed feedback replaces a complex network, performing excellently in speech recognition and time series prediction tasks. Our approach simplifies the reservoir computing concept drastically, opening new perspectives for high-speed electronics and photonics implementations. Moreover, this experiment represents the first hardware implementation of reservoir computing with results comparable to those obtained with state-of-the-art digital realizations.

9
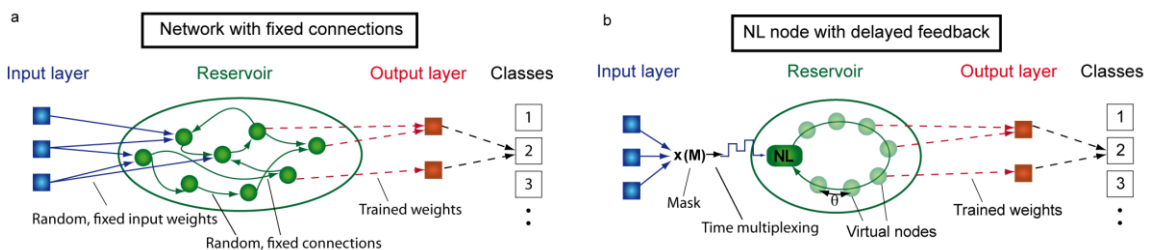
Sketch of RC schemes. (a) Classical RC scheme. The input is coupled into the reservoir via a randomly connected input layer to the N nodes in the reservoir. The connections between reservoir nodes are randomly chosen and kept fixed. The reservoir's transient dynamical response is read out by an output layer, which are linear weighted sums of the reservoir node states. (b) Scheme of RC utilizing a nonlinear node with delayed feedback. A reservoir is obtained by dividing the delay loop into N intervals and using time multiplexing.

The use of delay dynamical systems implies certain constraints, because the feeding of the virtual nodes is carried out serially, in contrast to the parallel feeding of the nodes in traditional reservoir computing. This serial feeding procedure results in a slow-down of the information processing, compared with parallel feeding. This potential slow-down is compensated for by the much simpler hardware architecture of the reservoir and by the fact that the read-out can be taken at a single point of the delay line. These simplifications will enable ultra-high-speed implementations, using high-speed components that would be too demanding or too expensive to be used for many nodes. In particular, realizations based on electronics or photonics systems should be feasible using this simple scheme, including real-time processing capabilities. Moreover, we expect that compromises can be found concerning speed, performance and memory capacity by extending the concept to network motifs of delay-coupled elements. Ultimately, a novel information-processing paradigm might emerge. We believe that this paper will have a major impact not only in information science, but also in dynamical systems, neuroscience, photonics and electronics.

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The effect of temporal disorder on Complex Systems: Temporal Griffiths Phases.

Does temporal disorder induce new phases analogous to the ones induced by spatial disorder?

In some systems the temporal variability of the control parameter induces what we call Temporal Griffiths Phases. These phases are analogous to standard Griffiths Phases appearing in systems with quenched spatial disorder, but where the roles of space and time are exchanged.

Disorder is an unavoidable ingredient of real systems. Spatial disorder generates Griffiths phases which, in analogy to critical points, are characterized by a slow relaxation of the order parameter and divergences of quantities such as the susceptibility. However, these singularities appear in an extended region of the parameter space and not just at a (critical) point, i.e. there is generic scale invariance. We have studied the effects of **temporal disorder**, focusing on systems with absorbing states. We demonstrate the existence of a new phase, that we call Temporal Griffiths phase, which is characterized by generic power-law spatial scaling and generic divergences of the susceptibility. These Temporal Griffiths phases turn out to be a counterpart of standard Griffith Phases, but with space and time playing reversed roles. They constitute a unifying concept, shedding light on the non-trivial effects of temporal disorder.

10
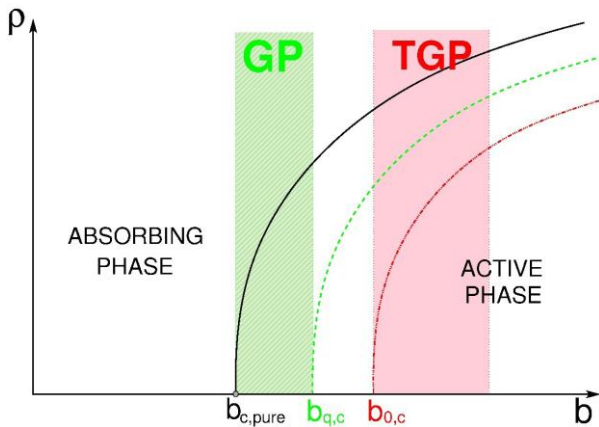
Schematic phase diagram for the pure contact process (solid line), with quenched disorder (dashed line), and with temporal disorder (dot-dashed line).
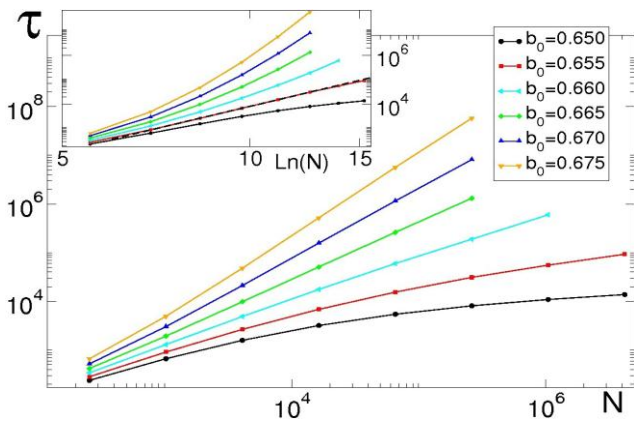
Lifetime as a function of system size for the contact process with temporal disorder.

Genuine Quantum and Classical Correlations in Multipartite Systems

Mutual information as well as quantum and classical correlations between parts of a system depend on the number of parties. This work shows how to distinguish the respective "genuine" contributions that cannot be accounted for considering any of the possible subsystems.

Quantum and classical correlations in bipartite systems can be measured through the paradigm of quantum discord, defined as the difference between the quantized versions of two equivalent definitions of the classical mutual information. We have generalized these definitions to the case of a n-partite systems, introducing a method which allows us the extraction of their genuine part, from global total, quantum and classical correlation. The measure we have given is based on the use of relative entropy to quantify the "distance" between two different density matrices. Following this approach, total correlations of a state are defined as the minimum relative entropy between the state itself and all the possible product states. Furthermore, genuine total correlations are measured by the minimum relative entropy between the state under study and all the possible states that are factorized at least along a bipartite cut. The relative entropy approach has been also used to quantify how much of the correlations (total or genuine) is classical and how much is quantum. This can be done considering the family of states that only have classical correlations (total or genuine) and taking the minimum relative entropy between the state of interest and all the states belonging to such a family as a measure of classical (total or genuine) correlations. Quantum discord is then simply obtained as the difference between total and classical correlations. A key point of our results is that we found that, according to the definition given above, total genuine correlations coincide with the lowest bipartite mutual information present in the state and can be calculated as the minimum Von Neumann entropy over all the possible reduced k-partite (k <n) states. This implies that its
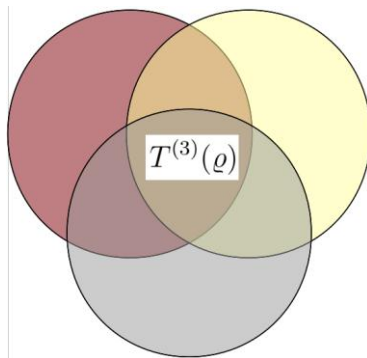
Genuine tripartite correlations

partition into its classical and quantum part can be done using the (simple) methods used for bipartite systems. In the specific case of tripartite states of qubits, we have also given a characterization of the internal distribution of the different types of correlations, showing that both quantum and classical bipartite correlations obey a ladder ordering law fixed by two-body quantum mutual informations, or, equivalently, by one-qubit entropies. Simple analytical expressions for these states have be obtained exploiting the interplay between the Von Neumann entropy conditional to a measurement performed on one of the parties and bipartite entanglement of formation. Our definition of total quantum correlations represents a true quantifier, since it can be used both for GHZ and W states (the two non-equivalent families of states of three qubits), overcoming the drawback present in other quantifiers used for tripartite systems, like the so-called three-tangle, which is not able to capture the correlations present in W states.

11

Josephson Current in Carbon Nanotubes with Spin-Orbit Interaction

We have investigated the electrical transport of nanotubes connected to superconductor electrodes where the super-current is formed by Cooper pairs of electrons with opposite spin and valley index. We have demonstrated that due to the presence of an external magnetic field and the spin-orbit interaction the sign of the super-current can be reversed in a controllable manner.

The discovery of carbon-based materials like graphene, carbon nanotubes, fullerences, etc has been a great achievement for the new technologies. In particular, carbon nanotubes are manufactured by rolling up one or more monolayers of graphene in a tubular geometry. These systems has unusual properties, they are the lightest materials never fabricated with applications in aero-spatial devices. Due to these properties, carbon nanotubes have not only an academic interest but also they are interesting for industrial purposes. Carbon nanotubes can be metallic or semiconductor and they can operate as nano-transistors. Therefore, they are considered a fundamental piece for the development of the future nanotechnology.

In addition to the spin degree of freedom, carbon nanotubes have an additional degree of freedom, the orbital or valley quantum number. This is denoted by K and K´ that take the value of +1 for K and y -1 for the valley K'. In this research done at the IFISC we have investigated how the electronic properties are modified when we attach a carbon nanotube to superconducting electrodes. In superconducting materials, the super-current is generated by pairs of electrons baptized as Cooper pairs. In carbon nanotubes these pairs are formed by have electrons with opposite spins and opposite valley quantum numbers. When a super-current is established in a carbon nanotube and a magnetic field is applied the super-current sign can be inverted.
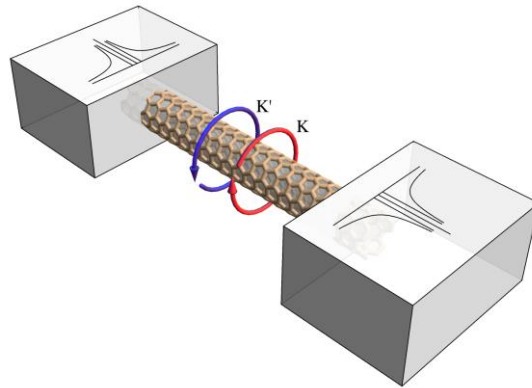
Carbon nanotube attached to two superconductors materials. K and K' are the two orbital degrees of freedom corresponding to clockwise (+1) and anticlockwise (-1) orbital modes

This phenomenon is a direct consequence of the existence of a type of interaction that entangled the spin and the valley degree of freedom, the so-called spin-orbit interaction generated by the nanotube curvature. We believe that our research can open new roads to explore the understanding of the electrical transport in nanotubes connected to superconductor materials. Our study will allow the search of new applications of these superconducting nano-devices in the future nanotechnology.

12

Dynamics of a semiconductor laser with polarization-rotated feedback and its utilization for random bit generation

In this paper, a simple and robust system, based on a single mode laser with polarization-rotated feedback, has been developed and realized, capable of fast random bit generation. In a systematic approach, the required dynamical properties and most suitable conditions have been determined experimentally. Applying the identified criteria, fast random bit generation rates up to 4Gbit/s have been achieved, requiring only minimal postprocessing.

Random bit generators (RBGs) play an important role in several digital technologies, including encryption and authentication protocols, stochastic modeling and online gaming. In contrast to pseudo-RBGs based on deterministic algorithms, semiconductor lasers are an excellent source for this purpose. Their short internal time scales allow for large bandwidth dynamics, and delayed optical feedback can induce strongly diverging chaotic trajectories, thus making fast bit rates possible.

Our experimental system includes a semiconductor laser subjected to polarization-rotated feedback (PROF), a delay-dynamical system known to exhibit complex behavior. We show that dynamics of this system are optimal for random bit generation when characterized simultaneously by a broad power spectrum and low autocorrelation. Based on this dynamical guidance, we select our operating point for RBG.
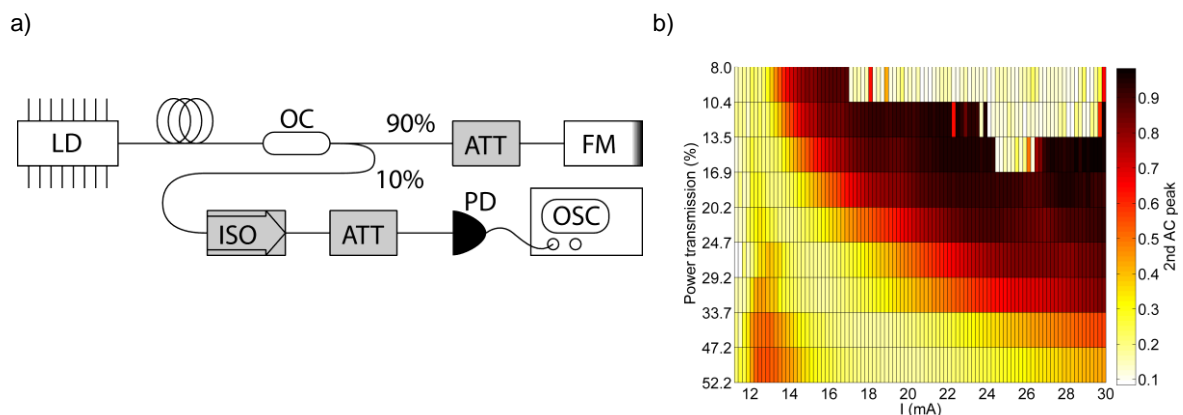
Fig. 1. a) Experimental schematic diagram. LD, Laser Diode; OC, Optical Coupler; ATT, variable attenuator; FM, Faraday mirror; ISO, inline isolator; PD, Photodiode; OSC, oscilloscope. The Faraday mirror is the source of PROF. Fig 1. b) Map of autocorrelation peak height for varying feedback and injection current conditions.

The chaotic optical signal for the operating point is converted to an 8-bit digital stream. Then, from data points sufficiently separated in time to be decorrelated, a subset of their bits are directly used as random bits. 1000 sequences of 1 million bits each acquired in this manner pass the standard test batteries, verifying that, with a proper balance between dynamical properties, acquisition conditions and postprocessing, our PROF configuration produces a statistically random bitstream at a bit rate of 4 Gbit/s. This speed is very competitive compared to the rates created with other "state-of-the-art" random bit generators.

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Digital key for chaos communication performing time delay concealment

This work introduces a new scheme that integrates a digital key in an optical chaos-based communication system. A pseudo-random binary sequence (PRBS) is mixed within the chaotic dynamics in a way that a mutual concealment is performed. Besides bridging the gap between algorithmic symmetric key cryptography and chaos-based analog encoding, the proposed approach is intended to benefit from the complex algebra mixing between a (pseudo-random) boolean variable, and another continuous time (chaotic) variable. The scheme also provides a large flexibility allowing for easy reconfigurations to communicate securely at high bit rate between different systems.

Since the emergence of experimental chaos encryption dating back to the seminal work of Cuomo et al. in the earlier 1990s, proofs of principles have been extensively reported ranging from electronic, optical to optoelectronic systems. Recently, field demonstrations have been conducted over installed optical fiber networks, involving a high bit rate message, and using standard telecommunications components. Typically, the chaos is generated using analog systems subject to either optical or electro-optical delayed feedback. In chaos encryption there is no rigorous counterpart to the digital key of algorithmic cryptography. Confidentiality relies essentially on keeping the hardware parameters secret. Unfortunately, the time delay in itself, though being a very sensitive key parameter for proper decoding, has been found to be vulnerable since it can be identified using the autocorrelation function, delayed mutual information (DMI), extrema statistics and filling factor even in systems with multiple delays. To circumvent these drawbacks, we propose in this work to implement a currently suggested principle in algorithmic cryptography, which consists in mixing different algebra when constructing the encryption algorithm. We combine a Boolean pseudorandom binary sequence (PRBS), used in algorithm cryptography, with a high-dimensional chaotic time series generated by an analog physical system, to make a symmetric-key encryption system with enhanced cryptographic security provided by reciprocal concealment. We consider a configuration built on a double electro-optic delayed feedback dynamics (Fig 1) which provides high speed phase chaos (up to 10 Gb/s achieved in field experiments).

14

Setup
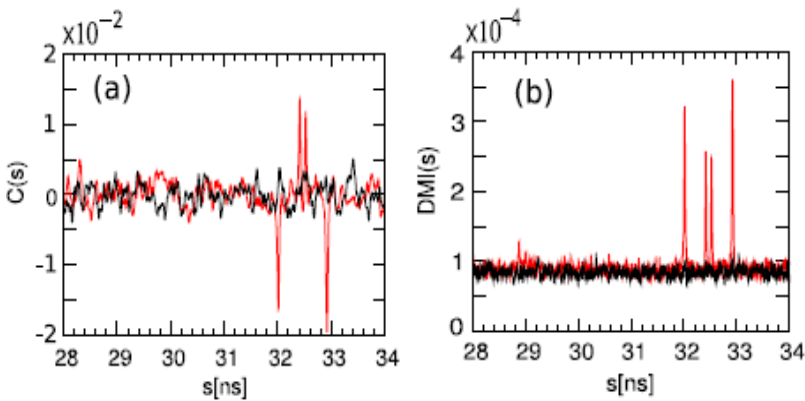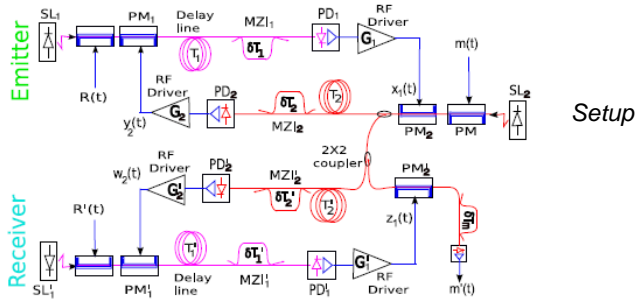
Autocorrelation and the Delayed Mutual Information (DMI) computed from the transmitted signal without PRBS (red) and with PRBS (black). In the first case both functions show peaks that allow the identification of the delay times while the delay time signature vanishes completely when the PRBS is included.

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How reliable are finite size Lyapunov exponents for the assessment of ocean dynamics?

Detecting oceanic Lagrangian Coherent Structures.

The implementation of appropriate Lagrangian tools are very necessary to study mesoscale mixing in the oceans. A prominent technique widely used in oceanography is that of Finite-Size Lyapunov Exponents. However it is still rather unclear how robust they are when confronted to real data. For this, we analyze the effect of finite scale samplings and of diverse types of noise on these Lyapunov Exponents.

Much of atmospheric and oceanic transport is associated with coherent structures. Lagrangian methods are emerging as optimal tools for their identification and analysis. An important Lagrangian technique which is starting to be widely used in oceanography is that of Finite-Size Lyapunov Exponents (FSLEs).
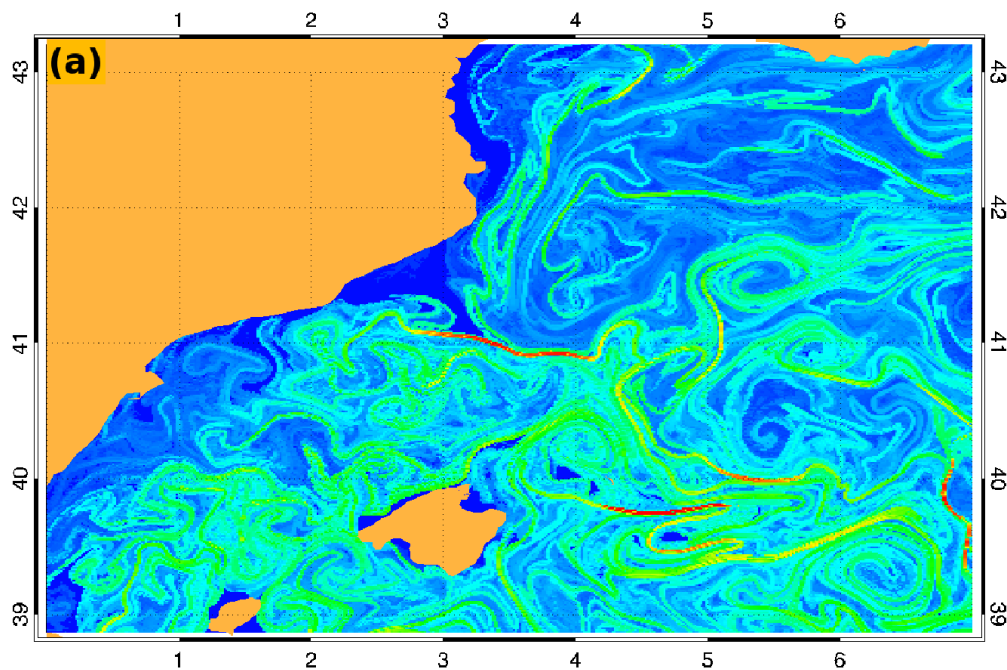
Lagrangian Coherent Structures in the Balearic Sea.

Despite this growing relevance there are still many open questions concerning the reliability of the FSLEs in order to analyse the ocean dynamics. In particular, it is still unclear how robust they are when confronted with real data. In this paper we analyze the effect on this Lagrangian technique of the two most important effects when facing real data, namely noise and dynamics of unsolved scales. Our results, using as a benchmarch data from a primitive numerical model of the Mediterranean Sea, show that even when some dynamics is missed the FSLEs results still give an accurate picture of the oceanic transport properties.

