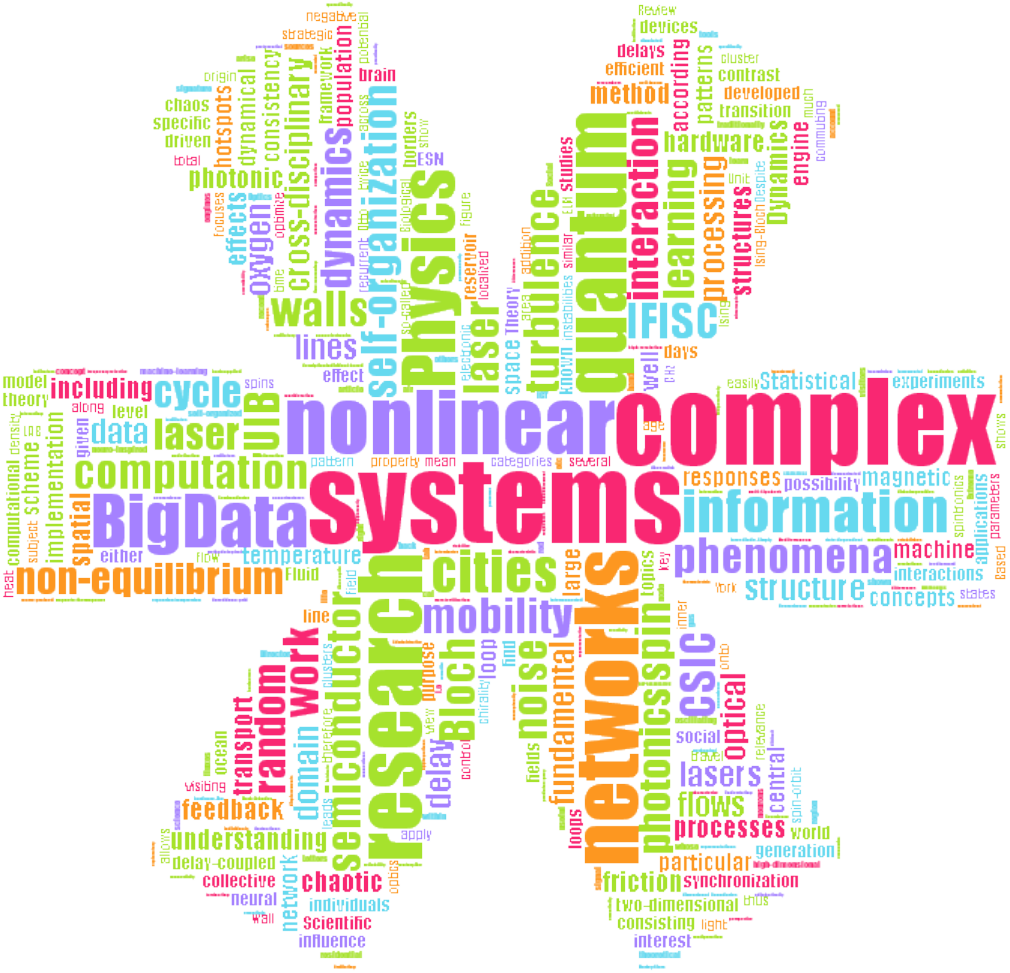
IFISC ANNUAL REPORT 2016



IFISC

Universitat de les Illes Balears

CSIC

Institute for Cross-Disciplinary Physics and Complex Systems

CSIC
Consejo Superior de Investigaciones Científicas

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PRESENTATION AND RESEARCH LINES

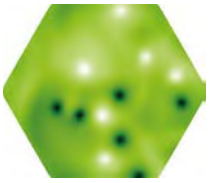
IFISC (Institute for Cross-Disciplinary Physics and Complex Systems) is a joint research institute of the University of the Balearic Islands (**UIB**) and the Spanish National Research Council (**CSIC**) created in 2007 building upon the former Cross-Disciplinary Physics Department of the Mediterranean Institute for Advance Studies (**IMEDEA**) dating from 1995. Its mission is to develop *Cross-Disciplinary* and *Strategic Research* in Complex Systems following the established scientific approach of physicists.

By *Cross-Disciplinary* Research we mean the transfer of knowledge, concepts and methods to create bridges among traditional disciplines. By *Strategic Research* we mean focusing on advanced studies in emerging strategic fields with a strong potential impact, avoiding the "basic-applied" polarization.