15

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Polarization of PAR Proteins by Advective Triggering of a Pattern-Forming System

Most biological cells are asymmetric. This asymmetry typically appears through a symmetry-breaking process. In this work we study an stereotypical symmetry breaking process which occurs when the worm C. elegans undergoes its first cell division from a unique fertilized egg cell. A combination between experiments and biophysical modeling helps to elucidate how this, so called, polarization process takes place.

Symmetry breaking processes have been extensively studied in physical and chemical systems. However, such processes are also very relevant in biology but have not been studied so far. In biology they are encountered in many different contexts either inside single cells or even in hole organisms. One example of a symmetry-breaking process occurring inside cells takes place during the phenomenon called cell polarization. Polarity, the asymmetry in shape present in many cells, is a common feature of many different cell types. The initial establishment of cell polarity can be considered as a symmetry-breaking process and has attracted much attention during the last years. The archetypical organism where this process has been studied is the embryos of the worm *Caenorhabditis elegans* where, prior to the first cell division, the distribution of some characteristic proteins becomes asymmetrical (see Figure).This asymmetric distribution of proteins in distinct anterior and posterior domains is responsible for the different fates that each daughter cell has after the asymmetric cell division.

Motivated by recent experimental evidence, in this publication we present and study a simple twovariable, reaction-diffusion system that describes the asymmetric distribution of the characteristic proteins in the cell membrane. The model exhibits a symmetry-breaking mechanism that leads to protein segregation and accounts for many experimental observations done in the worm *C. elegans* and other organisms. We show that this spontaneous symmetry breaking is induced by a mechanism similar to a Turing instability. However, in our model the wavelength of the fastest growing spatial pattern is always equal to the system size. The model is both motivated and validated by extensive experiments in *C. elegans* done by our team.

16
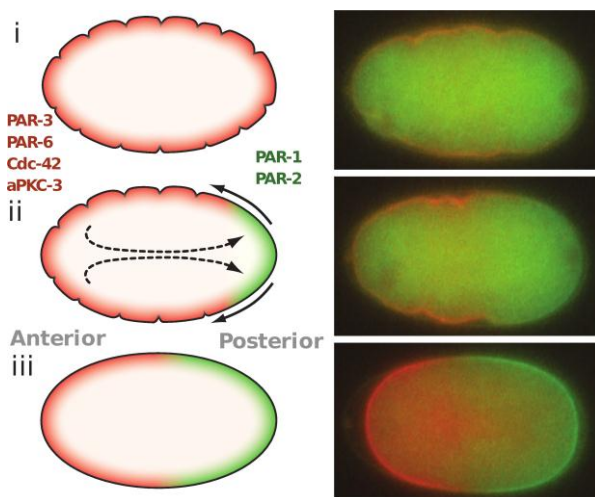
Example of polarization of the one-cell embryo of the worm C elegans. Red indicates a high concentration of the protein PAR-6 and green PAR-2 (schematic on the left and experimental data on the right) for three subsequent stages: (i) initial (unpolarized), (ii) transitory and (iii) final (polarized) state.

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Scaling properties of protein family phylogenies

We have analyzed the shape of phylogenetic trees representing the evolutionary history of a large set of protein families, and found characteristics similar to those of trees representing the evolution of biological species, implying the existence of evolutionary mechanisms that act in the same way at the gene level and at the level of the full organism.

By the process of evolution, nature continuously generates new and diverse organisms from existing ones. Some of them will survive and propagate their characteristics to future generations. The relationships between ancestors and descendants is conveniently represented as a 'family tree' or 'phylogenetic tree', in which the leaves are the organisms present now, and the other ramification points, closer to the root, represent their ancestors.

This picture has been developed both for living organisms as for other biological objects such as proteins. A protein family is a set of proteins (or protein fragments), present nowadays in different organisms, which are supposed to have evolved from the same ancestor protein. The analysis of the shape of their phylogenetic trees provides information about evolutionary history and mechanisms. It has been known since long ago that phylogenetic trees are very unbalanced (i.e. some ancestor organisms have a very large descent, whereas others have only a few descendants), and this characteristics has been analyzed in detail for the case of trees depicting the evolution of *species.*

In this work we have analyzed the shape of trees depicting the evolution of 7,738 *protein families* from the PANDIT database (one of the families, and two of their representatives, are plotted in the figure). We have confirmed and quantified the extreme degree of imbalance present in them and, more important, we have shown that the main characteristics are the same as for trees of species, implying that there are evolutionary mechanisms that act in the same way at the gene level (since the genes directly encode the protein characteristics) and at the species level, where the characteristics of a full organism depend on many thousands of genes. We have also developed simplified evolutionary models that reproduce some aspects of the shape of the trees.

17
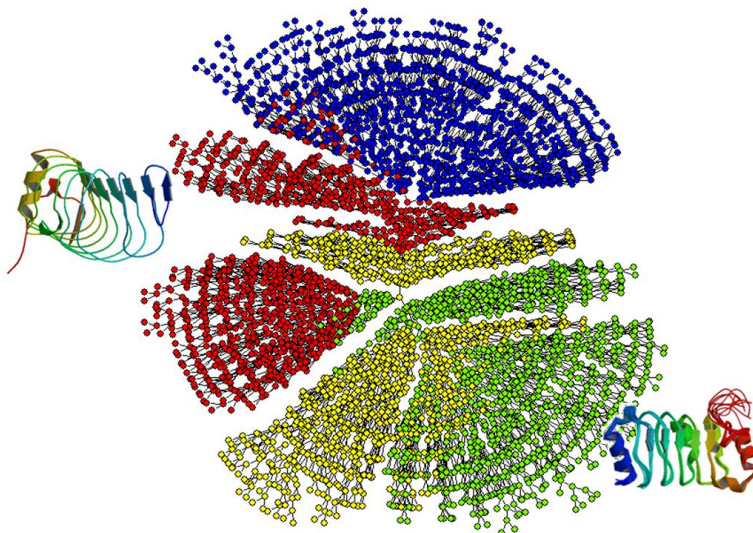
The phylogenetic tree of the PF00560 set of proteins, specifying the evolutionary changes leading to their present day form (represented as the tips of the tree). The left object is the shape of a version of the protein existing today in humans, and the right one in mice.

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Synchronization and entrainment of coupled circadian oscillators

By numerical simulations of a simplified model, we prove that the response of the suprachiasmatic nucleus to the external daylight stimulus with 24h period is optimized when there is some degree of heterogeneity in their neurons such that they are not all identical to each other.

Circadian rhythms in mammals are controlled by the neurons located in the suprachiasmatic nucleus of the hypothalamus. In physiological conditions, the system of neurons is very efficiently entrained by the 24 h light–dark cycle. Most of the studies carried out so far emphasize the crucial role of the periodicity imposed by the light–dark cycle in neuronal synchronization. Nevertheless, heterogeneity as a natural and permanent ingredient of these cellular interactions seemingly plays a major role in these biochemical processes. In this work, we use a model that considers the neurons of the suprachiasmatic nucleus as chemically coupled modified Goodwin oscillators, and introduce non-negligible heterogeneity in the periods of all neurons in the form of quenched noise. The system response to the light–dark cycle periodicity is studied as a function of the inter-neuronal coupling strength, external forcing amplitude and neuronal heterogeneity. Our results indicate that the right amount of heterogeneity helps the extended system to respond globally in a more coherent way to the external forcing. Our proposed mechanism for neuronal synchronization under external periodic forcing is based on heterogeneity-induced oscillator death, damped oscillators being more entrainable by the external forcing than the self-oscillating neurons with different periods.

18
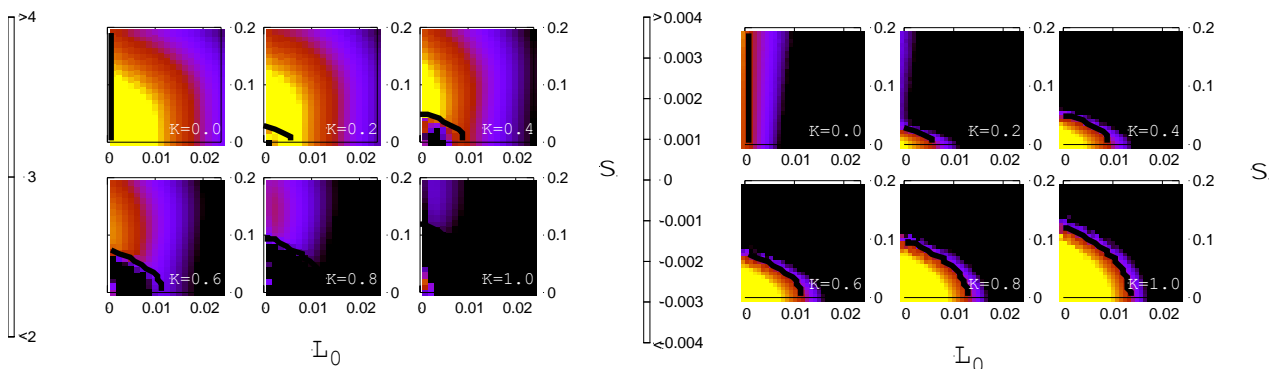
(Left) Measure of the response as a function of the light intensity L_0 and the heterogeneity σ of the neurons. Note the maximum at intermediate values of σ. (Right) maximum real part of the average eigenvalues. When they are negative, the self-sustained neuronal oscillations disappear through the so-called oscillation death.

IFISC

Social learning: aggregating information in social networks

Social learning is defined as the ability of a population to aggregate information. Consumers choosing which product to buy, or voters deciding which option to take with respect to an important issue, typically confront external signals to the information gathered from their contacts. We show with an intuitive threshold process of individual adjustment that social interaction does not always lead to social learning.

Social learning is defined as the ability of a population to aggregate information, a process which must crucially depend on the mechanisms of social interaction. It has been a topic of central concern in economics during the last decades, as it is central to a wide range of socio-economic phenomena. Consumers who want to choose among a given set of available products may seek the opinion of people they trust, in addition to the information they gather from prices and/or advertisement. And voters who have to decide what candidate to support in an election, or citizens who have to take a stand on some issue of social relevance may rely on their contacts to form their opinion. Thus, individuals usually confront external signals to the information gathered from their contacts. Ultimately, whether our societies take the right course of action on any given issue (e.g. on climate change) will hinge upon our ability to aggregate individual information that is largely disperse. Thus, in particular, it must depend on the information diffusion mechanism by which agents learn from each other, and therefore on the underlying social network in which they are embedded. The significance of the conceptual challenges raised by these issues is made even more compelling by the booming advance in Information and Communication Technologies, with its impact on the patterns of influence and communication, and on the way and speed in which we communicate. Economic models typically predict that correct social learning occurs in large populations unless some individuals display unbounded influence. We have challenged this conclusion by showing that an intuitive threshold process of individual adjustment does not always lead to such social learning. We find, specifically, that three generic regimes exist separated by sharp discontinuous transitions, and only in one of them, where the threshold is within a suitable intermediate range, the population learns the correct information. In the other two, where the threshold is either too high or too low, the system either freezes or enters into persistent flux, respectively. These regimes are generally observed in different social networks (both complex or regular), but limited interaction is found to promote correct learning by enlarging the parameter region where it occurs.

19
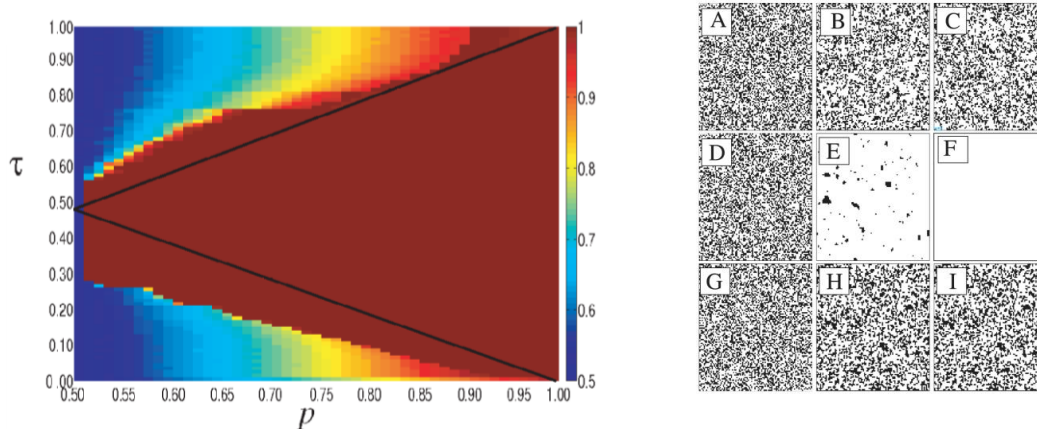
Left: Phase diagram of the threshold model in a scale-free network. The colors represent the fraction of agents choosing the correct action (from red, 1, to blue 0). Right: Time evolution (from left to right) of the learning model on a two-dimensional lattice increasing threshold values (from top to bottom).

Wikipedia information flow analysis reveals the scale-free architecture of the semantic space

The Wikipedia is a collaborative, online encyclopedia that contains more than 3.5 million entries. Considering concepts to be represented by the word frequency distribution in its wikipedia page, and based on information theory, we have extracted the semantic web, which displays a hierarchical structure with a scale-free topology.

In 2011 we celebrated the 10th anniversary of Wikipedia, a collaborative, online encyclopedia. Currently, it contains more than 3.5 million pages in its English version and more than 0.8 million pages in Spanish. In this work we have revealed the network connecting wikipages with similar semantic content and found that it displays the scale-free property similarly to many other complex networks. As a fingerprint, each wikipage can be characterized by its word frequency distribution. The distribution of words in a wikipage provides the meaning of the corresponding entry according to the post-structuralist definition of meaning of a word, i.e., the set of other words that circumscribe the semantic content of the word they represent. Thus, based on the Jensen-Shannon divergence, we have introduced an information theory-based distance between word frequency distributions as a proxy of the semantic distance. We have developed an algorithm that maps the semantic distance between pairs of Wikipedia entries in a complex network that represents the semantic flow (see Figure). The analysis of the semantic flow in Wikipedia unveils the architecture of meaning. It shows a fascinating hierarchical structure, where large taxonomies form the bases of a pyramidal architecture, and where more complex concepts form bridges between different semantic clusters. The semantic space shows a dizzying resemblance with other complex systems as biological systems, suggesting evolutionary mechanisms as the leading actor in shaping the semantic space.

20
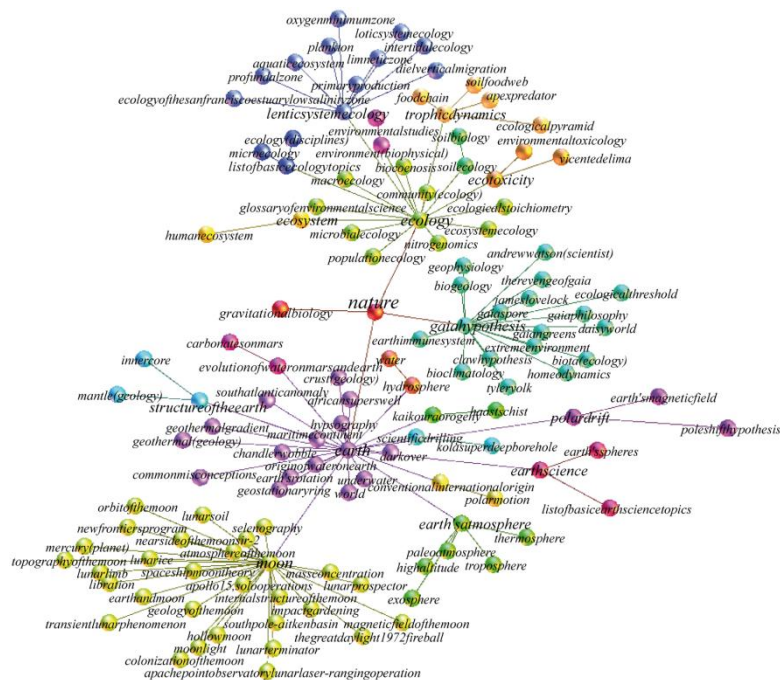
Except of the semantic web centered around the word "nature" (in the center of the image). Nodes represent entries in Wikipedia and links, the semantic flow between the entries. The node color indicates different semantic communities.

IFISC

Human mobility networks, travel restrictions and the global spread of 2009 H1N1 pandemic

Travel-related and mobility restriction policies are often considered to be the first line of defence against the spread of an emerging infectious disease. The wide range of implementation scenarios of such policies calls for models that are able to anticipate their actual effectiveness.

During the early phase of the 2009 H1N1 pandemic outbreak, some countries implemented travel-related measures to prevent the infection from crossing the national borders. Many governments advised against non-essential travel to Mexico and activated airports entry screening to detect the potentially infected travelers. Even a few countries banned every flight connection to/from Mexico. All these measures, with the addition of self-imposed travel limitations due to the pandemic concerns following the international alert, contributed to an almost 40% reduction in the international passengers flying to and from Mexico. However, no containment was achieved by such restrictions and the virus was able to reach pandemic proportions in a short time.

| before March 31 |
| April 1 - April 15 |
| April 16 - April 30 |
| May 1 - May 15 |
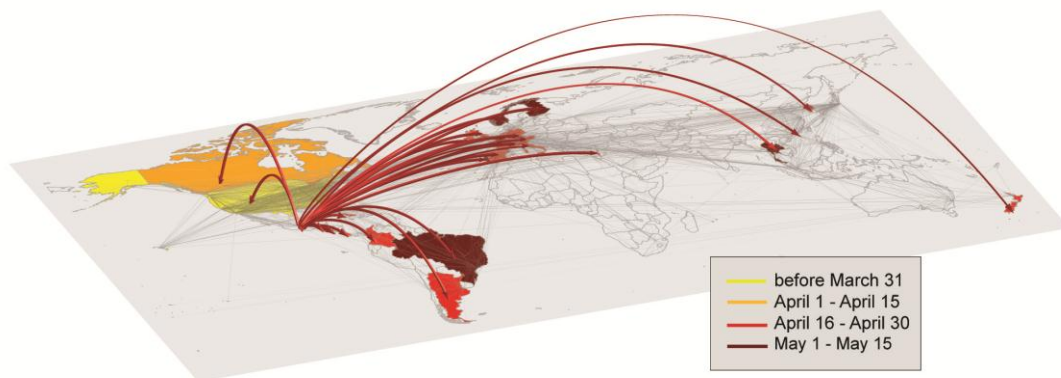
Illustration of the global invasion of the 2009 H1N1 pandemic during the early stage of the outbreak. The arrows represent the seeding of unaffected countries due to infected individuals traveling from Mexico. The color code indicates the time of the seeding. The map shows the layer of the worldwide air transportation network, which is incorporated into GLEaM.

GLEaM is suitable to simulate the spreading of an influenza-like illness and, in particular, it has been calibrated to simulate the 2009 H1N1 pandemic considering the etiology of the disease and the initial conditions. Taking advantage of the high detailed mobility data at the global level integrated in the model structure, Bajardi and coworkers assessed the impact of different travel reduction policies in the unfolding of the simulated pandemics. The work shows that feasible mobility limitations, highly disruptive in economic terms, generally are not effective: even with strong and lasting restrictions (a 90% reduction in the international air traffic to/from Mexico starting with the international alert and kept to the end of the epidemic was tested) the delay achieved is limited to two weeks. In a pandemic scenario, this delay can be used to allocate resources and to enhance the surveillance systems, but it is definitely too short to develop a vaccine. Finally, the paper provides a quantitative discussion devoted to explain how the large heterogeneity of human mobility patterns is responsible for the ineffectiveness of travel restrictions. It is unlikely that, given the ever-increasing mobility of people around the world, travel restrictions could be used effectively in a future pandemic event.

21

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2. PERSONNEL

22

2.1 PERMANENT SCIENTIFIC STAFF

* **Montserrat Casas**, University Full Professor UIB

* **Pere Colet**, CSIC Research Professor

* **Víctor M. Eguíluz**, CSIC Tenured Scientist

* **Ingo Fischer**, CSIC Research Professor

* **Damià Gomila**, CSIC Tenured Scientist

* **Emilio Hernández-García**, CSIC Research Professor, IFISC Deputy Director

* **Cristóbal López**, University Professor UIB

* **Rosa López**, University Professor UIB

* **Manuel Matías**, CSIC Senior Researcher

* **Claudio Mirasso**, University Full Professor UIB

* **Maxi San Miguel**, University Full Professor UIB, IFISC Director

IFISC

* **David Sánchez**, University Professor UIB

* **Alessandro Scirè**, University Professor UIB

* **Llorenç Serra**, University Professor UIB

* **Tomàs Sintes**, University Professor UIB

* **Raúl Toral**, University Full Professor UIB

* **Roberta Zambrini**, CSIC Tenured Scientist

23

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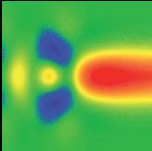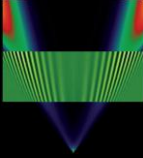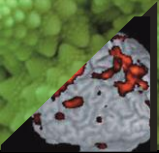
2.2 POSTDOCTORAL RESEARCH ASSOCIATES

* **Daniel Brunner,** Postdoctoral Contract Project PHOCUS, Marie Curie Contract since July

* **Juan José Cerdà**, UIB lecturer

* **Miguel C. Soriano**, UIB lecturer

* **Valentin Flunkert**, German Academic Exchange Service Fellowship

* **Fernando Galve Conde**, JAE-CSIC Postdoctoral Contract

* **Gianluca Giorgi**, Juan de la Cierva Contract

* **Els Heinsalu**, Govern Balear Postdoctoral Contract

* **Hideyuki Kato**, Japanese Government Fellowship

* **Jong Soo Lim**, UIB Postdoctoral Contract

* **Adolfo Paolo Masucci**, Postdoctoral Contract Project EDEN

* **Ernesto M. Nicola**, JAE-CSIC Postdoctoral Contract

* **José Javier Ramasco**, JAE-CSIC Postdoctoral Contract

* **Krzysztof Suchecki**, UIB Postdoctoral Contract Project FISICOS

* **Paula Tuzón**, UIB Postdoctoral Contract Project FISICOS

* **Daniele Vilone**, UIB Postdoctoral Contract Project FISICOS

24

DISTRIBUTION OF SENIOR SCIENTISTS AMONG RESEARCH LINES

Participation in the lines of research during 2011 of the permanent scientific staff is summarized in the following scheme. Every senior researcher participates in the transversal line on Complex Systems: Statistical and Nonlinear Physics. In addition, typically a senior researcher participates in one or two other focused lines. This collaborative organization provides coherence and integration as well as interaction and bridges. It is an alternative to static schemes with disjoint groups of researchers devoted exclusively to one line of research.

IFISC

		Montserrat Casas	Pere Colet	Damià Gomila	Ingo Fischer	Emilio Hernández-García	Cristóbal López	Rosa López	Víctor M. Eguíluz	Manuel Matías	Claudio Mirasso	David Sánchez	Maxi San Miguel	Llorenç Serra	Alessandro Scire	Tomás Sintes	Raúl Toral	Roberta Zambrini
COMPLEX SYSTEMS. NONLINEAR AND STATISTICAL PHYSICS		X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
QUANTUM PHYSICS: PHOTONS, ELECTRONS AND INFORMATION		x		x				x				x		x				x
NON LINEAR OPTICS AND DYNAMICS OF OPTOELECTRONIC DEVICES			x	x	x						x				x			x
FLUID DYNAMICS, BIOFLUIDS AND GEOPHYSICAL FLUIDS.						x	x									x		
BIOLOGICAL PHYSICS AND NONLINEAR PHENOMENA IN ECOLOGY AND PHYSIOLOGY					x	x	x		x	x	x					x	x	
DYNAMICS AND COLLECTIVE PHENOMENA OF SOCIAL SYSTEMS			x			x			x				x				x	

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2.3 PHD STUDENTS

* **José María Aparicio**, FPI Fellowship Project FISICOS

* **Joao Bettencourt**, FCT Fellowship, Portugal

* **Adrián Carro Patiño,** UIB Fellowship

* **Miguel Angel Escalona-Morán,** Fellowship Project PHOCUS

* **Juan Fernández Gracia**, Govern Balear Fellowship

* **Luis Fernández Lafuerza**, JAE-CSIC Fellowship

* **Pablo Fleurquin,** Fellowship European Project COMPLEXWORLD

* **Gerardo Gómez**, FPI-MICINN Fellowship, EVOCOG group

* **Juan Carlos González Avella**, FPI Fellowship Project CONOCE2

* **Przemyslaw Grabowicz**, JAE CSIC Fellowship.

* **Ismael Hernández**, FPI Fellowship Project FISICOS

* **Alejandro Herrada**, Govern Balear Fellowship

* **Konstantin Hicke**, Govern Balear Fellowship

* **Leonardo Lyra Gollo**, FPI Fellowship Project FISICOS

* **Ricardo Martínez**, JAE CSIC Fellowship

* **Jade Martínez**, Govern Balear Fellowship

* **María Moreno**, UIB University Teaching Assistant

* **R. Modeste Nguimdo**, FPI Fellowship Project PhoDeCC

* **Neus Oliver**, JAE CSIC Fellowship

* **Pedro José Parra Rivas**, PIE-CSIC Project

26

* **Antonio Pérez Serrano**, Govern Balear Fellowship

* **Xavier Porte Parera**, FPI Fellowship Project DeCoDicA

* **Flora Souza Bacelar**, Govern Balear Fellowship

2.4 TECHNICAL AND ADMINISTRATIVE SUPPORT

* **Pep Canyelles Pericas**, Lab Technician

* **Inma Carbonell**, Administration Unit Head

* **David de la Montaña Gutiérrez**, Computing Lab Technician since October

* **Eduardo Herraiz**, Computing Lab Technician

* **Rubén Tolosa**, Computing Lab Technician

* **Maria Antònia Tugores Pons**, GridCSIC Technician

27

* **Marta Ozonas**, Secretary

* **Rosa María Rodríguez**, Outreach

HUMAN RESOURCES IFISC 2005-2011

	2005	2006	2007	2008	2009	2010	2011
PERMANENT STAFF	10	11	12	13	14	17	17
POSTDOCTORAL FELLOWS	8	9	10	10	17	14	15
PHD STUDENTS	16	16	16	20	22	25	23
LONG TERM VISTORS	6	6	8	9	4	15	8
SUPPORT PERSONNEL	3	2	2	4	7	7	8

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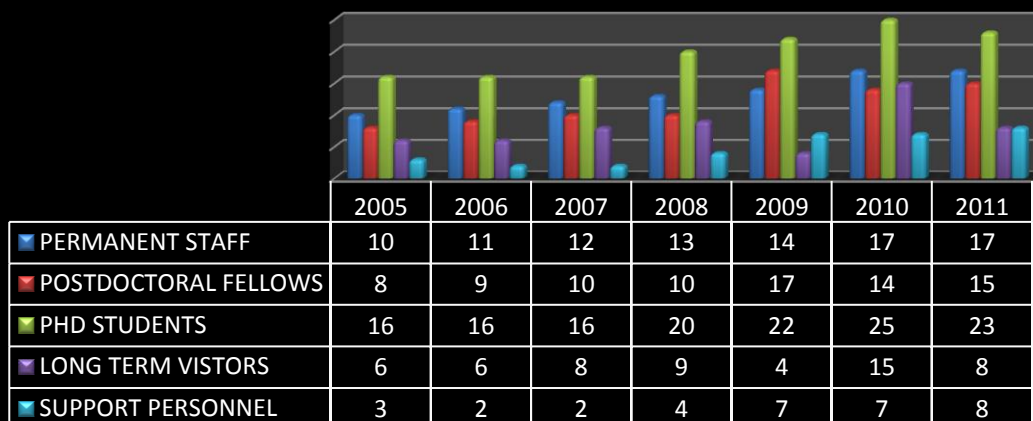
2.5 STUDENT ASSISTANTS

* **Andrés Adrover González,** UIB collaboration fellowship

* **Adrián Almazán,** JAE-Intro CSIC

* **Nestor Bonilla,** JAE-Intro CSIC

* **Jorge Pablo Rodríguez,** JAE-Intro CSIC

* **Javier Osca Cotarelo,** UIB collaboration Fellowship

28

2.6 VISITORS

a) **Long Term Visitors (>1 month)**

* **Yuri Braiman**, *Center for Engineering Science Advanced Research, Oak Ridge National Laboratory and University of Tennessee, USA.* January- February

* **Marco Patriarca**, *National Institute of Chemical Physics and Biophysics, Tallinn, Estonia.* January- April

* **Peyman Zarrineh,** *SISTA, Katholieke Universiteit Leuven, Belgium.* February, November and December

IFISC

✱ **Michael Moskalets**, *Kharkiv Polytechnic Institute, Kharkiv, Ukraine*. February and March

✱ **Diana Arroyo Almanza**, *Centro de Investigaciones ópticas de México*. April to July

✱ **Matteo G. A. Paris**, *Dipartimento di Fisica, Università di Milano, Milano, Italy.* June

✱ **David Sukow**, *Department of Physics and Engineering, Washington and Lee University, USA*. January to August.

✱ **Angel Plastino**, *Universidad de La Plata, Argentina*. June-July and September

✱ **Bruno Gonçalves**, *Northeastern University, Boston, USA.* November

b) **Short Term Visitors (< 1month)**

✱ **Miguel Angel García March,** *University College Cork, Ireland.* January and May

✱ **José Ramón Uriarte**, *Dpto. Fundamentos del Análisis Económico, Universidad País Vasco, Spain*. February

29

✱ **Francesc Sagués**, *Departament de Química Física, Universitat de Barcelona, Spain*. March

✱ **M. Angeles Serrano**, *Universidad de Barcelona, Spain*. March

✱ **Lennert Appeltant**, *Vrije Universiteit, Brussels, Belgium*. March and November

✱ **Javier Buceta**, *Parc Científic Barcelona, Barcelona, Spain*. March

✱ **Esteban Moro**, *Dept. Mathematics, Universidad Carlos III de Madrid, Spain*. April

✱ **Bruno Bellomo**, *Dipartimento di Fisica, Università di Palermo, Palermo, Italy*. April

✱ **Thomas Erneux**, *Université Libre de Bruxelles, Belgium.* April

✱ **Laurent Larger**, *Universitè de Franche-Comte,Besancçon, France.* April

✱ **Virginia Penhune**, *Concordia University, Montreal, Canada*. April

✱ **Robert Zatorre**, *McGill University, Montreal, Canada*. April

✱ **Javier Villarroel**, *Universidad de Salamanca, Spain*. April

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* **Boris Malomed**, *Tel Aviv University, Israel*. May

* **Wolfang Kinzel**, *University of Würzburg, Germany.* May

* **Santo Fortunato**, *ISI, Turin, Italy.* May

* **Cristina Masoller**, *Departament de Fisica i Enginyeria Nuclear, Universitat Politecnica de Catalunya, Terrassa, Spain*. May

* **Ghazal Tayebirad**, *University of Heidelberg, Germany.* May

* **Konstantin Klemm**, *Bioinformatics, University of Leipzig, Germany.* May

* **Marc Sciamanna**, *Optics & Electronics Research Group (OPTEL), Supélec, Metz, France*. May

* **Delphin Wolfersberger**, *SUPELEC, Escuela Superior de Electricidad, France*. May

* **Eduardo Altmann**, *Max Planck Institute for the Physics of Complex Systems, Dresden, Germany*. May

* **Haydee Lugo**, *Dept. de Fundamentos del Análisis Económico, Universidad Complutense de Madrid, Spain.* May

30

* **Elena Bascones**, *Dept. Theory and Simulation of Materials, Instituto de Ciencia de Materiales de Madrid ICMM (CSIC), Madrid, Spain.* May

* **Heung-Sun Sim**, *Korea Advanced Institute of Science and Technology, Korea.* June

* **Lendert Gelens**, *Vrije Universiteit Brussels, Belgium*. June

* **Adrian Jacobo**, *Max Planck Institute, Germany*. June

* **Carlos Escudero**, *Departamento de Economía Cuantitativa UAM & Instituto de Ciencias Matemáticas (CSIC-UAM-UC3M-UCM), Spain.* June

* **Jan Danckaert**, *Vrije Universiteit Brussels, Belgium*. July

* **Gerardo Iñíguez**, *Aalto Univ. School of Science and Technology, Finland*. September

* **Diego Maza**, *Universidad de Navarra, Spain*. September

* **Yamir Moreno**, *BIFI, Universidad de Zaragoza, Spain*. September

* **Christopher Jarzynski**, *University of Maryland, USA*. September

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* **Frank Jülicher**, *Max Planck Institute, Germany*. September

* **Yuli Nazarov**, *Delft University, Netherlands*. September

* **Ramón Aguado**, *Inst. De Ciencia de Materiales de Madrid, Spain*. September

* **Maximiliano Expósito**, *Universidad Libre de Bruselas, Belgium*. September

* **Marc Barthelemy**, *CEA-Saclay, France*. November

* **Sabrina Maniscalco**, *Heriot-Watt University, Edinburgh, UK*. November

* **Ruggero Vasile**, *University of Turku, Finland*. November

* **Rudolf Sollacher**, *Siemens, Munich, Germany.* November

* **Francesco Plastina**, *Universita de Calabria, Italy*. December

* **María José López**, *Universidad de Valladolid, Spain.* December

* **Renaud Lambiotte**, *University of Namur, Belgium*. December

* **Jari Saramaki**, *University of Aalto, Finland*. December

31

VISITING SICENTISTS AT IFISC 2005-2011

	SPAIN	EUROPE	REST OF THE WORLD	TOTAL
SHORTS VISITS	83	145	70	298
LONG VISITS	1	29	26	56
TOTAL VISITS	84	174	96	354

IFISC
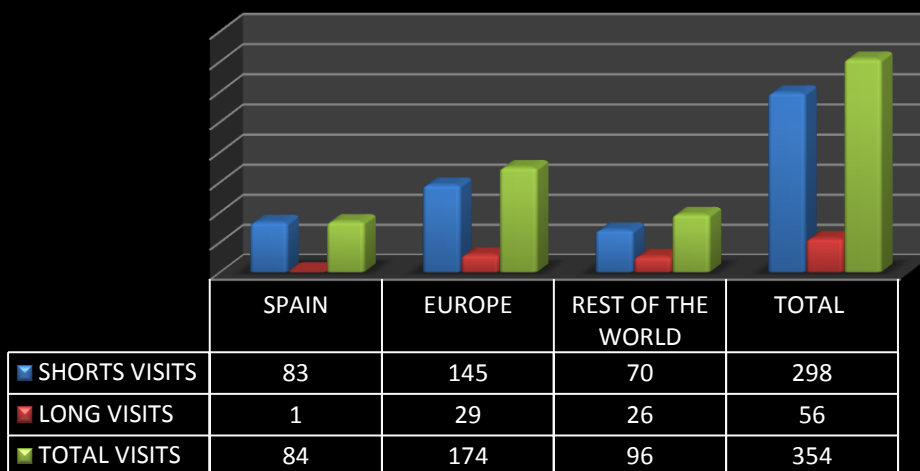
3. RESEARCH PROJECTS

3.1 RESEARCH PROJECTS FUNDED BY THE EUROPEAN COMMISSION

PHOCUS: Towards a Photonic liquid state machine based on delay-CoUpled Systems. [FP7-ICT-2009-C-240763] Specific Targeted Research Projects (STREP). European Coordinator: Claudio Mirasso. Principal Investigators: Claudio Mirasso (UIB) and Ingo Fischer (CSIC). (2010-2012). UIB Budget: 305.261 €. CSIC Budget: 330.228 €

LINC: Learning about Interacting Networks in Climate. [FP7-PEOPLE-2011-Initial training NEtwork, PITN-GA-2011-289447] European Commission. Principal Investigator: Emilio Hernández-García (2011-2015) Budget: 502.162 €

NANOCTM: Nanoelectronics: Concepts, theory and modeling. [234970] Marie Curie Network for Initial Training (ITN). Principal Investigator: Colin Lambert from Lancaster University, UK. IFISC Participating Scientists: David Sánchez y Rosa López. (2010-2013)

NOVALIS: A Novel Architecture for a photonics LIquid State machine. [275840] Marie Curie Intra-European Fellowships for career development. European Commission. Principal Investigator: Daniel Brunner. (2011-2013) Budget: 167.066 €

PhD ComplexWorld: Analysis of air transportation using complex networks. Subproyecto de SESAR. Comisión Europea-SESAR Joint Undertaking-Eurocontrol. Contract 10-220210-C4. Principal Investigator: Maxi San Miguel. (2011-2015) Budget: 120.000 €

PhysCoCo: Physics of Competition and Conflicts. [COST-MP0801] European COST ACTION Coordinator: P. Richmond (Trinity, Dublin, Ireland). Principal Investigator: Maxi San Miguel, Spanish representative in the Steering Committee (2008-2012)

UAS: Unmanned Aerial Systems in atmosferic research. [COST-ES802] European COST-ACTION. European Coordinator: Joachim Reuder (University of Bergen). Principal Investigator: Damià Gomila. (2008-2012)

3.2 RESEARCH PROJECTS OF THE SPANISH NATIONAL PLAN FOR SCIENCE

FISICOS: Física Interdisciplinar y Sistemas Complejos. [FIS2007-60327] Principal Investigator: Maxi San Miguel. Deputy Principal Investigator: Raúl Toral. (2007-2013) Budget: 1.318.900 €

32

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DeCoDicA: **Delay-Coupled Diode Lasers for Photonic Applications**. [TEC2009-14101] MICINN. Principal Investigator: Ingo Fischer. (2009-2012) Budget: 236.313 €

3.3 OTHER IFISC RESEARCH PROJECTS

NoLocal: **Efectos del acoplamiento no-local en sistemas complejos**. Proyecto Intramural Especial. CSIC. Principal Investigator: Damià Gomila (2011-2012) Budget: 25.000 €

i-LINK0272:. **Synchronization without correlation in neuronal systems**. Proyecto Bilateral. CSIC. Principal Investigator: Ingo Fischer. Partners: Michael Breakspear, Queensland Institute of Medical Research, Australia and Luis Martinez Otero, CSIC, Spain. (2011-2012) Budget: 28.800 €

DiSQuC 10: Dinámica de sistemas cuánticos complejos. [AAEE0113/09]. Acción especial. Balear Government. Principal Investigator: Roberta Zambrini (2010-2011) Budget: 8.000 €

TurBiD: **Impact of Turbulence on Biological Dynamics**. Proyecto Intramural Especial. CSIC. [200450E644]. Principal Investigator: Emilio Hernández-García. (2009-2012)

PIEModelizacion: **Modelización computacional en sistemas complejos**. [201050E119] Proyecto Intramural Especial. CSIC. Principal Investigator: Pere Colet. (2010-2013)

33

COQUSYS: **Complexity and Quantum Systems**. [200450E566]. Proyecto Intramural Especial CSIC. Principal Investigator: Maxi San Miguel. (2009-2012)

3.4 RESEARCH PROJECTS WITH PARTICIPATION OF IFISC MEMBERS

IBERSINC: **Red sobre dinámica y sincronización en redes**. Accion Complementaria. Gobierno Español. FIS2010-09832-E (subprograma FIS). IFISC Coordinator: Víctor M. Eguíluz. (2011)

RedFueraEq: **Red Española de Fisica de sistemas fuera de equilibrio**. [FIS2010-11438-E] Accion Complementaria. MICINN. IFISC Coordinator: David Sánchez. (2011-2012)

T2CNI: Transporte cuantico en nanoestructuras e informacion cuantica. [FIS2008-00781]. Plan Nacional de I+D+I. IFISC Participating Scientists: Llorens Serra, David Sánchez, Rosa López and Montserrat Casas. (2009-2011).

RiaFormosaFCT: **Genetica paisagistica duma lagoa costeira; uma abordagem empirica e de modelaçao usando a erva marinha Zostera noltii in Ria Formosa.** [PTDC/MAR/099887/200] Projecto de Investigaçao Cientifica e Desenvolvimento Tecnologico. Fundaçao para a Ciencia e a Tecnologia (FCT Portugal). Coordinator: Filipe Alberto. IFISC Participating Scientists: Emilio Hernández García and Victor Eguíluz. (2010-2013)

IFISC

3.5 OTHER FUNDING

SummerSchool2011_ESF: **Summer School on Statistical Physics of Complex and Small Systems**. ESF Program. European Science Foundation. 3487. Principal Investigator: Pere Colet. (2011-2011) Budget: 20.000 €

SummerSchool2011_UIB: **Summer School on Statistical Physics of Complex and Small Systems**. Principal Investigator: Pere Colet. (2011-2011) Budget: 3.000 €

Transport11_ESF: **Nonlinear spin and charge transport through nanoscopic systems**. ESF Program. European Science Foundation. [122479]. Principal Investigator: David Sánchez. (2011-2011) Budget: 11.900 €

Transport11_UIB: **Nonlinear fluctuation-dissipation relations and magnetoasymmetries in mesoscopic conductors**. [073487]. Principal Investigator: David Sánchez. (2011-2011) Budget: 3.000 €

NANOMED3: **Tercera reunió d'investigadors en nanoelectrònica de l'àrea mediterrània**. Acciones Especiales. Govern Balear. NANOMED3. Principal Investigator: Llorenç Serra. (2011-2011) Budget: 1.000 €

PostdocGovern2009-2011: **Subvencio per incorporar personal investigador al sistema d'innovacio de les Illes Balears**. Subvencion. Govern Balear. Principal Investigator: Emilio Hernández-García. (2009-2011) Budget: 67.320 €

Programa de Comunicació i Cultura Científica-IFISC2011. [AAEE0131/09] Acciones Especiales. Govern Balear. Principal Investigator: Maxi San Miguel. (2010-2011) Budget: 18.000 €

Explorant4: Explorant les Fronteres entre els Sabers IV. [AAEE187/09]. Acciones Especiales. Govern Balear. Principal Investigator: Claudio Mirasso. (2011) Budget: 6.000 €

GrupCompetitius-FESC: GrupCompetitius-FESC. Govern Balear. Principal Investigator: Ingo Fischer. (2011-2014) Budget: 36.000 €

GrupCompetitius: Grupo de Física Interdisciplinar. Govern Balear. Principal Investigator: Maxi San Miguel (2011-2014) Budget: 36.000 €

FISICOS Project Technician. [PTAT2008-00895]. Spanish Government. Principal Investigator: Maxi San Miguel. (2008-2013) Budget: MICINN 78.000 € and Balear Government: 29.400 €

34

3.6 SUMMARY OF IFISC FUNDING 2005-2011

✳ **European Commission Framework Program projects**: 8 (EDEN, PATRES, GABA, PICASSO, IOLOS, THRESHOLDS, PHYSBIO, PHOCUS), 1 individual Marie Curie (NOVALIS)

✳ **European Networking**: 7 EC-FP networks (BIOSIM, EUR-OCEANS, ONCECS, MARBEF, ComplexWorld, NANOCTM, LINC), 3 European COST Actions, 3 ESF Program.