IFISC´s working environment is a complex system in itself seeking coherence and integration from diversity, interaction, scientific dialog, transversal structures, bridge building and selforganization. Research is therefore organized in terms of research lines, rather than research groups.

1.1 IFISC RESEARCH LINES

Emerging from a back-bone transversal research line of exploratory nature on Complex Systems, Statistical and Nonlinear Physics, there are 5 research lines of transfer of knowledge in the interface with other disciplines (Quantum Technologies, Information and Communication Technologies, Earth Sciences, Life Sciences and Social Sciences):



Complex systems. Nonlinear and statistical physics

Complex systems are characterized by emergent and collective phenomena of many interacting units. Fundamental understanding of these systems and the Micro-Macro paradigm, comes from Statistical Physics together with Computational Methods, Quantum Mechanics, Information Theory, Complex Networks, Big Data analysis and the Theory of Dynamical Systems, which includes the study of nonlinear dynamics, chaos and the effect of fluctuations and random events on system's evolution.

This research line of exploratory nature is the backbone of IFISC: We develop new concepts and methods for the study of Complex Systems, and we analyze generic phenomena such as synchronization, phase transitions, nonequilibrium instabilities, spatiotemporal pattern formation, and the dynamics and evolution of complex networks.

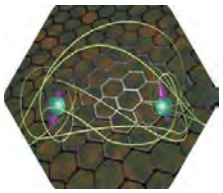
COMPUTING LAB

The Computing Services Unit manages IFISC computational resources. Those include two IBM iDataPlex clusters for intensive calculations and data management. The Nuredduna cluster with 48 dx360M4 nodes and a total of 576 computational cores and 1.8TB of RAM is configured for High Throughput Computing (HTC) and used for intensive calculations.

The other cluster with 68 dx360M2 nodes and a total of 544 cores, 1TB of RAM and 96 TB of raw storage is used for grid computing, virtualization and data management. Big data handling is performed by using a MongoDb a non-relational data base which is distributed over 10 shards, each consisting of 3 servers replicating the data. Other computational tools at IFISC include several servers for specific tasks and a fully integrated network consisting on about 50 desktops and a similar number of laptops.

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 and systems for the study and demonstration of chaos and bifurcation phenomena (including Autonomous Boolean Networks, Chua, Mackey-Glass and Rössler oscillators), chaos synchronization, and the study of networks with delay-coupled nonlinear elements for information processing.



Transport and Information in Quantum Systems

Understanding of Quantum Complex Phenomena plays a key role in the development of Quantum Technologies identified as one of the most strategic areas for future research and innovation.

In this research line, we are devoted to questions related to quantum transport for charge(nanoelectronics), spin (spintronics), energy (thermoelectrics) and information (quantum correlations), with a particular focus on nanostructures. Moreover, we investigate decoherence effects in complex environments, explore quantum probing, and emergent phenomena such as synchronization, with a focus on quantum correlations and thermodynamics and their impact on information processing.

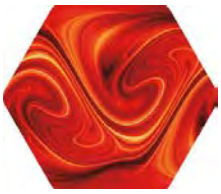
Nonlinear Photonics

Within this line of research, we explore complex phenomena in photonics,filling the gap between Modern Photonic Sources and Functional Complex Systems. Our Nonlinear Photonics Lab, working alongside a strong theoretical team, aims to gain an in-depth understanding of complex phenomena and to provide novel solutions from communication to information processing, transferring knowledge to the Information and Communication Technologies (ICT) domain.

We study nonlinear and spatio-temporal emission properties of semiconductor lasers, implement optical complex networks based on lasers, advance characterization techniques, and demonstrate the utility of optical complexity for information technologies including encryption and ultra-fast neuro-inspired photonic information processing.

PHOTONICS LAB

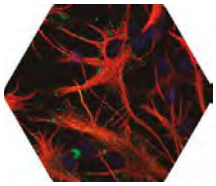
Since 2009 a Photonics Laboratory of highest standards has been established. The lab is equipped with a Faraday cage for electromagnetic shielding and houses several experiments of delay-coupled lasers and laser arrays, optoelectronic systems, as well as photonic information processing systems using the latest technology to characterize the optical 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 heterodyne techniques and different spectrometers. Finally, optical and electrical laser modulation can be implemented with arbitrary waveforms up to 9.6 GHz bandwidth.