✳ **Spanish National Plan:**
- 5 Research Projects
- 6 International Bilateral Projects (Germany (3), Italy, Hungary, Australia)
- 6 Thematic networks (Statistical and Nonlinear Physics, Quantum and Nonlinear Optics, E-science, Dynamics of collective phenomena in socioeconomic systems (2), IBERSINC)

✳ **Regional Balear Government**: 22 Research actions.

BUDGETS:
- Grand total budget of projects granted in 2005-11: **6.622.117 €**
- Grand total budget of active projects in 2011: **3.203.603 €**
- Budget of EC-funded active projects in 2011: **44,47 % of total**

35

BUDGET IFISC'S RESEARCH PROJECTS 2005-2011

	2005	2006	2007	2008	2009	2010	2011	TOTAL
EUROPEAN COMMISSION	491.808€	341.000€	588.396€	0€	53.000€	635.489€	789.228€	2.898.921€
SPANISH NATIONAL PLAN FOR SCIENCE	25.820€	123.240€	1.377.330€	92.890€	415.952€	0€	0€	2.035.232€
OTHER FUNDING	44.450€	48.000€	161.630€	274.280€	500.625€	470.279€	188.700€	1.687.964€
TOTAL	562.078€	512.240€	2.127.356€	367.170€	969.577€	1.105.768€	977.928€	6.622.117€
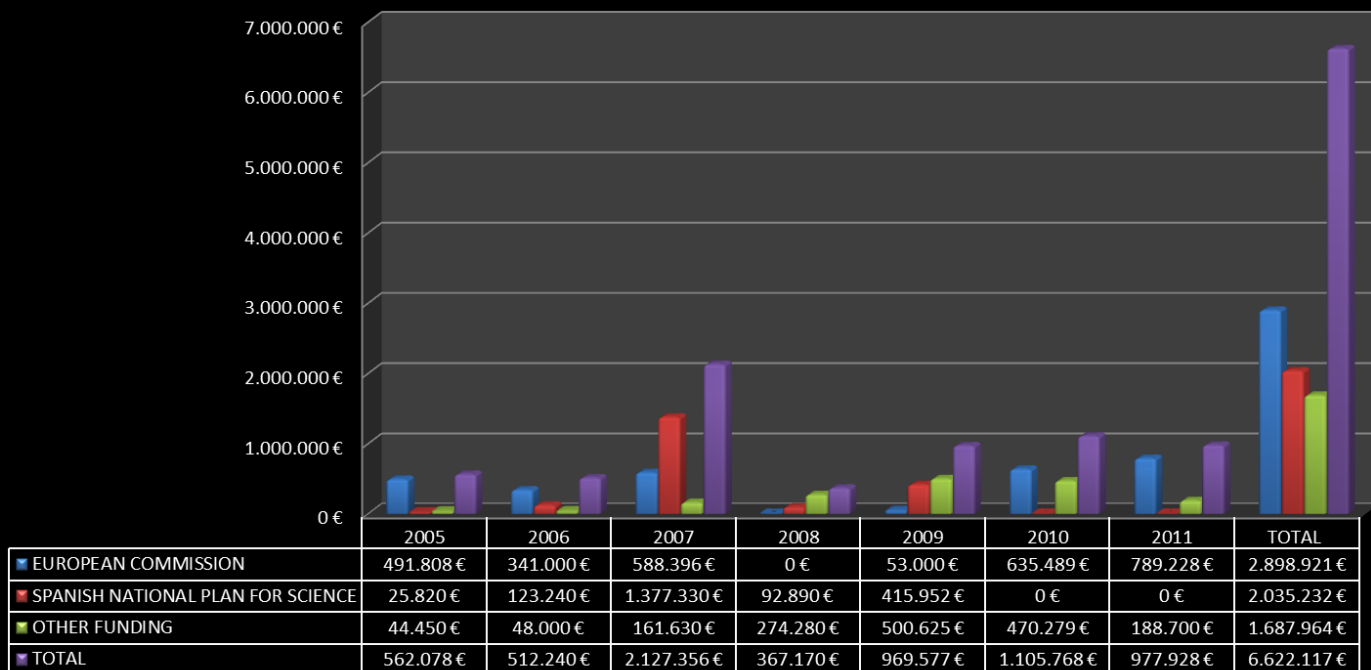
4. IFISC SEMINARS

Seminars are <u>broadcasted live</u> and recorded.You can watch and retrieve them at:

http://ifisc.uib-csic.es/seminars/

Coordinator: Dr. Ernesto M. Nicola

36

Przemyslaw A. Grabowicz, IFISC, Palma de Mallorca, Spain

Heterogeneity shapes groups growth in social online communities

January 13

Luis Lafuerza, IFISC, Palma de Mallorca, Spain

Synchronization phenomena in coupled excitable systems

January 18

Adolfo Paolo Masucci, IFISC, Palma de Mallorca, Spain

Wikipedia information flow analysis reveals the scale-free architecture of the Semantic Space

January 27

Susanna C. Manrubia, Centro de Astrobiología (INTA-CSIC), Torrejón de Ardoz, Madrid, Spain

Effect of mutations on fitness: the case of RNA secondary structure

February 3

Alejandro Herrada, IFISC, Palma de Mallorca, Spain

A Complex Network Approach to Phylogenetic Trees: From Genes to the Tree of Life

February 4

Daniele Vilone, Departamento de Matemáticas, Uni. Carlos III, Madrid, Spain

The role of topology in the evolution of cooperation

February 10

J. R. Uriarte, Dpto. Fundamentos del Análisis Económico, Universidad País Vasco

Minority Language and the Stability of Bilingual Equilibria

February 17

Leonardo Lyra Gollo, IFISC, Palma de Mallorca, Spain

How does zero-lag long-range cortical synchronization emerge in different frequency bands?

February 18

Yuri Braiman, Center for Engineering Science Advanced Research, Oak Ridge National Laboratory and University of Tennessee, USA

Synchronization and coherence in arrays of broad area semiconductor lasers

February 22

Pedro A. Sánchez, IFISC, Palma de Mallorca, Spain

Transitions at the mesoscale: morphological changes in thin solid films and magnetic filaments

February 25

Carlos M. Duarte, IMEDEA, Palma de Mallorca, Spain

The European Research Council: An opportunity to develop your ideas

March 3

Francesc Sagués, Departament de Química Física, Universitat de Barcelona, Spain

Addressing soft matter: From organized monolayers to actuated colloids

March 4

Michael Moskalets, Kharkiv Polytechnic Institute, Kharkiv, Ukraine

Spectroscopy of electron flows

March 10

 João Bettencourt, IFISC, Palma de Mallorca, Spain

Design Methods in Incompressible Aerodynamics

March 17

Pere Colet, IFISC, Palma de Mallorca, Spain

Detection of change points in time series using nonlinear spatio-temporal dynamics

March 24

37

*IFISC

Javier Buceta, Parc Científic Barcelona, Barcelona, Spain
Puzzling out the Mechanical Stability of the DV Organizer of the Wing Imaginal Disc
March 31

Esteban Moro Egido, Dept. Mathematics, Universidad Carlos III de Madrid, Spain
The dynamical strength of social ties in information spreading
April 5

Bruno Bellomo, Dipartimento di Fisica, Università di Palermo, Palermo, Italy
Revival of quantum correlations without system-environment back-action
April 7

Virginia Penhune, Dept of Psychology, Concordia University, Montreal, Canada
Developmental contributions to motor skill learning: Effects of musical training
April 14

Robert Zatorre, Montreal Neurological Institute, McGill University, Montreal, Canada
Music in the brain: Pitch, Plasticity and Emotion
April 14

Thomas Erneux, Université Libre de Bruxelles, Belgium
Delay Differential Equations in Action
April 14

38

Javier Villarroel, Dept. de Estadística, Universidad de Salamanca, Spain
NLS equation driven by Poisson noise and distribution of impurities in optical fibers
April 19

Wolfgang Kinzel, University of Würzburg, Germany
Chaos Synchronization of networks with time-delayed couplings
May 3

Boris Malomed, Tel Aviv University, Israel
Dynamical Symmetry Breaking in Dual-Core Nonlinear Systems
May 4

Santo Fortunato, ISI, Turin, Italy
The complexity of networks and social dynamics
May 5

Ghazal Tayebirad, University of Heidelberg, Germany
Engineering Landau-Zener Tunneling of Ultra-cold Atoms in Tilted Lattices
May 9

*IFISC

Eduardo Altmann, Max Planck Institute for the Physics of Complex Systems, Dresden, Germany
Dissemination of words in online discussion groups
May 10

Marc Sciamanna, Optics & Electronics Research Group (OPTEL), Supélec, Metz, France
Recent works on nonlinear dynamics: bistable mode switching, chaos multiplexing and control of optical patterns
May 12

Haydee Lugo, Dept. de Fundamentos del Análisis Económico, Universidad Complutense de Madrid, Spain
An impure public good model with lotteries in large groups
May 13

Elena Bascones, Dept. Theory and Simulation of Materials, Instituto de Ciencia de Materiales de Madrid ICMM (CSIC), Madrid, Spain
Interplay between ferromagnetism and charging effects in the transport through nanoparticle arrays
May 19

Heung-Sun Sim, Korea Advanced Institute of Science and Technology, Korea
Topological aspect of Klein tunneling in bilayer graphene
June 3

39

Lendert Gelens, Vrije Universiteit Brussels, Belgium
Boundary effects on localized structures in the Lugiato-Lefever model
June 8

Damià Gomila, IFISC, Palma de Mallorca, Spain
Computing with dissipative solitons
June 16

Carlos Escudero, Departamento de Economía Cuantitativa UAM & Instituto de Ciencias Matemáticas (CSIC-UC3M), Spain
Non-equilibirum growth of radial clusters: weak convergence to the asymptotic profile and implications for morphogenesis
June 21

D. Heiss, University of Stellenbosch, South Africa
The Physics of Exceptional Points
June 23

Matteo G.A. Paris, Dipartimento di Fisica, Università di Milano, Milano, Italy
Quantum Estimation for Quantum Technology
June 28

IFISC

Angel Plastino, Univ. Nac. de La Plata and Inst. de Física La Plata (CONICET), La Plata, Argentina

Legendre structure in quantum mechanics

July 7

M. Magdalena Gelabert, UIB, Palma de Mallorca, Spain

Quantum features of electron and hole quantum wires with Rashba coupling

July 13

Rosa López, IFISC, Palma de Mallorca, Spain

Electronic transport in mesoscopic systems: some examples

July 14

Juan Jose Cerdà, IFISC, Palma de Mallorca, Spain

Theory and simulations applied to the understanding of ferrofluids, shifted dipole particles, and magnetic filaments

July 22

Dante R. Chialvo, CONICET, Argentina & UCLA, Los Angeles, USA

Criticality in brain's physics and mind dynamics

July 26

40

Krzysztof Suchecki, IFISC, Palma de Mallorca, Spain

The category structure of Wikipedia

September 8

Pedro Valdes-Sosa, Cuban Neuroscience Center, Cuba

Effective connectivity: Influence, causality and biophysical modeling

September 23

Gianluca Giorgi, IFISC, Palma de Mallorca, Spain

Genuine quantum and classical correlations in multipartite systems

September 29

Romain Modeste Nguimdo, IFISC, Palma de Mallorca, Spain

Chaos and Synchronization in Opto-electronic Devices with Delayed Feedback

October 14

Daniele Vilone, IFISC, Palma de Mallorca, Spain

Chaos and unpredictability in game theory

October 20

Hideyuki Kato, IFISC, Palma de Mallorca, Spain

Structures and dynamics in neural networks organized through spike timing-dependent plasticity

October 27

*IFISC

Valentin Flunkert, IFISC, Palma de Mallorca, Spain

Synchronization in networks with large delay and application to lasers

November 3

Antonio Pérez Serrano, IFISC, Palma de Mallorca, Spain

Modeling Semiconductor Ring Lasers

November 7

Sabrina Maniscalco, Heriot-Watt University, Edinburgh, UK

One year of public outreach in Finland

November 8

Marc Barthelemy, CEA-Saclay, France

Evolution of transportation networks

November 8

Sabrina Maniscalco, Heriot-Watt University, Edinburgh, UK

Non-Markovianity and Information Flow

November 9

J. C. González-Avella, Universidad Federal de Río Grande do Sul, Porto Alegre, Brazil

General coevolution of topology and dynamics in networks

November 10

41

Bruno Gonçalves, Northeastern University, Boston, USA

Towards a characterization of behavior-disease models

November 16

Rudolf Sollacher, Siemens, Munich, Germany

Technologies for Next Generation Sensor & Actuator Networks

November 22

Peyman Zarrineh, SISTA, Katholieke Universiteit Leuven, Belgium

The mutual relation between the regulatory interaction network and other data sources: application to the E. coli genome

November 29

María José López, Universidad de Valladolid, Spain

Simulation of hydrogen adsorption on graphene nanoribbons and on graphene supported palladium clusters

December 2

Juan Fernández Gracia, IFISC, Palma de Mallorca, Spain

Link-based social dynamics in complex networks: time evolution and heterogeneous asymptotic states

December 15

Renaud Lambiotte, Namur Center for Complex Systems, University of Namur, Belgium

Generalized Master Equations for non-Poissonian Dynamics on Networks

December 19

Jari Saramaki, Department of Biomedical Engineering and Computational Science, University of Aalto, Finland

Temporal networks of human communication

December 19

42
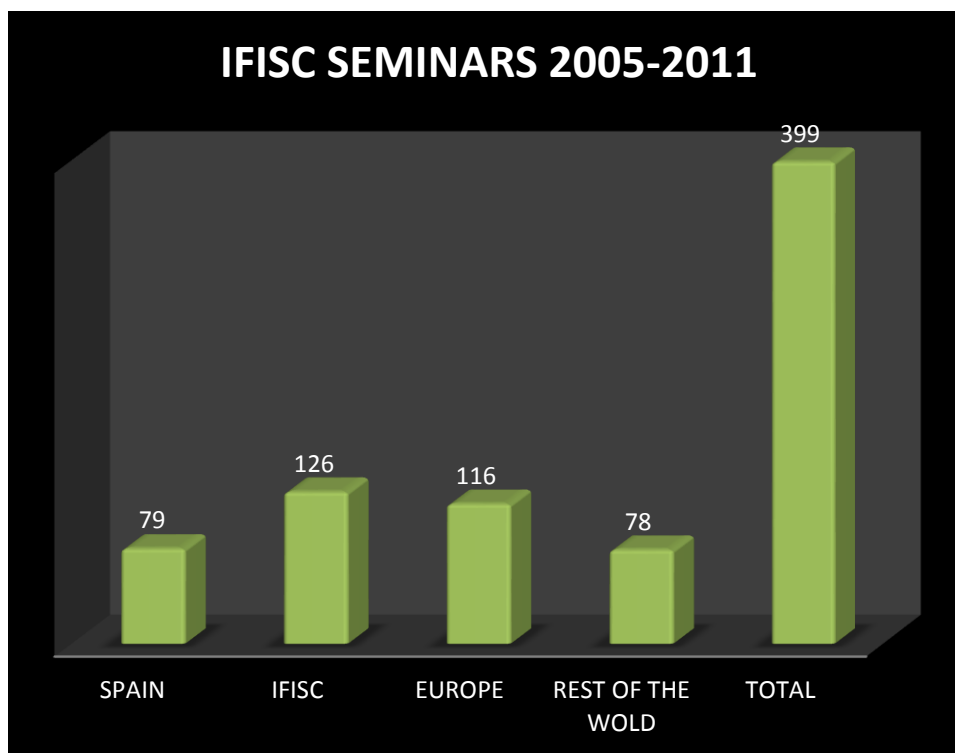
IFISC SEMINARS 2005-2011

	2005	2006	2007	2008	2009	2010	2011	TOTAL
SPAIN	7	15	7	11	12	14	13	79
IFISC	12	20	12	19	23	21	19	126
EUROPE	16	12	16	19	20	16	17	116
REST OF THE WORLD	13	12	13	10	5	14	11	78
TOTAL	48	59	48	59	60	65	60	399

43
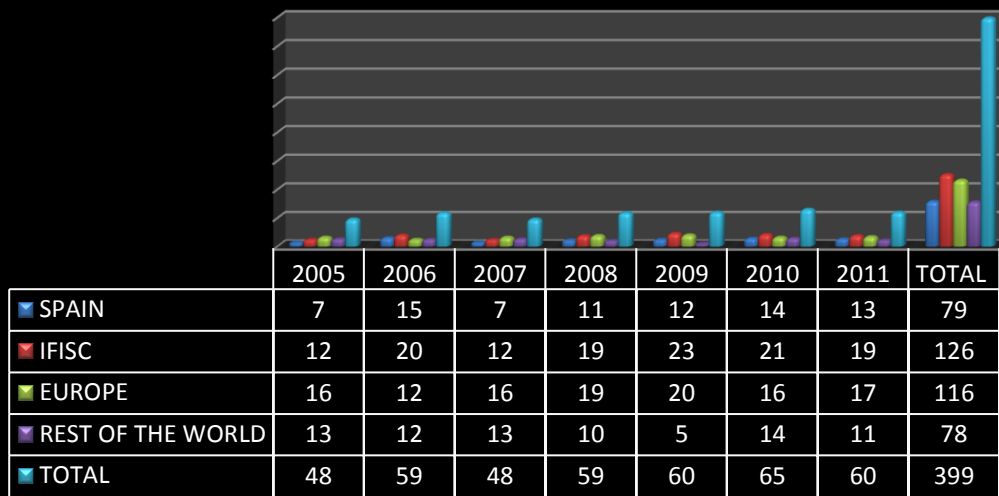
5. PUBLICATIONS

Publications are available from IFISC web page: **http://ifisc.uib-csic.es/publications/**

5.1 ISI PUBLICATIONS

5.1 A) JCR JOURNALS

Polarization of PAR Proteins by Advective Triggering of a Pattern-Forming System.

Goehring, N.W.; Khuc Trong, P.; Bois, J.S.; Chowdhury, D.; Nicola, Ernesto M.; Hyman, A.A.;
Grill, S.W..

Science 334, 1137-114

Information processing using a single dynamical node as complex system.

Appeltant, L.; Soriano, M.C.; Van der Sande, G.; Danckaert, J.; Massar, S.; Dambre, J.;
Schrauwen, B.; Mirasso, C.R.; Fischer, I..

Nature Communications 2, 468

Controlling the Interaction of Electron and Nuclear Spins in a Tunnel-Coupled Quantum Dot.

Kloeffel, Christoff;Dalgarno, Paul; Urbaszek, Bernhard; Gerardot, Brian; Brunner, Daniel; Petroff,
Pierre; Loss, Daniel; Warburton, Richard.

Physical Review Letters 106, 046802-046806

44

Temporal Griffiths Phases.

Vazquez, Federico; Bonachela, Juan Antonio; López, Cristóbal; Muñoz, Miguel Angel.

Physical Review Letters 106, 235702

Digital key for chaos communication performing time delay concealment.

Romain Modeste Nguimdo, Pere Colet, Laurent Larger and Luís Pesquera.

Physical Review Letters 107, 034103 (1-4)

Genuine quantum and classical correlations in multipartite systems.

Giorgi, Gian Luca; Bellomo, Bruno; Galve, Fernando; Zambrini, Roberta.

Physical Review Letters 107, 190501 (1-5)

Josephson Current in Carbon Nanotubes with Spin-Orbit Interaction.

Jong Soo Lim, Rosa López, and Ramón Aguado.

Physical Review Letters 107, 196801 (1-5)

*IFISC

Strong and Weak Chaos in Nonlinear Networks with Time-Delayed Couplings.

Heiligenthal, Sven; Dahms, Thomas; Yanchuk, Serhiy; Jüngling, Thomas; Flunkert, Valentin; Kanter, Ido; Schöll, Eckehard; Kinzel, Wolfgang.

Physical Review Letters 107, 234102 (1-5)

Human Mobility Networks, Travel Restrictions, and the Global Spread of 2009 H1N1 Pandemic.

Bajardi, Paolo; Poletto, Chiara; Ramasco, Jose J; Tizzoni, Michele; Colizza, Vittoria; Vespignani, Alessandro.

PLoS ONE 6, e16591

Wikipedia information flow analysis reveals the scale-free architecture of the Semantic Space.

Masucci, A.P.; Kalampokis, A.; Eguíluz, V.M.; Hernández-García, E..

PLoS ONE 6, e17333

Theta band zero-lag long-range synchronization via hippocampal dynamical relaying.

Gollo, L. L.; Mirasso, C.; Atienza, M.; Crespo-García, M.; Cantero, J. L.

PLoS One, e17756

Evolution of Surname Distribution under Gender-Equality Measures.

Lafuerza, Luis F.; Toral, Raul.

PLoS ONE 6, 4, e18105 (1-4)

Finding statistically significant communitites in networks.

Lancichinetti, A.;Radicchi, F.;Ramasco, J.J.;Fortunato, S.

PLos ONE 6, e18961

Effect of the topology and delayed interactions in neuronal networks synchronization.

Pérez, Toni; García, Guadalupe; Eguíluz, Víctor M.; Vicente, Raúl; Pipa, Gordon; Mirasso, Claudio.

PLoS ONE 6(5), e19900

Threshold learning dynamics in social networks.

González-Avella, Juan Carlos; Eguíluz, Victor M; Marsili, Matteo; Vega-Redondo, Fernando; San Miguel, Maxi.

PLoS ONE 6(5), e20207

Longitudinal mode multistability in Ring and Fabry-Perot lasers: the effect of spatial hole burning.

Perez-Serrano, Antonio; Javaloyes, Julien; Balle, Salvador.

Optics Express 19, 3284-3289

45

*IFISC

General coevolution of topology and dynamics in networks.

Herrera, J. L.; Cosenza, M. G.; Tucci, K.; González-Avella, J.C..

Europhysics Letters 95, 58006

Orthogonal measurements are almost sufficient for quantum discord of two qubits.

Galve, F.; Giorgi, G.L.; Zambrini, R.

Europhysics Letters 96, 40005

Tuning quantum correlations with intracavity photonic crystals.

M. de Castro, Maria; Garcia-March, Miguel Angel; Gomila, Damià; Zambrini, Roberta.

Physical Review A 84, 033832 (1-6)

Maximally discordant mixed states of two qubits.

Galve, Fernando; Giorgi, Gian Luca; Zambrini, Roberta.

Physical Review A 83, 012102 (1-5)

Propagation properties and limitations on the attainable entanglement in a driven harmonic chain.

Galve, Fernando.

Physical Review A 84, 012318

Monogamy properties of quantum and classical correlations.

Giorgi, Gian Luca.

Physical Review A 84, 054301 (1-4)

Enhancement of Rashba coupling in vertical In(0.05)Ga(0.95)As/GaAs quantum dots.

Huang, S. M.; Badrutdinov, A. O.; Serra, L.; et al.

Physical Review B 84, 085325 (1-5)

g-factor anisotropy of hole quantum wires induced by Rashba interaction.

Gelabert, M.M.; Serra, L.

Physical Review B 84, 075343 (1-7)

Kramers polarization in strongly correlated carbon nanotube quantum dots

Lim, Jong Soo; López, Rosa; Giorgi, Gian Luca; Sánchez, David.

Physical Review B 83, 155325 (1-8)

Effect of many-body correlations on mesoscopic charge relaxation.

Lee, Minchul; López, Rosa; Choi, Mahn-Soo; Jonckheere, Thibaut; Martin, Thierry.

Physical Review B (Rapid) 83, 201304 (1-4)

46

*IFISC

Thermoelectric transport of mesoscopic conductors coupled to voltage and thermal probes.
Sánchez, D.; Serra, L.
Physical Review B 84, 201307 (R) (1-4)

From one- to two-dimensional solitons in the Ginzburg-Landau model of lasers with frequency selective feedback.
Paulau, P.V.; Gomila, D.; Colet, P.; Malomed, B.A.; Firth, W.J..
Physical Review E 84, 036213 (1-7)

Extracting directed information flow networks: an application to genetics and semantics
Masucci, A.P.; Eguíluz, V.M.; Hernández-García, E.; Kalampokis, A.
Physical Review E 83, 026103 (1-6)

Information filtering in complex weighted networks.
Radicchi, F.;Ramasco, J.J.;Fortunato, S.
Physical Review E 83, 046101

Mismatch and synchronization: Influence of asymmetries in systems of two delay-coupled lasers.
Hicke, Konstantin; D'Huys, Otti; Flunkert, Valentin; Schöll, Eckehard; Danckaert, Jan; Fischer, Ingo.
Physical Review E 83, 056211 (1-11)

Role of delay for the symmetry in the dynamics of networks.
D'Huys, Otti; Fischer, Ingo; Danckaert, Jan; Vicente, Raúl.
Physical Review E 83, 046223 (1-7)

Structural and functional networks in complex systems with delay.
Eguíluz, Víctor M.; Pérez, Toni; Borge-Holthoefer, Javier; Arenas, Alex.
Physical Review E 83, 056113

Update rules and interevent time distributions: Slow ordering vs. no ordering in the Voter Model.
Fernández-Gracia, Juan; Eguíluz, Víctor M.; San Miguel, Maxi.
Physical Review E 84, 015103

Towards easier realization of time-delayed feedback control of odd-number orbits.
Flunkert, Valentin; Schöll, Eckehard.
Physical Review E 84, 016214 (1-12)

47

*IFISC

Role of delay in the stochastic creation porcess.

Lafuerza, Luis F.; Toral, Raúl.

Physical Review E 84, 021128 (1-9)

Anticipated synchronization in a biologically plausible model of neuronal motifs.

Matias, F. S.; Carelli, P. V.; Mirasso, C. R., Copelli, M.

Physical Review E 84, 021922

Exact solution of a stochastic protein dynamics model with delayed degradation.

Lafuerza, Luis F.; Toral, Raul.

Physical Review E 84, 051121 (1-7)

Adaptive tuning of feedback gain in time-delayed feedback control.

Lehnert, Judith; Hövel, Philipp; Flunkert, Valentin; Guzenko, Peter; Fradkov, Alexander. L.;
Schöll, Eckehard.

Chaos 21, 043111 (1-6)

Phase clustering in complex networks of delay-coupled oscillatos.

Pérez, Toni; Eguíluz, Víctor M.; Arenas, Alex.

Chaos: An Interdisciplinary Journal of Nonlinear Science 21, 025111

Time Scales of a Chaotic Semiconductor Laser With Optical Feedback Under the Lens of a Permutation Information Analysis.

Soriano, Miguel C.; Zunino, Luciano; Rosso, Osvaldo A.; Fischer, Ingo; Mirasso, Claudio R.

IEEE Journal of Quantum Electronics 47, 252-261

Interplay of Current Noise and Delayed Optical Feedback on the Dynamics of Semiconductor Lasers.

Soriano, Miguel C.; Berkvens, Thomas; Van der Sande, Guy; Verschaffelt, Guy; Danckaert, Jan;
Fischer, Ingo.

IEEE Journal of Quantum Electronics 47, 368-374

Model of the Self-Q-Switching Instability of Passively Phased Fiber Laser Arrays

Bochove, Erik J.; Aceves, Alejandro B.; Braiman, Yehuda; Colet, Pere; Deiterding, Ralf; Jacobo,
Adrián; Miller, Casey A.; Rhodes, Charley; Shakir, Sami A.

IEEE J. Quantum Electronics, **47**, 777-785

Characterizing the Hyperchaotic Dynamics of a Semiconductor Laser Subject to Optical Feedback Via Permutation Entropy.

Zunino, Luciano; Rosso, Osvaldo A.; Soriano, Miguel C.

IEEE Journal of Selected Topics in Quantum Electronics 17, 1250 – 1257

48

*IFISC

Conductance oscillations of a spin-orbit stripe with polarized contacts.
Gelabert, M M; Serra, L.
European Physical Journal B 79, 341-349

Diffusing opinions in bounded confidence processes.
M. Pineda, R. Toral, and E. Hernandez-Garcia.
European Physical Journal D 62, 109-117

Formal vs self-organised knowledge systems: a network approach.
Masucci; A.P.
Physica A 390, 4652–4659

Commodity predictability analysis with a permutation information theory approach.
Zunino, Luciano; Tabak, Benjamin M.; Serinaldi, Francesco; Zanin, Massimiliano; Pérez, Darío G.; Rosso, Osvaldo A.
Physica A 390, 876-890

Reconciling phase diffusion and Hartree–Fock approximation in condensate systems
Giorgi, Gian Luca; de Pasquale, Ferdinando.
Physica A: Statistical Mechanics and its Applications 391, 82-86

Life history and mating systems select for male biased parasitism mediated through natural selection and ecological feedbacks
S. Bacelar, Flora; White, Andrew; Boots, Mike
Journal of Theoretical Biology , **269**, 131 - 137

How reliable are Finite-Size Lyapunov Exponents for the assessment of ocean dynamics?.
Hernández-Carrasco, Ismael; López, Cristóbal; Hernández-García, Emilio; Turiel, Antonio.
Ocean Modelling 36, 208-218

Interference of Fano-Rashba conductance dips.
Gelabert, M.M.; Renart, A.; Serra, L.
Journal of Physics Condensed Matter 23, 115301 (1-6)

Semiflexible magnetic filaments near attractive flat surfaces: a Langevin dynamics study.
Sánchez, P.A.; Cerdà, J.J.; Balleneger, V.; Sintes, T.; Piro, O.; Holm, C.
Soft Matter 7, 1809-1818

Ferrofluids with shifted dipoles: ground state structures.
Kantorovich, Sofia; Weeber, Rudolf; Cerda Juan J.; Holm C.
Soft Matter 7, 5217-5227

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*IFISC

Synchronisation Induced by Repulsive Interactions in a System of van der Pol Oscillators.

Vaz Martins, Teresa; Toral, Raúl.

Progress of Theoretical Physics 126, 353-368

Magnetic particles with shifted dipoles.

Kantorovich, S.; Weeber, R.; Cerdà, Juan J.; Holm, C.

Journal of Magnetism and Magnetic Materials 323, 1269-1272.

Study of the structure factor anisotropy and long range correlations of ferrofluids in the dilute low-coupling regime.

Cerdà, Juan J.; Elfimova, E.; Ballenegger, V.; Krutikova, E.; Ivanov, A; Holm, C.

Journal of Magnetism and Magnetic Materials 323, 1246-1253

Structure factor of ferrofluids with chain aggregates: theory and computer simulations.

Pyanzina, E.; Kantorovich, S.; Cerdà, Juan J.; Holm, C.

Journal of Magnetism and Magnetic Materials 323, 1263-1268.

Particle-particle particle-mesh method for dipolar interactions:on error estimates and efficiency of schemes with analytical differentiation and mesh interlacing.

Cerdà, Juan J.; Ballenegger., V.; Holm, C..

Journal of Chemical Physics 135, 184110 (1-13)

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Scaling properties of protein family phylogenies.

Herrada, E.A.; Eguíluz, V.M.; Hernández-García, E.; Duarte, C.M..

BMC Evolutionary Biology 11, 155 (1-9)

Distinguishing fingerprints of hyperchaotic and stochastic dynamics in optical chaos from a delayed optoelectronic oscillator.

Soriano, Miguel C.; Zunino, Luciano; Larger, Laurent; Fischer, Ingo; Mirasso, Claudio R.

Optics Letters 36 (12), 2212-2214

Role of the phase in the identification of delay time in semiconductor lasers with optical feedback.

Nguimdo, Romain Modeste; Soriano, Miguel C.; Colet, Pere.

Optics Letters 36, 4332-4334

Dynamics of a semiconductor laser with polarization rotated feedback and its utilization for random bit generation

Oliver, Neus; Soriano, Miguel C.; Sukow, David W.; Fischer, Ingo.

Optics Letters 36, 4632-4634

IFISC

Robustness of different indicators of quantumness in the presence of dissipation.

Giorgi, Gian Luca; Galve, Fernando; Zambrini, Roberta.

International Journal of Quantum Information 9, 1825-1836

Extreme Fisher Information, Nonequilibrium Thermodynamics and Reciprocity Relations.

Plastino, A.; Olivares, F.; Flego, S.; Casas, M.

Entropy 13, 184-194

Novel Simulation Approaches for Polymeric and Soft Matter Systems.

Cerdà, Joan J.; Holm, Christian; Kremer, Kurt.

Macromolecular Theory and Simulations 20, 444-445. 2011.

Simulation of irregular waves in an offshore wind farm with a spectral wave model.

Ponce de Leon, S.; Bettencourt, J.H.; Kjerstad,N..

Continental Shelf Research 31-15, 1541-1557

Peculiarities of quantum discord´s geometric measure.

Batle, J.; Casas, M.

Journal of Physics A: Math. Teor. 44, 505304

Non locality and entanglement in qubit systems.

Batle, J.; Casas, M.

Journal of Physics A: Math. Teor. 44, 445304

51

Smart thorium and uranium determination exploiting renewable solid-phase extraction applied to environmental samples in a wide concentration range

Avivar, J. ; Ferrer, L. ; Casas, M. ; Cerdà, V.

Analytical and Bioanalytical Chemistry, **400**, 3585-3594

Econophysics review: I. Empirical facts

Chacraborti, Anirban; Muni Toke, Ioane; Patriarca, Marco; Abergel, Frédéric

Quantitative Finance, 11, 7 (991-1012)

Econophysics review: II. Agent-based models

Chacraborti, Anirban; Muni Toke, Ioane; Patriarca, Marco; Abergel, Frédéric

Quantitative Finance, 11, 7 (1013-1041)

5.1 B) OTHER ISI PUBLICATIONS

Synchronization and entrainment of coupled circadian oscillators

Komin, Niko; Murza, Adrian C.; Hernandez-Garcia, Emilio; Toral , Raul.

Interface Focus 1, 167-176

*IFISC

Noise-induced transitions vs. noise-induced phase transitions.

Toral, Raul.

AIP Conference Proceedings 1332, 145-154

Asymmetric charge susceptibility in a mesoscopic interferometer

Lim, J.S.; Sanchez, D.; Lopez, R.

AIP Conference Proceedings 1399, 307-308

5.2 OTHER PUBLICATIONS

Interaction of oscillatory and excitable dissipative solitons in a nonlinear optical cavity.

Gomila, Damià; Jacobo, Adrian; Matías, Manuel A.; Colet, Pere.

Localized States in Physics: Solitons and Patterns (O. Descalzi, M. Clerc, S. Residori & G. Assanto, eds.) 241-264

Viability and Resilience in the Dynamics of Language Competition.

Castelló, Xavier; Vazquez, Federico; Eguíluz, Víctor M.; Loureiro-Porto, Lucía; San Miguel, Maxi; Chapel, Laetitia; Deffuant, Guilaume.

Viability and Resilience of Complex Systems. Concepts, Methods and Case Studies from Ecology and Society. G. Deffuant and N. Gilbert, eds., 39-74

Optical Delay Dynamics and its Applications.

Larger, Laurent; Fischer, Ingo.

The Complexity of Dynamical Systems: A Multi-disciplinary Perspective, Dubbeldam, Johan; Green, Kirk; Lenstra, Daan (ed.) 63-98

Dynamical and Synchronization Properties of Delay-Coupled Lasers.

Gonzalez, Cristina M.; Soriano, Miguel C.; Torrent, M. Carme; Garcia-Ojalvo, Jordi; Fischer, Ingo Nonlinear Laser Dynamics: From Quantum Dots to Cryptography; Kathy Lüdge (Editor), Heinz Georg Schuster (Series Editor) p. 217-244

New Microscopic Connections of Thermodynamics.

Plastino, A; Casas, M.

Thermodynamics (edited by M. Tadashi) pag. 3-22

Delay-Coupled Complex Systems.

Flunkert, Valentin.

Series: Springer Theses, Springer Verlag, ISBN: 78-3-642-20249-0

52

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Semiconductor laser dynamics at IFISC

Colet, P.; Fischer, I.; Mirasso, C:R.; Pérez-Serrano, A.; Scirè, A.

Optica Pura y Aplicada 44, 519-525

Spatial structures in nonlinear optical cavities at IFISC

Colet, P; Gomila, D; Jacobo, A; Zambrini R.

Optica Pura y Aplicada 44, 493-499

Quantum physics with multimode light, electronic waveguides and driven oscillators at IFISC.

Galve, Fernando; Giorgi, Gianluca; López, Rosa; Sánchez, David; Serra, Llorenç; Zambrini, Roberta.

Optica Pura y Aplicada 44, 301-307

5.3 SUMMARY OF PUBLICATIONS 2005-2011

1) Total number of publications in the period 2005-2011: 460 (387 of them in JCR journals).

2) Publications in journals of high impact in 2005-2011 include:

* **Nature: 2**
* **Proc. Nat. Acad. Sci.: 8**
* **Physical Review Letters: 31**
* **Science: 2**

3) Journals with the highest number of publications during 2005-2011:

* P**hysical Review E: 57**
* **Physical Review Letters: 31**
* **Physical Review A: 29**
* **Physical Review B: 22**
* **European Physical Journal: 20**
* **IEEE journals: 20**
* **Europhysics Letters: 11**

4) Total number of publications in JCR journals outside the domain of basic Physics: 87

In addition to 20 publications in IEEE journals and Applied Physics, in the last years IFISC researchers have published in the following journals:

* Geophysical Research Letters, Tellus A, Nonlinear Processes in Geophysics, J. Marine Systems, Estuaries and Coasts, Deep Sea Research, Ocean Modelling, Continental Self Research.

53

* Macromolecules, Macromolecular Theory and Simulations, Biophysical Chemistry, Biopolymers, Biosystems, J. Theoretical Biology, Mathematical Biosciences, Biophysics Journal, Physical Biology, BMC Systems Biology, BMC Evolutionary Biology, Oikos, The American Naturalist, Trends in Ecology and Evolution, Theoretical Ecology, Ecological Complexity, Ecological Modelling, J. Royal Society Interface. Inferface Focus, HFSP Journal, Developmental Dynamics, Marine Ecology Progress Series, PLoS ONE, PLoS Computational Biology, Birth Defects Research, J. of Physiology, Neuroscience Letters, J. Neurophysiology, J. of Neuroscience, Neuroimage, European J. of Pharmaceutical Sciences .

* J. Economic Dynamics and Control, American Journal of Sociology, J. Artificial Societies and Social Simulation, J. of Conflict Resolution, Advances in Complex Systems, PLoS ONE, Quantitative Finance.

54

JOURNALS WITH LARGEST NUMBER OF PUBLICATIONS								
IFISC PUBLICATIONS	2005	2006	2007	2008	2009	2010	2011	TOTAL
Physical Review E	9	10	9	9	4	5	11	57
Physical Review Letters	5	5	6	3	2	4	6	31
Physical Review A	3	3	3	5	7	4	4	29
European Physical Journal	2	0	3	1	7	5	2	20
Physical Review B	1	4	4	1	2	5	5	22
IEEE	3	3	1	1	4	4	4	20
Physica A	3	2	4	0	1	3	3	16
Europhysics Letters	3	0	2	1	1	2	2	11
Non-Physics Journals (excluding IEEE Journals)	5	3	11	8	12	12	16	67

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IFISC PUBLICATIONS 2005-2011

	2005	2006	2007	2008	2009	2010	2011
OTHER PUBLICATIONS	4	9	9	14	18	7	12
JCR JOURNALS	55	45	53	42	56	64	72

55

IFISC PUBLICATIONS 2005-2011

	2005	2006	2007	2008	2009	2010	2011
Physical Review E	9	10	9	9	4	5	11
Physica A and Physica D	4	6	5	0	1	5	3
Physical Review A and Physical Review B	4	7	7	6	9	9	9
Physical Review Letters	5	5	6	3	2	4	6
Non-Physics Journals (Excluding IEEE)	5	3	11	8	12	12	16
IEEE	3	3	1	1	4	4	4

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6. CONFERENCES AND WORKSHOPS

6.1 IFISC WORKSHOPS

http://ifisc.uib-csic.es/workshops

IFISC aims to position itself as a reference place for international workshops defining future trends in the field.
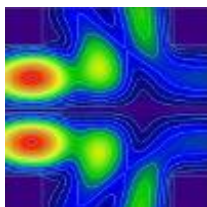
3RD WORKSHOP ON NANOELECTRONICS FOR RESEARCHERS OF THE MEDITERRANEAN AREA
IFISC, Palma de Mallorca, June 10, 2011

56

http://ifisc.uib-csic.es/nanomediterraneo3

Scientific coordination:

Llorenç Serra, Rosa López and David Sánchez, *IFISC, Palma de Mallorca, Spain*

In this meeting invited researchers of the Mediterranean area share their latest research work within the broad topic of nanoelectronics. In the first and second editions, more than 40 participants discussed about graphene, quantum dots, photonic crystals and semiconductor nanowires and nanocrystals.

In this edition, the program included invited international speakers, contributed talks and posters. Given the wide variety of subjects covered by the workshop, oral presentations were expected to be of general interest.

Invited speakers:

Rolf Haug, Leibniz Universität Hannover, *Institute for Solid State Systems*, *Hannover, Germany*
Miguel Ortuño, Universidad de Murcia, *CIOyN*, *Murcia, Spain*
Pablo Ordejón, *Centro de Investigacion en Nanociencia y, Nanotecnologia - CIN2 (CSIC-ICN), Bellaterra, Barcelona, Spain*
Sergio Valenzuela, ICREA / ICN, *CIN2*, *Bellaterra, Spain*
Joaquín Fernández Rossier, *Universidad de Alicante, Alicante, Spain*
José María Escartín, Universitat de Barcelona, *Facultat de Física i Institut de Nanociència i Nanotecnologia*, *Barcelona, Spain*
Markus Büttiker, University of Geneva, *Physics*, *Geneva, Switzerland*
Carlos Untiedt, *Universidad de Alicante, Alicante, Spain*
Alfredo Levy Yeyati, Universidad Autónoma de Madrid, *Facultad de Ciencias*, *Madrid, Spain*
Ana Ballester Caudet, *Universitat Jaume I, Castelló de la Plana, Spain*

57

NONLINEAR SPIN AND CHARGE TRANSPORT THROUGH NANOSCOPIC SYSTEMS

IFISC, Palma de Mallorca, June 6-9, 2011

Supported by the

http://ifisc.uib-csic.es/transport

Scientific Coordination:
Rosa Lopez, *IFISC (CSIC-UIB), Palma de Mallorca, Spain*
David Sanchez, *IFISC (CSIC-UIB), Palma de Mallorca, Spain*
Llorens Serra, *IFISC (CSIC-UIB), Palma de Mallorca, Spain*
Gloria Platero, *ICMM (CSIC), Madrid, Spain*
Pascal Simon, *LPS (Universite Paris-Sud), France*

This meeting aimed at bringing leading experts in mesoscopic transport to contribute to the understanding of novel aspects of the nonlinear regime of electronic and spintronic transport through nanoscale devices. Special focus was given to nonequilibrium effects, time-dependent phenomena and fluctuations in quantum dots, nanowires, carbon nanotubes and hybrid nanostructures.