Nonlinear dynamics in fluids

Fluid flows occur in a huge range of scales, from blood capillaries to atmospheric weather systems. The way in which substances are transported has large impacts, e.g., on how pollutants arrive to distant locations, plankton meets the nutrients, or into the whole heat balance involved in the Earth climate.

At IFISC we develop techniques useful to characterize transport in fluids, quantify stretching, mixing, and connectivity between parts of a fluid. We apply them to geophysical settings, mostly in the ocean. We develop tools to identify barriers to the transport of oxygen and nutrients, evaluate the ecological implications of larval transport, or track the origins of water vapor masses transported by atmospheric winds.



Biocomplexity

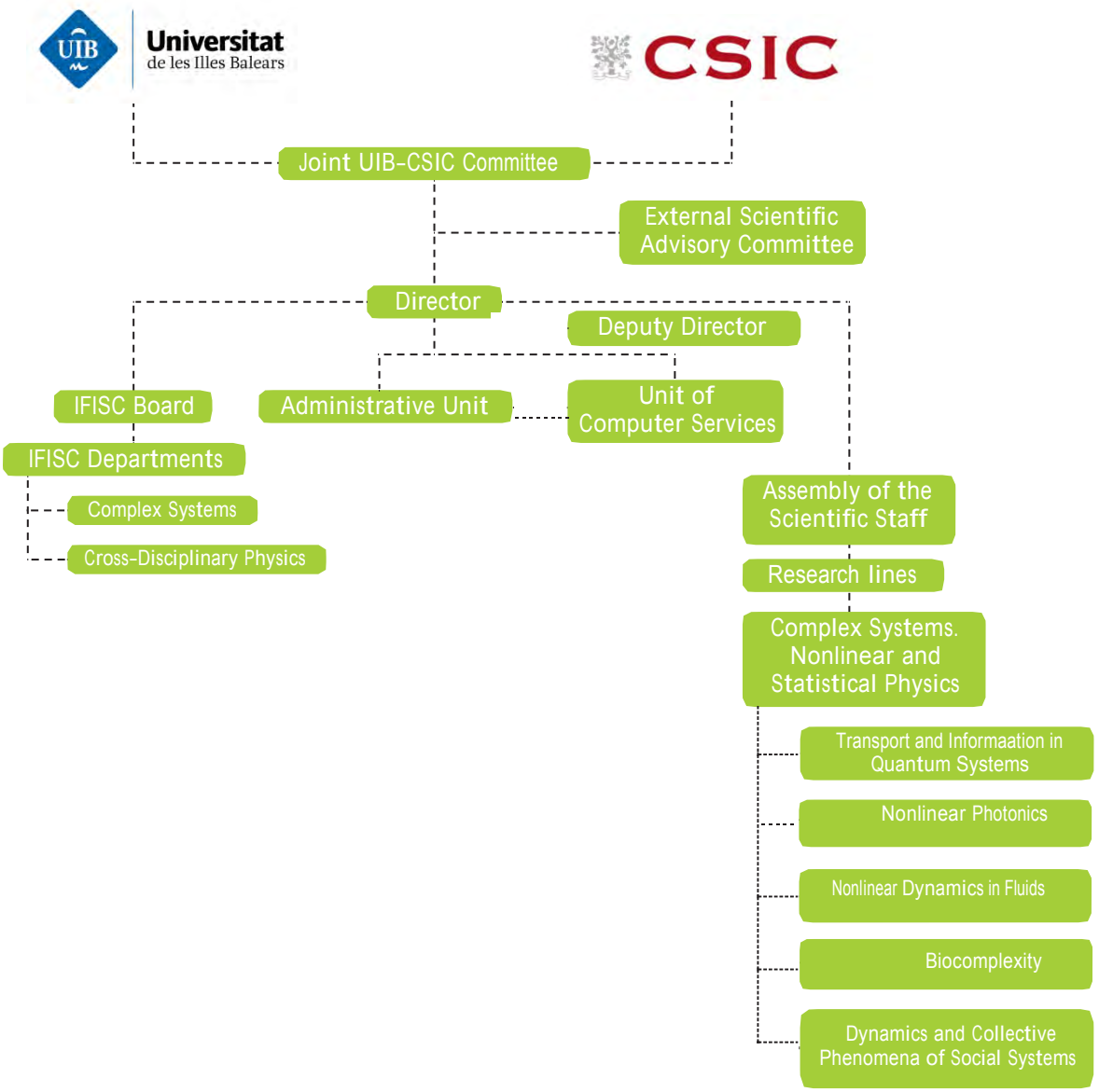
Living systems are the paradigm of complex systems, with nonlinear interactions occurring at all spatial and temporal scales, from molecules and genes to the planetary scales defining the global biosphere. One of the focus of our research is the ecological level where we consider modes of organisms' mobility and their interplay with food search, disease propagation, spatial patterning, and also with the basic ecological interactions such as competition, predation, or mutualism. Another focal issue in our studies is understanding brain function, which requires approaches at scales that range from individual neurons to the whole brain. At the neuronal level, we concentrate on aspects of synchronization between interacting neuronal populations and study how information flows. With the help of statistical measures, we analyze experimental data and compare the results with neuronal models.