58

Invited Speakers:

Markus Büttiker, University of Geneva, Switzerland

Lukas Worschech, Würzburg University, Germany

Raúl Toral, IFISC, Palma de Mallorca, Spain

Laurent Saminadayar, Université Joseph Fourier-Néel, France

Gergely Zarand, FU Berlin/TU Budapest, Germany

Sabine Andergassen, RWTH Aachen University, Germany

Yuli Nazarov, TU Delft, Netherlands

Audrey Cottet, CNRS – Ecole Normale Supérieure, France

Hongqi Xu, Lund University, Sweden

Klaus Ensslin, ETH Zurich, Switzerland

Tobias Brandes, TU Berlin, Germany

Joerg P. Kotthaus, LMU Munich, Germany

Antti-Pekka Jauho, Technical University of Denmark, Germany

Maura Sassetti, Universita di Genova, Italy

Guido Burkard, University of Konstanz, Germany

Javier Tejada, Universidad de Barcelona, Spain

Takis Kontos, CNRS, France

Pascal Simon, University Paris Sud, France

Rolf Haug, Leibniz Universität Hannover, Germany

Bogdan Bulka, Polish Academy of Sciences, Poland

Mircea Crisan, University of Cluj, Romania

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Luis Bonilla, Universidad Carlos III de Madrid, Spain

Janine Splettstoesser, RWTH Aachen University, Germany

Gloria Platero, ICMM- CSIC, Madrid, Spain

Jaroslav Fabian, University Regensburg, Germany

Hans W. Schumacher, Physikalisch-Technische Bundesanstatt – PTB, Branunschweig, Germany

Mykhailo Moskalets, NTU Kharkiv, Ukraine

Peter Samuelsson, Lund University, Sweden

Fabio Taddei, NEST, NANO-CNR, Italy

Ramón Aguado, ICMM, CSIC, Madrid, Spain

Jan Martinek, Polish Academy of Sciences, Poland

6.2 IFISC EXPLORATORY WORKSHOPS

NONEQUILIBRIUM FLUCTUATION RELATIONS IN QUANTUM SYSTEMS

IFISC, Palma de Mallorca, September 22, 2011

59

http://ifisc.uib-csic.es/fluctuation

Scientific coordination:

Rosa López, Raúl Toral and Llorenç Serra, IFISC, Palma de Mallorca, Spain

The search of Fluctuation-Dissipation theorems far from equilibrium has been an active area of research for the last decades. A major breakthrough in this topic has been the discovery of exact fluctuation relations which hold for classical systems far from equilibrium. These are collectively referred as *fluctuation theorems.* The aim of the workshop was to bring together people working on classical and quantum systems to share a common frame regarding the aplicability of fluctuation theorems under non-equilibrium conditions in quantum systems.

Invited Speakers:

Ramón Aguado (Instituto de Ciencia de Materiales de Madrid, ICMM, Spain)

Markus Büttiker (Geneva University, Switzerland)

Massimiliano Esposito (Center for Nonlinear Phenomena and Complex Systems, Université Libre de Bruxelles, Belgium)

Christopher Jarzynski (University of Maryland, USA)

K. Kobayashi (Kyoto University, Japan)

Yuri Nazarov (Delft University, Netherlands)

J. M Rodriguez Parrondo (Universidad Complutense de Madrid, Spain)

Miguel Rubí (Universidad de Barcelona, Spain)

*IFISC

Rafael Sánchez (Instituto de Ciencia de Materiales de Madrid, ICMM Spain)

Fernando Sols (Universidad Complutense de Madrid, Spain)

6.3 SCHOOLS

SUMMER SCHOOL ON STATISTICAL PHYSICS OF COMPLEX AND SMALL SYSTEMS

IFISC, Palma de Mallorca, September 12-23, 2011

Sponsored by

http://ifisc.uib-csic.es/gefenol/school

Scientific Coordination:

Juan Manuel R. Parrondo, GISC, Universidad Complutense de Madrid, Spain

Pere Colet, IFISC, CSIC-UIB, Palma de Mallorca, Spain

Fernando Falo, BIFI, Universidad de Zaragoza, Spain

Juan Antonio White, Universidad de Salamanca, Spain

Miguel Ángel Rodríguez, IFCA, CSIC, Universidad de Cantabria, Spain

Statistical Physics born as an attempt to explain thermodynamic properties of systems from its atomic and molecular components has evolved into a solid body of knowledge that allows for the understanding macroscopic collective phenomena. One of the largest success of Statistical Physics has been the development of paradigms, stylized simplified models which capture the essential ingredients, for a wide variety of phenomena. These paradigms have allowed not only the understanding of the systems by themselves but also to realize that many apparently different behaviors are just different manifestations of the same collective phenomena.

The tools developed by Statistical Physics together with Dynamical Systems Theory are of key importance in the understanding of Complex Systems which are characterized by the by emergent and collective phenomena of many interacting units. In particular the understanding of small systems, in which fluctuations are typically large, benefits from Statistical Physics body of knowledge. At the same time small systems fuel the development of new techniques and provide the basis to test predictions (such as for fluctuation and work theorems) at a very deep level.

While the traditional basic body of knowledge of Statistical Physics is well described in textbooks and typically at an undergraduate or master level, the applications to Complex and Small Systems are well beyond the scope of those textbooks. The organization of a Summer School on this topics aims at bridging the gap between the master level and the necessities of PhD students working on these fields.

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The Summer School open *to students world wide* will take place along two weeks in which there will be a total of six courses (three courses each week) on the following subjects:

- First Week:

  - Non-linear Dynamics and Stochastic Processes by *Raúl Toral* (IFISC, CSIC-UIB)

  - Critical Phenomena in Complex Networks by *Yamir Moreno* (BIFI, Universidad de Zaragoza)

  - Granular Media by *Diego Maza* (Universidad de Navarra)

- Second Week:

  - Foundations of Statistical Mechanics: Fluctuations and work theorems in small systems
    by *Christopher Jarzynski* (University of Maryland)

  - Statistical Physics of Cells and Tissues
    by *Frank Jülicher* (Max-Planck-Institute for the Physics of Complex Systems)

  - Statistical Physics in Social and Ecological Systems by *Maxi San Miguel* (IFISC, CSIC-UIB)
    and *Cristóbal López* (IFISC, CSIC-UIB)
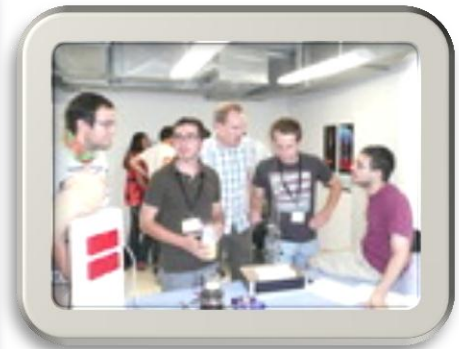
61
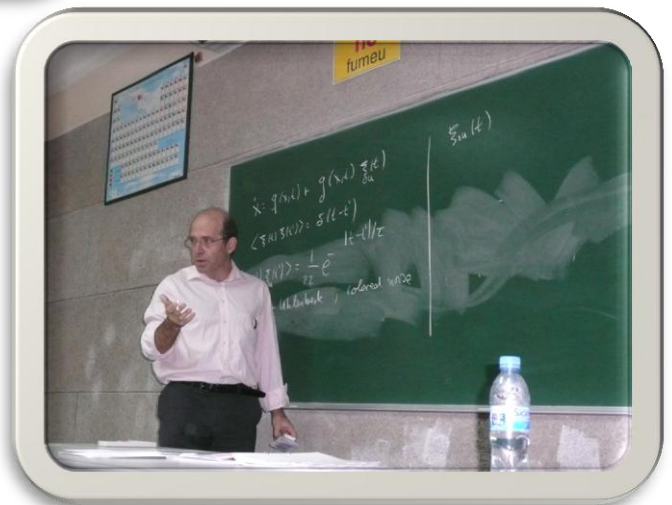
6.4 INVITED TALKS IN CONFERENCES AND WORKSHOPS

Gomila, Damià
From Kerr-cavity to Townes Solitons.
PIERS 2011 Marrakesh Progress In Electromagnetics Research Symposium, Marrakesh
March 20-23

Gomila, Damià
Logical Operations Using Cavity Solitons.
PIERS 2011 Marrakesh Progress In Electromagnetics Research Symposium, Marrakesh
March 20-23

Zambrini,Roberta
Quantum aspects of synhronization.
Fourth Italian Quantum Information Science Conference 2011, Vietri sul Mare, Italy.
April 17 - 20

San Miguel, Maxi
Comprendiendo el Laser.
X Congreso Balear de Urología 2011, Mallorca, Spain
May 7

Hernandez-Garcia, E.
Stretching structures in the ocean surface: transport and biological impacts.
Workshop on Coherent Structures in Dynamical Systems (Lorentz Center, Leiden, Netherlands
May 20

Toral, Raul
Violation of the fluctuation-dissipation relation in disordered systems.
Meeting of Fluctuation Phenomena in Interdisciplinary Science, Barcelona, Spain
May 27 - 29

Toral, Raul
Fluctuation-dissipation relation in a random-field model.
Nonlinear spin and charge transport through nanoscopic systems, Palma de Mallorca, Spain
June 2 - 6

San Miguel, Maxi
Social Consensus as a selforganization phenomenon.
Applications of Self-Organization in Technology, Lakeside Research Days 2011, Klagenfurt, Austria.
July 10 – 15

IFISC

Zambrini, Roberta

Synchronization and quantum correlations of dissipative oscillators.

20th International Laser Physics Workshop (LPHYS11), Sarajevo, Bosnia and Herzegovina

July 11 - 15

San Miguel, Maxi.

Challenges in Complex Systems Science.

FuturICT meeting, Baveno, Italy

September 2 – 7

Matías, Manuel A.

Localized structures in extended media: excitability and computation.

Workshop on Nonlinear Physics and Applications (NOLPA 2011) Joao Pessoa, PB, Brasil

September 5 - 9

Nicola, Ernesto M.

Mixed feedback loops greatly improve the adjustability of genetic oscillators.

Mini-symposium Noise and Oscillations in Biological Systems in Physcon 2011: 5th International Scientific Conference on Physics and Control, Leon, Spain.

September 5 – 8

63

Toral, Raúl

Non-linear Dynamics and Stochastic Processes.

Course of the Summer School on Physics of Complex and Small Systems, Palma de Mallorca, Spain.

September 12 - 16

San Miguel, Maxi; López, Cristóbal

Statistical Physics in social and ecological systems.

Set of 5 lectures given at the Summer School on Statistical Physics and Small Systems, Palma de Mallorca, Spain

September 12 - 23

López, Cristóbal

Three dimensional oceanic Coherent Structures.

Dynamics Days Europe XXXI, Oldenburg, Germany

September 14

López, Cristóbal

Estructuras Lagrangianas Coherentes en el Océano.

Jornada de Complejidad y Nolinealidad en Geociencia, Barcelona, Spain

October 6

San Miguel, Maxi

Update rules and interevent time distributons: Slow ordering vs. nonordering in the Voter Model in complex networks.

Net-Works 2011, El Escorial, Madrid, Spain

October 26-28

Tuzón, Paula

The Aligned Two-Higgs-Doublet model.

III Jornadas CPAN, Barcelona, Spain.

November 2 – 4

San Miguel, Maxi

What can we learn from the voter model?.

Workshop on Statistical Physics and Complex Networks in Socio-Economic Systems, Pottdam, Germany.

November 15 - 17

Colet, Pere

Synchronization: from oscillators to chaotic lasers

Low Cost High Physics and Appropriate Solutions to Real Life Problems in Developing Countries, Yaoundé, Cameroon

December 5- 9

64

Gomila, Damià

Spatially nonlocal bistable media: front propagation and localized structures.

Fifth "Rio de la Plata" Workshop on Laser Dynamics and Nonlinear Photonics Colonia de Sacramento, Uruguay.

December 6-9

Gomila, Damià

From the Townes soliton to Kerr-cavity solitons.

Fifth "Rio de la Plata" Workshop on Laser Dynamics and Nonlinear Photonics Colonia de Sacramento, Uruguay.

December 6-9

San Miguel, Maxi

Modelling Collective Social Dynamics

International Conference on Low Cost High Physics and appropriate solutions to real life problems in developing countries, Yaounde, Cameroon

December 6-8

Mirasso, Claudio

Synchronization in delayed-coupled systems.

Low Cost High Physics and Appropriate Solutions to Real World Problems in Developping Countries, Yaounde, Cameroon.

December 5 – 7

IFISC

Zambrini, Roberta

Quantum aspects of synchronization.

Fifth 'Rio de la Plata' Workshop on Lasers Dynamics and Nonlinear Photonics, Colonia, Uruguay.

December 6 - 9

6.5 SEMINAR TALKS IN OTHER RESEARCH CENTERS

San Miguel, Maxi

Dynamics of Language Competition: Social consensus, bilingual agents and complex networks.

Departamento de Fundamentos de Anlaisis Economico, Universidad del Pais Vasco, Bilbao, Spain

February 4

Toral, Raúl

Macroscopic order induced by microscopic disorder: Role of diversity distribution in excitable systems.

Departament de Fisica i Enginyeria Nuclear, UPC, Terrassa, Spain.

February 11

Zambrini, Roberta

Quantum correlation in multimode optical systems

Department of Physics, Universita della Calabria, Arcavacata di Rende, Cosenza, Italy.

February 20 - 25

65

San Miguel, Maxi

The voter model: A test bed for nonequilibrium collective phenomena.

GISC/Matemáticas Universidad Carlos III de Madrid, Spain

February 21

San Miguel, Maxi

The voter model: A test bed for nonequilibrium collective phenomena.

Centro Atómico Bariloche, Argentina.

March 17

Tugores, Antònia

User Friendly interfaces for grid.

Curso Iniciación a Grid (IAA-CSIC) - Instituto de Astrofísica de Andalucía – Granada, Andalucía, Spain

March 28

San Miguel, Maxi

The voter model: A test bed for nonequilibrium collective phenomena.

Centro de Fisica Teorica y Computacional, Universidad de Lisboa, Portugal.

April 15

IFISC

Toral, Raul

Fluctuation-dissipation relation in disordered systems.

Departamento de física atómica, molecular y nuclear de la universidad Complutense de Madrid, Spain.

May 17

Escalona-Morán, Miguel

Curso sobre dinámica y sincronización en redes biológicas.

Curso de dirigido a estudiantes de doctorado. Realizado en Madrid, Spain

July 4 - 7

Giorgi, Gian Luca

Genuine quantum and classical correlations in multipartite systems.

Instituto per la Microelettronica e Microsistemi, Agrate Brianza, Italy.

October 5

Lafuerza, Luis F.

Role of delay in the stochastic birth and death process.

University of Tokyo, Kaneko Lab, Tokyo, Japan

October 12

San Miguel, M.

Colloquium on Modelling problems of social consensus.

Faculty of Computer Sciences, Universidad Passau, Germany.

October 18

Colet, Pere

Scientific Computing at IFISC. IBM IDataPlex for e-science.

Reunión de computación de altas prestaciones organizada por IBM, Sevilla, Spain

October 26

San Miguel, M

Colloquium on Modelling problems of social consensus.

Institute of Physics, Humboldt University, Berlin, Germany.

November 15

66

6.6 TALKS IN CONFERENCES AND WORKSHOPS

Lafuerza, Luis F.; Toral, Raúl
Analytical solution of a stochastic birth and death process with delayed death.
DPG Spring meeting, Dresden, Germany.
March 13 – 18

Nicola, E.M.
A common mechanism connects diverse reaction-diffusion models of cellular symmetry breaking.
75. General Meeting of the German Physical Society, Dresden, Germany
March 13 - 18

Nicola, E.M.
Global bifurcations in delay differential equations with multiple feedback loops.
75. General Meeting of the German Physical Society, Dresden, Germany
March 13 – 18

Hicke, Konstantin; D'Huys, Otti; Flunkert, Valentin; Schöll, Eckehard; Danckaert, Jan; Fischer, Ingo
Asymmetries in delay coupled systems: Mismatches and their impact on dynamics and synchronization of two coupled lasers.
DPG spring meeting in Dresden, Germany.
March 16

67

López, Cristóbal
Oceanic Coherent Structures, and the behavior of marine ecosystems.
European Geosciences Union General Assembly, Viena, Austria.
April 6

Pérez-Serrano, Antonio; Javaloyes, Julien; Balle, Salvador
Wavelength Multistability in Lasers: The Effect of Spatial Hole Burning.
IONS 9, Salamanca, Spain
April 8

Jacquot, Maxime; Lavrov, Roman; Oden, J. Chembo Yanne Kouomou; Nguimdo; Romain Modeste; Colet, Pere; and Larger, Laurent
Field experiment optical chaos communication @10Gb/s demonstrating electro-optic phase chaos principles.
CLEO-Europe-EQEC 2011, Munich, Germany
May 22 – 26

Pérez-Serrano, Antonio; Javaloyes, Julien; Balle, Salvador
Wavelength Multistability in Ring and Fabry-Pérot Lasers: The Effect of Spatial Hole Burning.
CLEO Europe - EQEC 2011, Munich, Germany
May 24

IFISC

Pérez-Serrano,Antonio; Javaloyes,Julien; Balle, Salvador;

Bichromatic Emission and Coexisting Multimode Dynamics in Ring Lasers.

CLEO Europe - EQEC 2011, Munich, Gemany

May 24

Porte, Xavier; Tiana-Alsina, Jordi; Hicke, Konstantin; Torrent, Carme; García-Ojalvo, Jordi; Fischer, Ingo

Experimental Characterization of Bubbling in Delay-Coupled Semiconductor Lasers.

CLEO Europe - EQEC 2011, Munich, Germany

May 25

Oliver, Neus; Cornelles Soriano, Miguel; Sukow, David; Fischer, Ingo.

Dynamics of semiconductor lasers subjected to polarization rotated feedback and its application for fast random bit generation.

CLEO Europe - EQEC 2011, Munich, Germany

May 26

Giorgi, Gian Luca

Maximally discordant mixed states of two qubits.

18th Central European Workshop on Quantum Optics, Madrid, Spain

May 30 to June 3

68

Lafuerza, Luís F.

Nonuniversal results induced by diversity distribution in coupled excitable systems.

XVII Congreso de Física Estadística FISES'11, Barcelona, Spain

June 2 – 4

Tugores, Antònia; Colet, Pere

Web interface for generic grid jobs, Web4Grid.

IBERGRID 2011, Santander, Spain

June 8 - 10

San Miguel, Maxi

Presentacion Flagship FuturICT.

3rd Workshop Econosociofisica, Burgos, Spain

June 13 – 15

San Miguel, M; Fernandez-Gracia, J; Eguiluz, V.M.

Update rules and interevent time distributions: Implementinghuman activity patterns in a model for consensus formation.

WEHIA 2011: 16th Annual workshop on Economic Herogeneous Interacting Agents, Ancona, Italy.

June 23 – 25

*IFISC

Fernández Gracia, Juan; M. Eguíluz, Víctor; San Miguel, Maxi
Update rules and interevent time distributions: Slow ordering vs. no ordering in the Voter Model.
International conference on complex systems 2011 (ICCS), New England Complex Systems Institute, Boston, UK
June 26 to July 1

San Miguel, M
Presentation of FuturICT-Spain.
Meeting of national representives of FuturICT, Zurich.
June 28

Cornelles Soriano, Miguel; Brunner, Daniel; Appeltant, Lennert; Mirasso, Claudio R.; Fischer, Ingo; Larger, Laurent
A Novel Experimental Approach for Information Processing in Photonics.
International Symposium on Nonlinear Theory and its Applications 2011, Kobe, Japan
September 4 – 7

Kato, Hideyuki; Ikeguchi, Tohru
Local Cortical Design of Voltage-Based STDP.
International Symposium on Nonlinear Theory and its Applications 2011, Kobe, Japan
September 4 - 7

Javaloyes, J.; Perez-Serrano, A.; Balle, S.
Bifurcation analysis of traveling wave models.
NUSOD 2011, Rome, Italy
September 7

Fleurquin, Pablo
The project based on air-traffic network analysis
Summer School on Statistical Physics and Small Systems , Palma de Mallorca, Spain
September 12 – 23

Martínez García, Ricardo
Temporal Griffiths Phases
Summer School on Statistical Physics and Small Systems, Palma de Mallorca, Spain
September 12 – 23

Lafuerza, Luis F.
Role of delay in the stochastic breath and death process
Summer School on Statistical Physics and Small Systems, Palma de Mallorca, Spain
September 12 – 23

69

*IFISC

Carro Patiño, Adrián

Sustainable development and spatial inhomogeneities: the role of transportation cost

Summer School on Statistical Physics and Small Systems , Palma de Mallorca, Spain

September 12 – 23

Martínez-Llinàs, Jade; Colet, Pere

Synchronization in delayed mutually coupled optoelectronic oscillators.

Summer School on Statistical Physics of Complex and Small Systems, Palma de Mallorca, Spain.

September 13

Eguíluz, Víctor M.

Update rules and interevent time distributions: slow ordering vs no ordering in the voter model.