Dynamics and collective phenomena of social systems

Social systems are prominent examples of Complex Systems, emergent phenomena, and the Micro-Macro paradigm. Today's main societal changes and challenges arise from the feedback loop that entangles society with Information and Communication Technologies (ICT) as a prototypical socio-technical system.

In this line of research we develop new concepts, tools and models aiming at identifying generic mechanisms underlying collective phenomena in these systems. We do this in the framework of Computational Social Sciences with the use of Game Theory, Statistical Physics, Agent Based Models, Complex Networks Theory, and Big Data analysis. We study phenomena such as opinion formation, cooperation, cultural conflicts, language competition and social learning. Moreover, we focus on ICT data-driven research on socio-technical systems, addressing problems of human mobility, transportation, tourism, city science, epidemics, and energy consumption.

1.2 STRUCTURE CHART



1.3 SOME REPRESENTATIVE RESEARCH RESULTS OF 2016

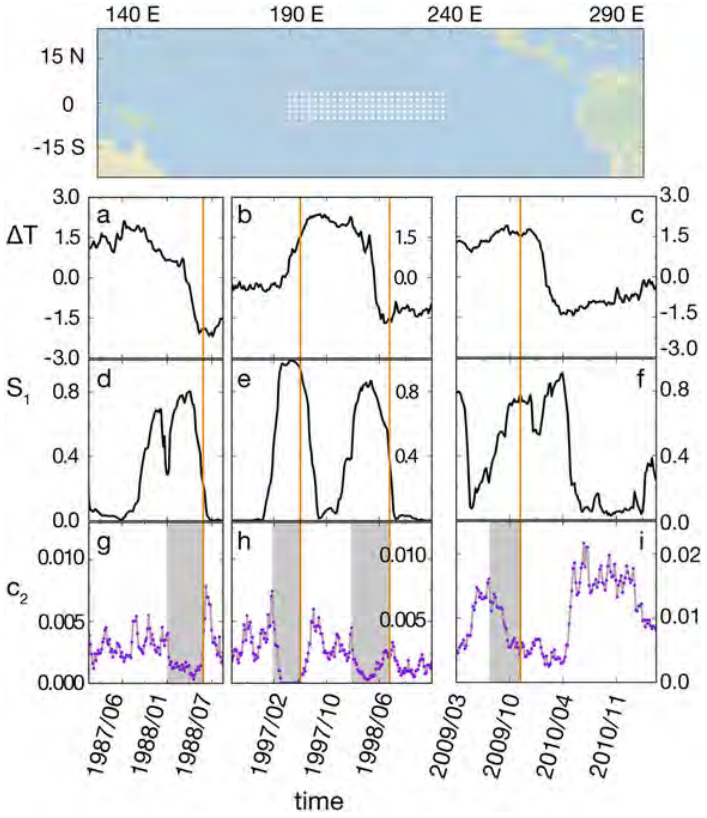
In the following we summarize some research results published during 2016. They are representative of the different research lines and thus illustrate the range of topics studied at IFISC

Percolation-based precursors of transitions in extended systems

Rodriguez-Mendez, Victor; Eguiluz, Victor M.; Hernandez-Garcia, Emilio; Ramasco, Jose J.
Scientific Reports 6, 29552 (1-10)

Abrupt changes, tipping points, catastrophic shifts, points of no return and related transition phenomena are ubiquitous in the dynamics of complex systems. Finding early indicators of the arrival of these phenomena, i.e. precursor signals, is fundamental in many areas of science such as ecology, electrical engineering, physiology or climate. However, obtaining warnings of an approaching transition well in advance remains an elusive task.

We have studied generic spatially extended dynamical systems in terms of the so-called *functional network* approach, i.e. we compute correlations between the time-series of the dynamic variables at each pair of spatial sites, and consider the two sites as linked if their correlation is high enough. This methodology has already given important insights in fields such as neurosciences or climate. Our new contribution here has been to develop new indicators in terms of a percolation process: We monitor how links are added to the functional network when different types of dynamical transitions are approached when changing a system parameter. This is an indication of increasing correlations close to the transition point. It happens that a percolation transition, i.e. the build-up of a large connected component out of disconnected pieces, happens way before the dynamic transition, and then quantities characterizing percolation (for example the size of the largest component, or the number of clusters of a given size), serve as indicators or early warnings of the approaching dynamical change. We illustrate the generality and versatility of our percolation-based framework with model systems experiencing different types of bifurcations and with Sea Surface Temperature time series associated to El Niño phenomenon.



The equatorial Pacific, ocean temperature anomalies (ΔT), the size of the network largest cluster (S_1) and the number of clusters of size two (c_2). These last quantities undergo recognizable behavior long before El Niño (temperature maxima) and La Niña (minima) events (indicated by vertical lines).

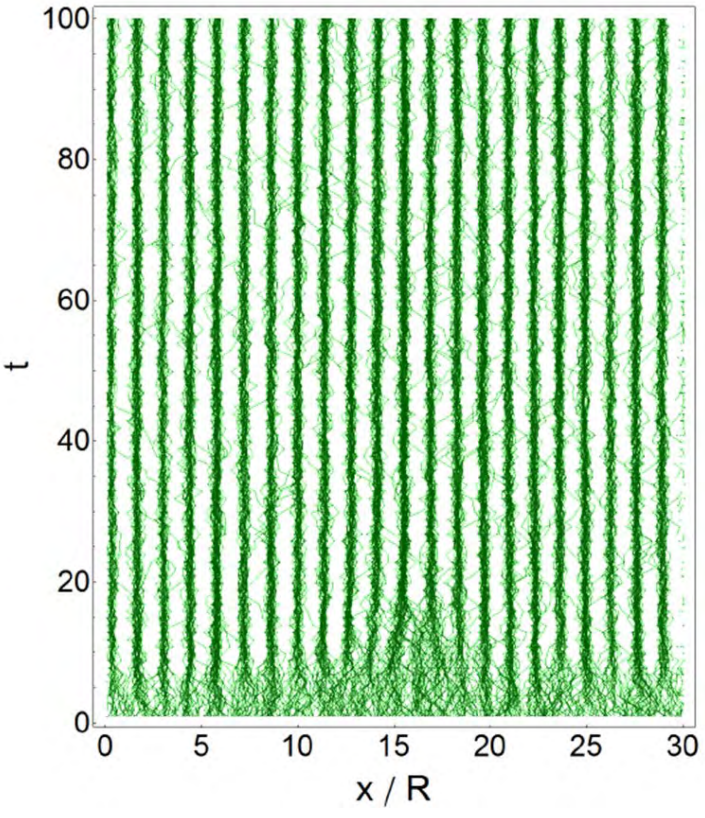
Pattern formation with repulsive soft-core interactions: Discrete particle dynamics and Dean-Kawasaki equation

Delfau, Jean-Baptiste; Ollivier, Hélène; López, Cristóbal; Blasius, Bernd; Hernández-García, Emilio
Physical Review E 94, 042120 (1-13)

It is difficult to imagine a set of particles that repel each other and yet cluster as if attracted. But this is what happens in certain circumstances. For example, in some colloidal solutions that interact with effectively repulsive forces (and without effects of excluded volume) there is a transition of the liquid-solid type where the unit cell is occupied not by one but by an aggregate of particles, forming what is called Cluster crystal, that is, a spatially periodic distribution of groups of particles. And not only do these structures appear in the context of soft matter, they have also been observed in models of organisms, which joint together even though they compete for the same resources.

In this work we have explained this phenomenon of aggregation mediated by repulsion. We have analised a set of Brownian (point) particles which interact with a soft repulsive two-body potential. By means of analytical and numerical studies, both in one and two dimensions, we explain the appearence of cluster crystal by the existence of a balance of repulsive forces: particles within a given cluster tend to separate, but this tendency is compensated by the forces with which neighboring aggregates repel those same particles. In addition, we have identified the conditions for that forces need to have for the appearence of this phenomenon. Essentially, repulsion has to be weak enought when particles are very close. This is the case for many effective potentials in colloidal and polymer solutions.