Complex Dynamics of Human Interactions, Satellite Meeting of European Conference of Complex Systems ECCS'11, Vienna, Austria

September 14

Eguíluz, Víctor M.

Threshold learning dynamics in social networks.

Cultural and Opinion Dynamics: Modelling, Experiments and Challenges for the Future, Satellite Meeting of European Conference of Complex Systems ECCS'11, Vienna, Austria

September 15

70

Tugores, Antònia; Colet, Pere

Web interface for generic grid jobs, Web4Grid.

EGI Technical Forum 2011, Lyon, France

September 19 – 23

Zambrini, Roberta

Quantum correlations and mutual synchronization.

Madrid Workshop on Open Quantum Systems, MWOQS-2011, Madrid, Spain .

October 3 – 5

San Miguel, Maxi

Selforganization. Modelling problems of social consensus.

Emergence and Nonlinearity in Physics, Natural and Social Systems, NUI Galway, Ireland.

October 21 - 23

Martínez García, Ricardo; López, Cristóbal.

The effect of temporal disorder on Complex Systems.

I Christmas PhD Students meeting, La Laguna, Canarias

December 22 - 23

6.7 POSTER PRESENTATIONS

Lim, Jong Soo; López, Rosa; Sánchez, David; Martinek, Jan
Nonlinear fluctuation relations in a spin diode system.
Nanospain 2011-IMAGINENANO, Bilbao, Spain.
April 11 – 14

Tugores, Antònia; Colet, Pere
Web interface for generic grid jobs.
EGI User Forum, Vilnius, Lithuania.
April 11 – 15

Lim, Jong Soo; López, Rosa; Sánchez, David; Martinek, Jan
Nonlinear fluctuation relations in a spin diode system.
Nonlinear spin and charge transport through nanoscopic systems, Palma de Mallorca, Spain.
May 6 - 9

Hernández-Carrasco, Ismael.; López, Cristobal.; Hernández-García, Emilio; Turiel, Antonio.
Horizontal Stirring in the global ocean.
Coherent Structures in Dynamical Systems, Leiden, Netherlands
May 16 – 20

Bettencourt, J.; López, C.; Hernández-García, E.
Coherent Structures in Three Dimensional Flows.
Coherent Structures in Dynamical Systems, Leiden, Netherlands
May 16 – 20

Jacobo, A.; Colet, P.; Bochove,E.J.; Braiman, Y.; Aceves, A.B.; Deiterding, R.; Miller, C.A.; Rhodes, C.; Shakir S.A.
Dynamics of passively phased fiber laser arrays.
CLEO-Europe-EQEC 2011, Munich, Germany
May 22 - 26

Konstantin Hicke, Jordi Tiana-Alsina, Xavier Porte, Jordi Garcia-Ojalvo and Ingo Fischer
Zero-lag synchronization of two delay-coupled lasers: The role of detuning.
CLEO/EQEC 2011, Munich, Germany.
May 26

Colet, Pere; Nguimdo, Romain Modeste; Larger, Laurent; Pesquera Luís
Digital key chaos-communication systems with delay time concealment.
CLEO-Europe-EQEC 2011, Munich, Germany
May 22 - 26

71

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Cornelles Soriano, Miguel; Zunino, Luciano; Larger, Laurent; Fischer, Ingo; Mirasso, Claudio R.;

Discriminating Chaotic and Stochastic Dynamics in an Optoelectronic Oscillator with Delayed Feedback.

CLEO/Europe-EQEC 2011, Munich, Germany

May 22 – 26

Nguimdo, Romain Modeste

Digital key chaos-communication system time delay concealment.

Lasers and Electro-Optics (CLEO), Munich, Germany

May 22 - 26

Cerdà, J.J; Sánchez, P.; Sintes, T.

First steps in the study of unconventional magnetic fluids.

FisEs2011, XVII Congreso de Fisica Estadistica, Barcelona, Spain

June 2 – 4

C. Soriano, Miguel; Zunino, Luciano; Fischer, Ingo; Mirasso, Claudio R.;

Time delay identification using permutation information theory quantifiers.

FisEs2011, XVII Congreso de Fisica Estadistica, Barcelona, Spain

June 2 – 4

Fernández-Gracia, Juan; Eguíluz, Víctor M.; San Miguel, Maxi

Interevent time distributions and the voter model.

FisEs2011, XVII Congreso de Fisica Estadistica, Barcelona, Spain

June 2 – 4

Hernández-García, E.; Keller-Schmidt, S.; Tugrul, M.; Eguíluz, V.M.; Klemm, K.

An Age-Dependent Branching Model for Macroevolution.

FisEs2011, XVII Congreso de Fisica Estadistica, Barcelona, Spain

June 2 -4

Jacobo, A.; Colet, P.; Bochove,E.J.; Braiman, Y.; Aceves, A.B.; Deiterding, R.; Miller, C.A.; Rhodes, C.; Shakir S.A.

Dynamics of passively phased fiber laser arrays.

FisEs2011, XVII Congreso de Fisica Estadistica, Barcelona, Spain

June 2 – 4

Lafuerza, Luis; Toral, Raul

Analytical solution of a stochastic birth and death process including delay.

FisEs2011, XVII Congreso de Fisica Estadistica, Barcelona, Spain

June 2 – 4

72

IFISC

Martínez García, Ricardo; Vázquez, Federico; Bonachela Juan A.; López Cristóbal; Munoz, M.A.

Temporal Griffiths Phases.

FisEs2011, XVII Congreso de Fisica Estadistica, Barcelona, Spain

June 2 – 4

Martínez-Llinàs, Jade; Colet, Pere

Synchronization in delayed mutually coupled optoelectronic oscillators.

FisEs2011, XVII Congreso de Fisica Estadistica, Barcelona, Spain

June 2 - 4

Matías, Manuel A.; Gomila, Damià; Colet, Pere; Gelens, Lendert; Van der Sande, Guy

Nonlocality-induced front interaction enhancement.

FisEs2011, XVII Congreso de Fisica Estadistica, Barcelona, Spain

June 2 – 4

Nguimdo, Romain Modeste Nguimdo; Colet, Pere; Larger, Laurent; Pesquera, Luís

Digital key for chaos communication performing time delay concealment.

FisEs2011, XVII Congreso de Fisica Estadistica, Barcelona, Spain

June 2 - 4

Nicola, Ernesto M.; Khuc Trong, P.; Goehring, N.W.; Grill, S.W.

How do cells break their symmetry? A simple reaction-diffusion mechanism for cell polarization.

FisEs2011, XVII Congreso de Fisica Estadistica, Barcelona, Spain

June 2 - 4

Paulau, P.V.; Gomila, D.; Colet, Pere; Malomed, B.; Firth, W.J.

Self-localized states in one and two dimensions in lasers with external feedback.

FisEs 2011 XVII Congreso de Física Estadística Barcelona, Spain.

June 2 – 4

Sánchez, P.; Cerdà, J. J.; Sintes, T; Ballenegger, V.; Holm, C.

Magneto-rheological properties of stiff magnetic filaments near an adsorbing surface.

FisEs2011, XVII Congreso de Fisica Estadistica, Barcelona, Spain

June 2 - 4

Vaz Martins, Teresa; Toral, Raul

Divide and conquer.

FisEs2011, XVII Congreso de Fisica Estadistica, Barcelona, Spain

June 2 - 6

Lafuerza, Luis; Toral, Raul

On the Gaussian approximation for master equations.

FisEs2011, XVII Congreso de Fisica Estadistica, Barcelona, Spain

June 2 – 6

73

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Tugores, María Antonia; Colet, Pere

Analysis of Xen efficiency in Grid environments for scientific computing.

5th Iberian grid infrastructure conference, IBERGRID 2011, Santander, Spain

June 8 -10

Hernández-Carrasco, I.; Rossi, V.; López, C.; Hernández-García, E.; Sudre, J.; Garçon, V.

Simulation of plankton dynamics in the turbulent Benguela upwelling system.

AMEMR III: 3rd Advances in Marine Ecosystem Modelling Research Symposium, Plymouth, UK

June 27 – 30

Lafuerza, Luis F.; Toral, Raúl

Role of delay in the stochastic birth and death process.

Engineering of Chemical Complexity, BCCS Berlin, Germany

July 4 - 8

Barceló, Francisco; Porte, Xavier; Prada, Laura

A bayesian model of human sensorimotor control during task switching.

XI International Conference on Cognitive Neuroscience, ICON XI, Palma de Mallorca, Spain

September 25 – 29

Fleurquin, Pablo

Analysis of air transportation using complex networks.

The First SESAR Innovation Days, Toulouse, France

November 29 to December 1

Lafuerza, Luis F.; Toral, Raúl

Role of delay in the stochastic birth and death process.

International Symposium on Complex Systems, University of Tokyo, Japan.

December 2

74

CONFERENCES AND WORKSHOPS 2005-2011

	2005	2006	2007	2008	2009	2010	2011	TOTAL
INVITED TALKS	28	27	22	21	20	22	25	165
ORAL TALKS	22	26	35	37	45	28	32	225
POSTERS	20	45	29	35	42	32	31	234
TOTAL	70	98	86	93	107	82	88	624

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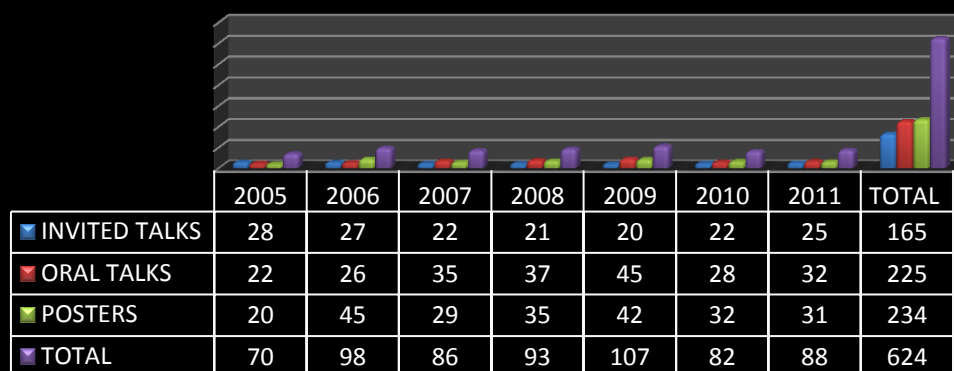
6.8 SCIENTIFIC COMMITTEES AND ORGANIZATION OF CONFERENCES AND WORKSHOPS

Toral, Raul
Member of the scientific committee.
FISES 2011, Barcelona, Spain
June 2 - 4

López, R., Sánchez, D., Serra, L.; Platero, G.; Simon, P.
Organization of the Conference: Nonlinear spin and charge transport through nanoscopic systems.
IFISC, Palma de Mallorca, Spain
June 6 - 9

López, R.; Sánchez, D.; Serra, L.
Organization of the 3rd Workshop on nanoelectronics for researchers of the mediterranean area.
IFISC, Palma de Mallorca, Spain
June 10

Colet, Pere
Main scientific organizer of the Summer School on Physics of Complex and Small Systems.
IFISC, Palma de Mallorca, Spain
September 12 – 23

Hernández-García, Emilio
Convener of the Minisymposium on Lagrangian Coherent Structures in Fluids.
Dynamics Days Europe XXI, Oldenburg, Germany
September 11 – 16

López, R.; Toral, R.; Serra, L.
Organization of the Conference Nonequilibrium fluctuation relations in quantum systems.
IFISC, Palma de Mallorca, Spain
September 22 - 24

San Miguel, M
Spokerman of FutruICT-Spain: Consortium meeting and public presentation of the project.
Barcelona, Spain
October 5 – 7

San Miguel, M
Colloquium on Modelling problems of social consensus.
Institute of Physics, Humboldt University, Berlin, Germany.
November 15

75

San Miguel, M

Organization of COST meeting on Multi-scale Mobility in Human Networks.

IFISC, Palma de Mallorca, Spain

December 19 - 20

76

7. OTHER ACTIVITIES

7.1 MASTER THESIS

Updatig rules and the voter model

Juan Fernández Gracia (Supervisors: Maxi San Miguel and Víctor M. Eguíluz)

February 3

Experimental Study of the Synchronization of Two Delay-Coupled Semiconductor Lasers

Xavier Porte Parera (Supervisors: Ingo Fischer, Miguel C. Soriano and Claudio Mirasso)

July 4

Quantum aspects of synchronization of coupled harmonic oscillators in presence of dissipation

Gonzalo Manzano Paule (Supervisor: Roberta Zambrini)

September 12

The effect of temporal disorder on Complex Systems: Temporal Griffiths Phases

Ricardo Martínez García (Supervisors: Cristóbal López and Federico Vázquez)

September 21

7.2 PhD THESIS

A Complex Network Approach to Phylogenetic Trees: From Genes to the Tree of Life

E. Alejandro Herrada (Supervisors: Emilio Hernández-García, Víctor M. Eguíluz and Carlos M. Duarte)

February 4

Transitions at the mesoscale: morphological changes in thin solid films and magnetic filaments.

Pedro A.Sánchez (Supervisors: Oreste Piro and Tomás Sintes)

February 25

Applications of semiconductor lasers with optical feedback: novel concepts for tunable lasers and chaos control

Ermakov, Ilya (Supervisors: Claudio Mirasso, Jan Danckaert and Stefano Beri)

March 31

77

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Transport features of electron and hole quantum wires with Rashba coupling

M. Magdalena Gelabert (Supervisor: Llorenç Serra)

September 2

Chaos and Synchronization in Opto-electronic Devices with Delayed Feedback

Romain Modeste Nguimdo (Supervisor: Pere Colet)

September 27

Modeling Semiconductor Ring Lasers

Antonio Pérez-Serrano (Supervisors: Alessandro Scirè and Salvador Balle)

November 5

7.3 RESEARCH STAYS IN OTHER CENTERS

Cornelles Soriano, Miguel

Instituto de Física de Cantabria, Santander, Spain.

November 27 to December 2

Fernández Gracia, Juan

Harvard Medical School, Boston.

May 3 to July 29

Gollo, Leonardo L.

Institute of Cognitive Science -University of Osnabrueck, Germany.

May 15 - 31

Kato, Hideyuki

Saitama University, Japan

August 22 to September 2 and November 28 to December 8

Konstantin Hicke

DONLL group @ UPC, Barcelona, campus Terrassa, Spain.

November 14 - 18

Lafuerza, Luis F.

The University of Tokyo, Graduate School of Arts and Sciences, department of basic science, Japan.

September 26 to December 20

Martinez Garcia, Ricardo.

Max Planck Institute for the Physics of Complex Systems, Dresden, Germany.

July 1 - 31

Miguel A. Escalona-Morán

Institute of Cognitive Sciences, Osnabruck, Germany.

November 9 - 19

Oliver, Neus

Tsing-Hua University, Laser Dynamics Lab, Hsinchu, Taiwan.

July 1 to August 30

San Miguel, M

Laboratory of Computational Engineering, Alto University, Helsinki, Finland.

August 1 - 10

Zambrini, Roberta

Institute for Theoretical Physics, University of Ulm, Ulm, Germany.

June 15 - 18

Zambrini, Roberta

Department of Physics, Universita della Calabria, Arcavacata di Rende, Cosenza, Italy.

February 20 - 25

79

7.4 MEMBERS OF EDITORIAL BOARD OF SCIENTIFIC JOURNALS

San Miguel M

Member of the Editorial Board of European Physical Journal B- Complex Systems.

January 1, 2010 to December 31, 2011

Eguíluz, Víctor M.

Associate Editor of Advances in Complex Systems

January 1, 2009 to December 31, 2012

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7.5 POSTGRADUATE COURSES

Cooperative and critical phenomena. Applications

Victor M. Eguíluz, Maxi San Miguel, Tomàs Sintes

Master in Physics, Universitat de les Illes Balears.

Nonlinear dynamical systems and spatio temporal complexity

Pere Colet, Emilio Hernández-García, Claudio Mirasso

Master in Physics, Universitat de les Illes Balears.

Stochastic simulation methods

Pere Colet, Raúl Toral

Master in Physics, Universitat de les Illes Balears.

Introduction to statistical and nonlinear physics

Pere Colet, Cristóbal López, Maxi San Miguel, Tomàs Sintes

Master in Physics, Universitat de les Illes Balears.

Computational Models of Social Evolution

Víctor M. Eguíluz

Master in Cognition and Human Evolution, Universitat de les Illes Balears

Nonlinear phenomena in biology

Claudio Mirasso, Cristóbal López, Tomàs Sintes, Raúl Toral

Master in Physics, Universitat de les Illes Balears.

Introduction to quantum systems

David Sánchez, Rosa López

Master in Physics, Universitat de les Illes Balears

Electronic properties of nanostructures

Llorenç Serra Crespí, David Sánchez, Rosa López

Master in Physics, Universitat de les Illes Balear

80

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8. OUTREACH ACTIVITIES

8.1 CONFERENCE SERIES

CONFERENCE SERIES "EXPLORING BOUNDARIES BETWEEN DISCIPLINES IV"

The conference series covers different aspects of complex systems and cross-disciplinary studies. The science of the 20th century has been characterized by a progressive specialization that has enabled major advances in specific areas. The great challenge of the 21st century is to explore the boundaries between different areas of knowledge and to develop an interdisciplinary approach, thus enabling the understanding of complex phenomena.

The Conference Series "Exploring boundaries between disciplines IV" took place in June in CaixaForum under the title: "**Research and cooking: the science flavor**". These conferences invited to walk through the modern cuisine by a scientific mind and sensory activity. Cooking uses science, specially physics and chemistry, to become creative, stimulating and astonishing. Neuroscience helps us to understand how we can feel the flavor, the smell and texture features.

81

The **Programme** was:

* **Cooking Science: Edible matter, solid matter, liquid or gaseous**
  By Dr. Josep Perelló Palou, Fundamental Physics Departament and Arts Santa Mónica, University of Barcelona. June 8.

* **What is cooking in your brain?**
  By Dr. Luis Martínez Otero, CSIC, Institute of Neuroscience, University Miguel Hernández, Alicante. June 15.

* **Soft-condensed matter and cooking**
  By Mr. Pere Castells, head of the Gastronomic and Scientific Investigation Departament of Alicia Foundation (Nutrition and Science)". June 22

IFISC organized the Conference Series with the collaboration of La Caixa (*Obra Social*), the University of the Balearic Islands (*Vicerectorat de projecció Universitària)* and the Conselleria d'Innovació, Interior i Justícia *(Direcció General de Recerca, Desenvolupament Tecnològic i Innovació).*

The programme of the UOM aims at disseminating science and culture to the small towns of Mallorca. IFISC approaches the citizens older than 50 years by training and disseminating culture and knowledge. The talks were given by Prof. Claudio Mirasso, Full Professor at UIB and researcher of IFISC, on May 23 in Son Servera and on June 3rd in Petra. The title of the talk was: Laser, an invention that has changed our lifes.

8.2 PROGRAM TO PROMOTE CARREERS IN SCIENCE

POTU (Programa de Orientación y Transición a la Universidad) is a programme created by the UIB to guide students on the transition from the secondary school to the University. IFISC participated with different activities that took place at our seminar room and at the IFISC labs.

DemoLab Program:

This activity was carried out by IFISC in collaboration with the Science Faculty of UIB, *"*Consell de Direcció*"* of UIB*, "*Conselleria d'Educació i Cultura*"* of the Balearic Government and the *"*Obra Social*"* of Sa Nostra*.* It consisted at two parts: one experimental activity that took place in the lab and other visiting the different facilities of IFISC. IFISC was the only Scientific Research Institute of the UIB joining this project with the activity: Approximation to the Physics of Complex Systems.

82

<u>**Research within UIB-IFISC**</u>:

This is a program of science dissemination also coordinated by POTU. IFISC organized two workshops for high school students:

- Light, laser and its technological applications
- Complex Systems: chaos and synchronization

Besides these two workshops, there was a visit to the labs (photonics, computation and electronics) and outreaching talks. The High Schools that participated were: IES Josep Maria Llompart, IES Son Pacs, IES Son Ferrer, Colegio Montesión, IES Binissalem, Colegio Madre Alberta, IES Arxiduc LLuís Salvador and IES Madina Mayurqa.

The working team of IFISC was composed by: Dr. Emilio Hernández-García, deputy of IFISC, Dr. Miguel Cornelles, Mr. Juan Fernández, Mrs. Jade Martínez, Mrs. Neus Oliver, Mr. Xavier Porte, Mr. Konstantin Hicke, Mr. Rubén Tolosa and Mr. Josep Canyelles.

Participants: more than 20 teachers and 400 students.

83

8.3 PARTICIPATION IN THE BALEARIC SCIENCE AND TECHNOLOGY WEEK (SCIT11)

The Balearic Science and Technology Week is organized yearly by the Goverment of the Balearic Islands. IFISC contributions in 2011 included:

- ✳ CON-CIENCIARTE Programme
- ✳ Introductory Course in Cross-disciplinary Physics and Complex Systems
- ✳ Open Days

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CON-CIENCIARTE PROGRAMME

This programme was organized by IFISC with the collaboration of UIB, CSIC and the Modern and Contemporary Art Museum "Es Baluard". All the acitivities took place in a special room of the museum, called "Aljub", an old well (cistern) from 17th century.

The main subject was the laser. There was an introductory workshop to laser-graffitti and a talk about the effects of laser in our lifes on November 19. And there was a contest and a laser exhibition on November 26. It is well known the connection between current art and new technologies and the laser in this case was the connection between art and science. The participants of the workshop and contest created graffitti with laser that were projected on the old walls of the "aljub". Science was the topic for the graffitti. The designers and optical artists were Javier Siquier and Pep Homar who also explained to the public how to use the tools and the computer programme.