Given the generality of the results, we expect that these results and conclusions may apply to very diverse systems, particularly in the context of population dynamics where the formation of structures of this type is widespread and misunderstood. Who knows if through these patterns you could identify the forces with which insects, bacteria, or other organisms interact.



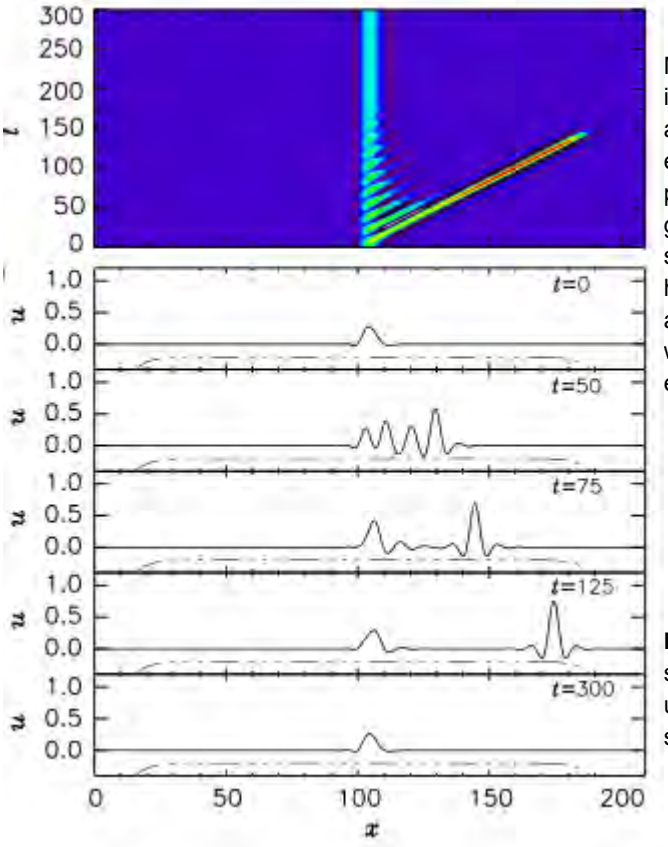
Trajectories of repelling particles forming a cluster crystal in one spatial dimension. Space is in the horizontal, and time in the vertical.

Competition between drift and spatial defects leads to oscillatory and excitable dynamics of dissipative solitons

Parra Rivas, P.; Gomila, D.; Matías, M.A.; Colet, P.; Gelens, L.
Physical Review E 93, 012211

Localized structures (LS), or dissipative solitons (DS), a kind of *mesas*, i.e. localized elevations over a flat background, can exhibit excitable behavior. Namely, a localized perturbation to a flat background that exceeds a certain threshold is able to recreate transiently a DS. This opens new avenues of possible applications. Beyond the proposed use of LSs as storage of bits of information, one could use these objects to process information, and as such in recent work we have shown that it is possible to build logical gates with excitable LS. Thus, they can mimic the operation of neuronal systems, that also use excitability to process incoming information.

Excitable behavior of LSs is, however, not widespread. In the present work we fully characterize a generic mechanism that very generally induces excitable behavior on systems exhibiting only stationary LS [Phys. Rev. Lett. **110**, 064103 (2013)]. It consists on adding a defect on a selected spatial location, and furthermore a mechanism that induces drift on the system. The physical mechanism is the competition between the action of the defect, that allows LS to pin, and the drift that pulls them away. Thus, one may have a static LS, while if the drift is strong enough it leads to a train of solitons or soliton tap (a source of traveling LS). One also finds a regime in which transient excitation leads to a single transient LS that is pulled by the drift, i.e, excitable behavior (see Figure 1).



Moreover, one finds the types of excitability found in both integrator and resonator neurons (technically known as Types I and II, respectively). The latter type had not been found in excitable LS before. Detailed bifurcation analyses have been performed with two different kind of defects in a well studied gradient system: the Swift-Hohenberg equation (SHE), intensively studied as a paradigm of pattern formation and LSs. The defect has been introduced in two different ways: as a constant term added to the SHE and as a defect in the linear term of the SHE, which yields different bifurcation scenarios. The Figure shows an example of Type II excitability.

Figure. An excitable excursion exhibiting Type II excitability is shown. The color panel shows the contour plot of the real field, u, while several spatial profiles u(x) for fixed values of time are shown below.

Non-Markovianity hinders Quantum Darwinism

Galve, Fernando; Zambrini, Roberta; Maniscalco, Sabrina
Scientific Reports **6**, 19607

The emergence of a classical world from an underlying quantum reality by “natural” selection of some preferred properties has been dubbed Quantum Darwinism. In spite of the great success of quantum mechanics at explaining microscopic phenomena and the fact that it should be able to describe physical behaviour at all scales, the macroscopic objects of our every day life are instead compatible with classical physics. How is that so?

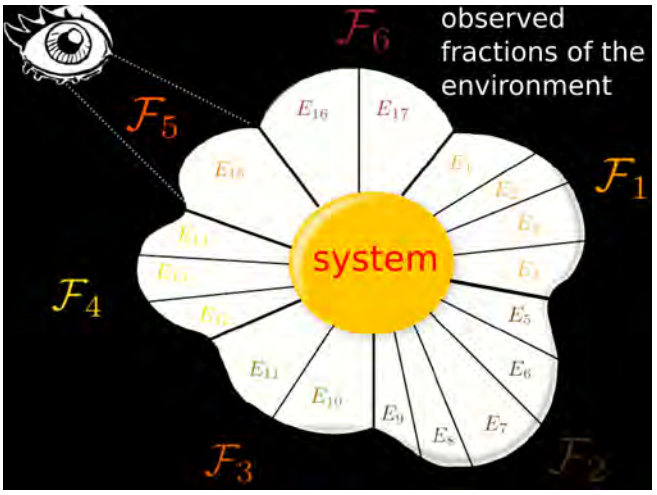
Decoherence theory has been for many years the paradigm for the emergence of classical properties from a quantum reality: interaction with a huge hot environment destroys the fragile information about superpositions, leading to the survival of only some classical states, the so-called pointer states. Quantum Darwinism is a further step along this chain of reasoning: an observer can in fact only access the properties of a given object by indirect interaction with the environment surrounding that object (an oscilloscope, a bubble chamber, light being scattered away, etc.). Such environment is thus an active player in the process, which amplifies only the classical properties to macroscopic proportions which can be accessed by macroscopic observers. It is thus the object of Quantum Darwinism to explain why some properties, and not others, are amplified and turned into the classical description of the observed system.

Recent results have shown that the massive amplification of information is generic in any quantum dynamics of sufficiently many degrees of freedom, however it is not clear which specific kind of interactions is able to fulfill the more stringent condition of resulting in *classical* amplified states.

Being these classical states an absolute minority in the total space of states, it seems as if nature had conspired to design physical interactions as to create the resulting classical reality we are used to.

It is thus legitimate to wonder which kind of interactions are capable of such immense feat?

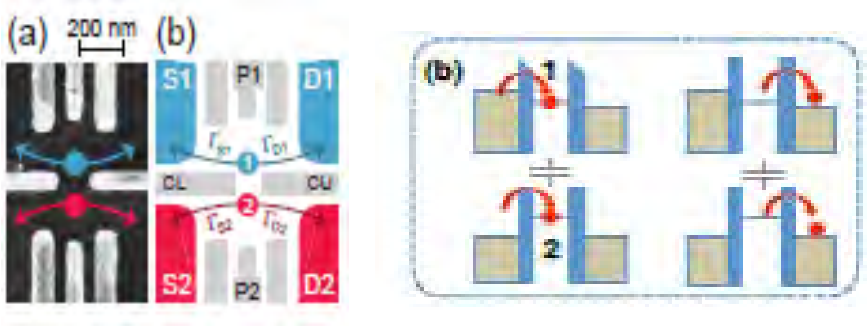
In collaboration with researchers form Turku University (Finland) we have studied the quantum Brownian oscillator, a paradigmatic model for quantum dissipation known to fulfill the criterion of classicality of the resulting environment states. We have discovered that this model, in the regime where it displays memory effects in the dynamics of the oscillator, is not any more able to fulfill the conditions for Quantum Darwinism, thus clarifying aspects of this fascinating theory.



Correlated drag effect in quantum dots

Keller, A.J.; Lim, S.J.; Sanchez, D.; Lopez, R.; Amasha, S.; Katine, J.A.; Shtrikman,H.; Goldhaber-Gordon, D.
Physical Review Letters 117, 066602 (1-5)

A quantum dot is a nanoscale system where electrons become confined in the three spatial directions. When two quantum dots are put in proximity with each other and a current source is connected to one of the dots, a drag current arises in the second dot due to electronic repulsion between the dot electrons. We showed that at low temperature electronic motion is correlated, leading to energy exchange between the two quantum dots. In our setup, a voltage is applied to the drive dot (the red subsystem in the figure) and a current is subsequently detected in the drag dot (the blue subsystem). A drag current arises even when the driving voltage is small and cotunnelling events are included [see Figure (b)].