Number of participants: 300

Scientific laser projection of a neuron

An introductory conference was given by Prof. Claudio Mirasso, researcher of IFISC.

84

The participants of the contest had five minutes to create the images. The activity was free and open to the public. The public could also visit the exhibition that explained the different laser applications and fundamentals. The exhibition included real devices like a gas laser, semiconductor lasers and optical materials from the IFISC photonics laboratory. The aim was also to highlight some investigations and projects related to the laser, that are being carried out at IFISC, for instance the PHOCUS project.

85

INTRODUCTORY COURSE ON CROSS-DISCIPLINARY PHYSICS AND COMPLEX SYSTEMS

The course aimed at introducing basic concepts like complexity, chaos or emergent behaviour through different examples related to disciplines like biology, sociology or ecology. Through the course, the students gained insight into how the statistics rules show the behavior of social-networks users, or how mass media can make us change our opinions. It also helped to understand the relevant role that neuronal synchronization plays in helping us to see and recognize our environment, or to visualize the shape of the tree of life or how to codify information on a chaotic beam to improve transmission security.

The course was coordinated by Prof. Claudio Mirasso. It was scheduled in two days (Nov. 14-15) in the IFISC seminar room and many of IFISC members collaborated: Dr. Juan José Cerdá, Dr. Pere Colet, Dr. Miguel Cornelles, Dr. Victor Eguíluz, Dr. Emilio Hernández, Dr. Cristóbal López, Dr. Tomas Sintes and Dr. Raúl Toral.

Participants: 45

IFISC (UIB-CSIC) OPEN DAYS (November 4, 11, 18, 24 and December 2)

OPTICS WORKSHOP: "Discovering rainbow´s secrets"

This workshop was organized by IFISC-OSA Student Chapter, a PhD student´s group from IFISC connected to the Optical Society of America (OSA). Research tasks of IFISC activity were presented, its installations were visited and a workshop about the light properties was offered. The latter included an introduction of basic concepts in optics by means of the rainbow concept. Through different experiments and activities the student learnt how the rainbow develops.


The aim was to approach optics to the students of last years of high school, promote scientific vocation and open communication ways between high school teachers and IFISC researchers. All the activities were held in the IFISC seminar room and labs by Dr. Emilio Hernández, Dr. Roberta Zambrini, Mr. Rubén Tolosa, Mr. Pep Canyelles, Dr. Miguel Cornelles, Mrs. Neus Oliver and Mr. Xavier Porte.

86

The high schools that participated were: Colegio Agora Portals (Calvià), Colegio Jesus Maria (Palma), Colegio Beato Ramon Llull (Palma), Colegio Aula Balear. (Palma), Colegio El liceo (Palma), Colegio Josep Font i Trias (Palma), IES Politécnico (Palma), IES Ses Estacions (Palma) and IES Santa Ponça (Calvià). Participated aroung 250 students.

Sponsors and collaborators were: Conselleria d'Educació, Cultura i Universitats, Direcció General d'Universitats, Recerca i Transferència del Coneixement, Desenvolupament Tecnològic i Innovació, Govern de les Illes Balears, Universitat de les Illes Balears (UIB), Optical Society of America (OSA) and Consejo Superior de Investigaciones Científicas (CSIC).
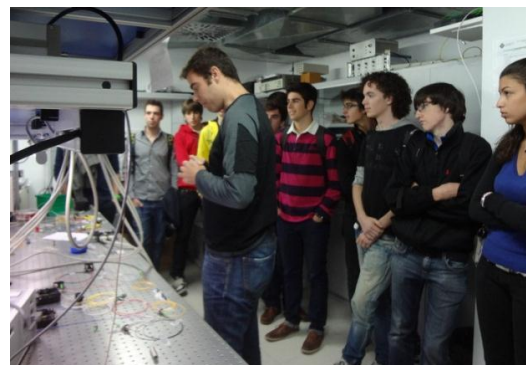
8.4 2011 SCIENCE FAIR OF THE BALEARIC ISLANDS

The Science Fair is an event organized by the Government of the Balearic Islands to promote scientific and technological awareness in the society. IFISC participated with two stands in the event that took place in Ibiza (April 7-9).

Stand 1: IFISC AND COMPLEX SYSTEMS The stand aimed at becoming a place of learning and fun. Through experiences, workshops and exhibitions, concepts of chaos theory and complexity were introduced. The interactivity, manipulation and experimentation were present in all the activities, divided into three areas of interest: chaos, patterns and synchronization.

Stand 2: 50 YEARS OF LASER with the collaboration of the "Associació de Físics de les Illes Balears" (ASFIB): The aim of this stand was to approach laser to the general public by workshops and interactive activities. There was also an exhibition of real devices: semiconductor lasers and gas lasers.

This outreach project was organized with the collaboration of FECYT (*Fundación Española para la Ciencia y la Tecnología*) and the *Conselleria d'Innovació, Interior i Justícia* of the Government of the Balearic Islands.

87
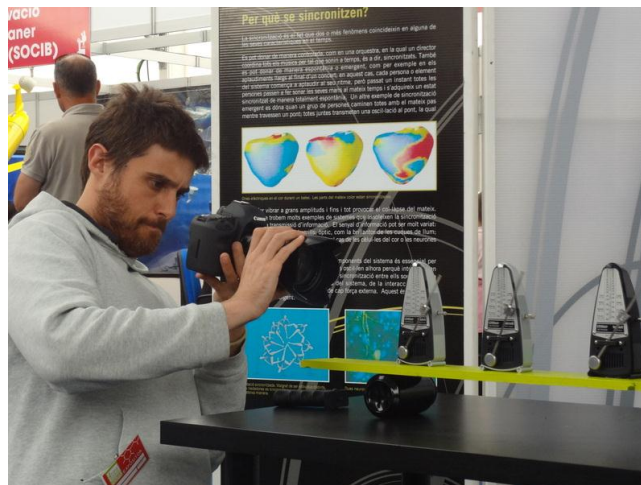
8.5 OSA-IFISC ACTIVITIES

In 2011, IFISC and the students of the Optical Society of America (OSA) Chapter organized the II Solar Car Race on June 11th, joining the World Envinroment Day. This edition took place in Plaza París, Palma. 50 participants with different profiles attended: young kids, high-school students, university students, parents, etc.. A solar kit, with the basic elements for building a mini solar car was provided to all the participants when they registered. In addition to the prize to the winner, creativity, application of scientific and technical knowledge, recycling, aesthetics, etc. were also rewarded.

88

This activity was organized in collaboration with the Envirement Department of "Consell de Mallorca" and the "Ajuntament de Palma".

8.6 PRESS AND MEDIA

PRESS NEWS

* **El profesor Maxi San Miguel obtiene la Medalla de la Real Sociedad Española de Física.**
  SINC. Servicio de Información y Noticias Científicas.
  Januar y12

* **Models Matemàtics per analitzar els Sistemes Neuronals.**
  Nota de prensa UIB.
  January 13

* **Enhorabona Maxi!.**
  Diario de Mallorca. Suplemento Universitat.
  January 13

*IFISC

* **Models matemàtics per analitzar els sistemes neuronals.**
  Diario de Mallorca. Suplement Universitat.
  January 13

* **Models matemàtics per analitzar els sistemes neuronals.**
  Reportaje de la UIB, sobre la tesis del Dr. Antonio Pérez.
  January 13

* **Hören und sehen dank chaotischer Laser.**
  Mallorca Magazin.
  January 21

* **La revista "Nature" es fa ressó de la recerca de l'investigador Fernando Galve, de l'IFISC (CSIC-UIB), sobre l'observació de fenómens quàntics a temperatura ambient.**
  Diario de Mallorca. Suplement Universitat.
  January 21

* **Wikipedia information flow analysis reveals the scale-free architecture of the semantic Space.**
  Nota SINC.
  January 27

89

* **Una cosa es saber que algo pasa y otra muy diferente es saber por qué.**
  Entrevista a Maxi San Miguel. El mundo- el dia de Baleares(B@leopolis).
  February 8

* **Maximino San Miguel, guardonat per la Societat de Física.**
  EnllaçUIB. Revista de la Universitat de les Illes Balears-Número XVI. Segona època. 1r semestre de 2011.
  February 14

* **Españoles a Alemania, alemanes a la UIB.**
  Diario de Mallorca, suplemento "La Almudaina".
  March 6

* **B@leópolis, un viaje al año 2025.**
  El mundo-El Día de Baleares.
  March 8

✱ **Un estudi dels investigadors de l'IFISC (CSIC-UIB) conclou que l'hipocamp és el responsable de coordinar la nostra percepció visual amb els records que tenim d'allò que percebem.**
Nota de Prensa UIB.
March 9

✱ **Els grups d'investigació mostren el fruit de la recerca de la UIB.**
Diario de Mallorca, suplement Universitat.
March 10

✱ **El hipocampo es el responsable de coordinar visión y recuerdos, según un estudio.**
adn. es.
March 13

✱ **El Hipocampo es el responsable de coordinar visión y recuerdos.**
Prensa FECYT.
March 14

✱ **El hipocampo es el responsable de coordinar visión y recuerdos.**
La razon. es.
March 14

✱ **Un estudio apunta a que el hipocampo coordina visión y recuerdos.**
La voz de Galicia. es.
March 14

✱ **El hipocampo es el responsable de coordinar visión y recuerdos.**
Ultima Hora.
March 14

✱ **El hipocampo coordina la visión.**
La Razón.
March 14

✱ **El cerebro de los recuerdos y la visión.**
Levante-emv. com.
March 17

✱ **Científics de l'IFISC conclouen com interpretam i reconeixem l'entorn.**
Diario de Mallorca. Suplement Universitat.
March 17

90

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* **Hipocampo, riendas de la memoria.**
  El Mundo. El Día de Baleares. Suplemento B@leopolis.
  March 29

* **Del DemoLab al Demotec.**
  Diario de Mallorca. Suplemento "Diari a l'escola".
  March 30

* **EL CSIC en la Fira de la Ciència de Ibiza.**
  Nota CSIC.
  April 6

* **"Modelamos la transmisión de información en redes sociales".**
  El Mundo. Suplemento B@aleopilis.
  April 26

* **La tesis de Juan Carlos González estudia el impacto de los medios de comunicación de masas en la formación de opinión y consenso desde la perespectiva de la Física Estadísitica.**
  Reportaje de tesis. UIB.
  May 2

* **La tesis de Juan Carlos González estudia el impacto de los medios de comunicación de masas en la formación de opinión y consenso desde la perespectiva de la Física Estadísitica.**
  Nota de prensa UIB.
  May 2

* **L'impacte del mass media en la formació d'opinió i consens.**
  Diario de Mallorca, Suplement Universitat.
  May 5

* **Balears fa ciència, d'IB3, entrevistarà a Maxi San Miguel.**
  Diari de Balears.
  May 7

* **Un estudio de la UIB constata que se va hacia el bipartidismo.**
  Diario de Mallorca.
  May 13

* **Dos investigadores del IFISC realizan un estudio sobre el comportamiento del votante.**
  Ultima Hora.
  May 13

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✳ **La UIB investiga com es comporten els votants.**
Diari de Balears.
May 13

✳ **Entrega del Premio de la Real Sociedad Española de Física al profesor Maxi San Miguel, director del IFISC (CSIC-UIB).**
Nota CSIC.
May 16

✳ **Los "premios de la Física" española 2010, de la RSEF y la Fundación BBVA, reconocen a San Miguel Ruibal y Tello Leon por ser pioneros y referentes en sus áreas.**
Nota de prensa de la Fundación BBVA.
May 16

✳ **Galardón para el Físico de las Redes Sociales.**
El Mundo.
May 16

✳ **LLiurament del premi Medalla de la Reial Societat Espanyola de Física al profesor Maxi San Miguel, director de l'IFISC.**
Nota de prensa UIB.
May 17

✳ **Investigación e innovación en los premios de Física 2010.**
Diario ABC.
May 17

✳ **La Real Sociedad Española de Física premia a Maximino San Miguel.**
El País.
May 18

✳ **UIB. Medalla de la Sociedad de Física.**
Diari de Balears.
May 18

✳ **Un experto sostiene que las campañas "agresivas" convencen a menos ciudadanos que las sutiles.**
El economista. es.
May 19

✳ **Un experto sostiene que las campañas "agresivas" convencen menos.**
Nota Europapress.
May 19

92

✳ **Un experto sostiene que las campañas "agresivas" convencen a menos ciudadanos que las sutiles.**
20minutos. es.
May 19

✳ **Un experto sostiene que las campañas "agresivas" convencen a menos ciudadanos que las sutiles.**
La Gaceta de Baleares.
May 20

✳ **Fenómenos Sociales bajo la Lupa de la Física.**
El Mundo.
May 22

✳ **II Carrera de mini coches Solares. IFISC-OSA Student Chapter.**
Anuncio de prensa
June 1

✳ **L'IFISC (CSIC-UIB) organitza el congrés Nonlinear Spin and Charge Transport through Nanoscopic Systems.**
Nota de prensa UIB.
June 3

93

✳ **II Carrera de mini coches Solares. IFISC-OSA Student Chapter.**
Nota SINC.
June 3

✳ **L'IFISC (CSIC-UIB) organitza el cicle de Conferències Explorant Les Fronteres entre els Sabers. El sabor de la ciència.**
Nota de prensa UIB.
June 7

✳ **Ciclo de Conferencias Exploranto lasFronteras entre los saberes.**
Nota CSIC.
June 7

✳ **Cuando la gastronomía se encuentra con las Ciencias.**
El Mundo. Suplemento B@leópolis.
June 7

✳ **Ciclo de Conferencias Investiga y cocina. el Sabor de la Ciencia IFISC (UIB-CSIC).**
Nota SINC.
June 8

IFISC

* **Congrés de l'IFISC a la Universitat.**
  Diario de Mallorca.
  June 9

* **Carrera de mini-coches solares.**
  Nota CSIC.
  June 9

* **L'IFISC-OSA Student Chapter organitza la segona cursa de cotxes Solars per Celebrar el Dia Mundial del Medi ambient.**
  Nota de prensa UIB.
  June 10

* **Carrera de coches Solares en Plaza Paris.**
  Diario de Mallorca.
  June 12

* **Los magos nos llevan dos mil años de ventaja.**
  El Mundo. Suplemento B@leopolis.
  June 21

* **Los elementos del entorno son los que determinan una buena cocina.**
  Diario de Mallorca.
  June 23

* **Els investigadors de l'IFISC (CSIC-UIB) proposen un sistema de comunicacions caòtiques amb clau digital per millorar la seguretat en eles comunicacions.**
  Nota de Prensa UIB.
  July 29

* **L´IFISC (CSIC-UIB) coordina el node espanyol del projecte FuturICT per crear un observatori de la crisi i les dinàmiques socials amb les noves tecnologies i la supercomputació.**
  Nota de Premsa UIB.
  August 11

* **L´IFISC (CSIC-UIB) organitza la primera edició de l´Escola d´Estiu de Física Estadística i Sistemes Complexos i Petits.**
  Nota de Premsa UIB.
  September 9

94

IFISC

* **IFISC Escola d´Estiu de física estadística i sistemes.**
  Diari de Balears.
  September 10

* **L´IFISC (CSIC-UIB) avança en el disseny de sistemes de computació basats en dispositius senzills.**
  Nota de Prensa UIB.
  September 14

* **Láseres acoplados para imitar al cerebro.**
  Fisica Hoy.
  September 14

* **Láseres acoplados para imitar al cerebro.**
  Noticias de la Ciencia y la Tecnología.
  September 15

* **El físico sin límites.**
  Revista Paradores.
  October 3

* **El acelerador del conocimiento.**
  El Mundo. Suplemento Baleópolis.
  October 4

* **El projecte europeu FuturICT es presenta públicament a Barcelona.**
  Nota de Premsa UIB.
  October 5

* **L´IFISC coordina el projecte europeu FuturICT.**
  Diario de Mallorca. Suplement Universitat.
  October 6

* **L´IFISC fa nous avenços en el projecte europeu PHOCUS.**
  Diario de Mallorca. Suplement Universitat.
  October 6

* **La ciència i la tecnologia de la UIB, a l´abast de la societat.**
  Diario de Mallorca. Suplement Universitat.
  October 13

95

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✻ **Nova proposta per millorar la seguretat en les comunicacions.**
Diario de Mallorca. Suplement Universitat.
October 13

✻ **La seguridad del caos.**
El Mundo. Baleopolis.
October 18

✻ **Proyectos con futuro. La Semana de la Ciencia celebra el año Internacional de la Química.**
El Mundo. Suplemento Baleópolis.
October 18

✻ **Universistat. Crecer en tiempo de crisis.**
Ultima Hora. Brisas.
October 22

✻ **El acelerador del conocimiento FuturICT se pone en marcha.**
Sinc.
October 26

✻ **La Fundació per a la Recerca de Flandes (FWO) premia la tesi doctoral de Lendert Gelens, defensada a la UIB.**
Nota de Premsa UIB.
October 27

✻ **Arranca la Semana de la Ciencia con más de 260 actividades del CSIC.**
Nota de Prensa del CSIC.
November 4

✻ **Agenda. Taller d´introducció als grafits amb làser.**
Diario de Mallorca. Suplemento Universitat.
November 10

✻ **Grafiteros del láser.**
El Mundo. Baleares. Cultura.
November 18

✻ **Es Baluard acoge hoy un taller de grafiti con láser.**
ABC.
November 21

96

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✳ **Comienza la Setmana de la Ciència i la Tecnologia.**
Diario de Mallorca.
November 21

✳ **Veinte institutos y empresas integran el primer acelerador de conocimiento español.**
El Nuevo Lunes. Suplemento Ciencia y Técnica.
November 21

✳ **La revolución en miniatura.**
El Mundo. Suplemnto Baleópolis.
December 13

✳ **Los entresijos de Twitter.**
El Mundo. Suplemento Baleópolis.
December 20

RADIO and TV

✳ **Interview to Dr. Paolo Masucci.**
Ona Mallorca Radio. "Això no és Sicilia" show.
January 26

97

✳ **Interview to Prof. Maxi San Miguel.**
"Això no és Sicilia" show. Ona Mallorca Radio. RTVMallorca.
February 2

✳ **Interview to Prof. Maxi San Miguel.**
TV Mallorca. "De Nit amb Neus Albis" show.
February 15

✳ **Interview to Prof. Claudio Mirasso.**
14.30 h News, TV Mallorca.
March 2

✳ **Phocus project outreaching video**
Video done by UIB Press for TV Mallorca. "Respostes" show.
April 1

✳ **Interview to Prof. Claudio Mirasso for the Science Fair in Ibiza.**
Balears fa Ciència show. IB3 Ràdio.
April 9

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✳ **Interview to Dr. Juan Carlos González Avella.**
Ona Mallorca Ràdio. "Això no és Sicilia" show.
May 3

✳ **Interview to Prof. Maxi San Miguel.**
IB3 Ràdio," Balears fa Ciència" show.
May 7

✳ **Interview to Dr. Juan Carlos González Avella.**
IB3 Ràdio, "Balears fa Ciència" show.
May 7

✳ **Interview to Dr. Juan Carlos González Avella.**
Cadena Ser Radio. "A vivir que son dos Días" show.
May 7

✳ **Second Solar Car Race. IFISC-OSA Student Chapter.**
Cuña de Radio.
June 1

✳ **Interview to Neus Oliver for the organization of the Second Solar Car Race.**
IB3 TV, "Bon dia Balears" show.
June 2

98

✳ **Interview to Prof. Claudio Mirasso for the Conference Series "Explorant les Fronteres entre els Sabers IV".**
IB3 Ràdio. "Balears fa Ciencia" show.
June 4

✳ **Interview to Dr. Roberta Zambrini for the Second Solar Car Race IFSC-OSA student Chapter.**
IB3 Ràdio. "Balears fa ciència" show.
June 4

✳ **Transport congress**
RTVE Balear News
June 7

✳ **Transport congress**
RTVE 24 hours Channel
June 7

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* **Interview to Dr. Josep Perelló for his participation in the Conference Series "Explorant les Fronteres entre els Sabers IV".**
  IB3 Ràdio. "Balears fa Ciència" show.
  June 11

* **Second Solar Car Race. IFISC-OSA Student Chapter.**
  IB3 TV. News.
  June 11

* **Interview to Dr. Josep Perelló for his participation in the Conference Series "Explorant les Fronteres entre els Sabers IV".**
  Cadena SER Mallorca. "A vivir que son dos días" show.
  June 12

* **Interview to Xavier Porte for the Second Solar Car Race IFSC-OSA student Chapter.**
  IB3 Ràdio. "Hem de parlar" show.
  June 16

* **Interview to Mr. Pere Castells for his participation in the Conferenc e Series "Explorant les Fronteres entre els Sabers IV".**
  IB3 Ràdio. "Balears fa ciència" show.
  June 25

99

* **Interview to Prof. Maxi San Miguel for the project FuturICT.**
  Radio Asturias.
  October 7

* **Interview to Prof. Maxi San Miguel for the project FuturICT.**
  Catalunya Ràdio.
  October 18

* **Interview to Prof. Claudio Mirasso for the Laser Graffiti contest at Es Baluard.**
  IB3 Radio.
  November 19

* "**Es Baluard acull avui un taller de grafit amb làser".**
  IB3 Notícies.
  November 19

* **Laser Graffiti contest and exhibition at Es Baluard.**
  TV de Mallorca.
  November 26

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