Quantum dots are unique systems in part because they might form the building blocks in future quantum computers. Our work will allow researchers to put a limit to the packing density of nanoelectronic circuits and opens the door to more detailed investigations on detection properties of quantum charge sensors. This work has been done in collaboration with IFISC researchers David Sánchez and Rosa López; A. J. Keller, S. Amasha and D. Goldhaber-Gordon from Stanford University; J. S. Lim from the Korean Institute for Advanced Study; J. A. Katine from HGST (San Jose, US) and Hadas Shtrikman from Weizmann Institute (Israel).

Chaos is the key

X. Porte, M. C. Soriano, D. Brunner, and I. Fischer.
Bidirectional private key exchange using delay-coupled semiconductor lasers.
Optics Letters 41, 2871-2874

A. Argyris, E. Pikasis, and D. Syvridis.
Gb/s One-Time-Pad Data Encryption With Synchronized Chaos-Based True Random Bit Generators.
Journal of Lightwave Technology 34, 5325-5331

Encryption is a key technology for ensuring privacy for our digital communication. Researchers from IFISC have recently experimentally demonstrated two novel encryption schemes that are based on chaos synchronization of remote lasers.

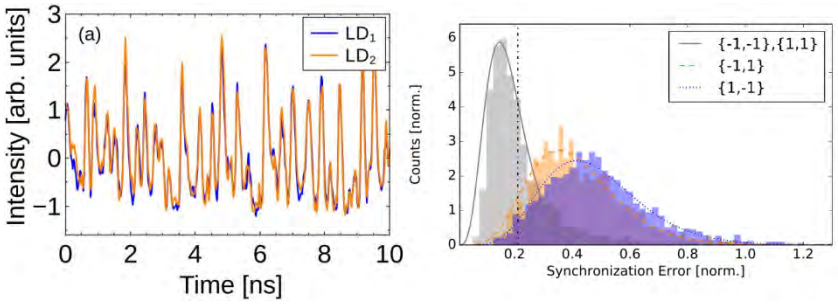


Figure. (Left) Time series demonstrating high quality synchronization. (Right) Experimental synchronization error, in which the gray histogram (and correspondingly fitted curve) represents the matched bits while the other two represent the mismatched bits of different sign

In the first work, we implemented a classical private key exchange scheme based on two bidirectionally delay-coupled semiconductor lasers with self-feedback. We showed that a secure key can be exchanged over a public channel, if the lasers operate in a chaotic regime and are synchronized (see left figure below). This scheme relies on achieving an identical synchronization state between the two lasers, which then can be perturbed by a small modulation of the pump current. The communication parties use signed bits {1, -1}, which are randomly and independently selected by each of them, to modulate the current. By applying this binary current modulation of the pump, synchronization is maintained (lost) when the two lasers modulate the pump current with identical (different) bit values. Modulation slots that result in a zero bit difference can be used to negotiate a private key (see right figure below). Consequently, the private key is the result of the global state of synchronization combined with the local knowledge of the random modulation.

We analyzed the security of this classical key distribution scheme considering the information leaked from the amplitude of the modulation bits and found that, using privacy amplification algorithm, the probability for the eavesdropper to identify the bits is below 0.50003. The final private key generation rate amounts to 11 Mb/s. This practical scheme poses an additional hardware restriction to avoid impersonations, namely the use of asymmetric coupling paths.

In the second article, we demonstrated the combination of two unique properties of semiconductor lasers that operate in a chaotic regime: (i) their potential to become highly synchronized when optically coupled through appropriate configurations and (ii) their ability to seed ultrafast true random bit generators. The concurrent fulfilment of both conditions was shown in experiments and exploited to experimentally implement a one-time-pad encryption communication protocol. Error-free operation of such an encryption system was demonstrated, exceeding for the first time Gb/s rates. Forward-error-correction coding was applied, in order to drastically reduce the errors of the synchronized true random bit sequences and to optimize the decoding performance of the system, while securing the distribution of the random seed.

Origin and stability of dark pulse Kerr combs in normal dispersion resonators

Pedro Parra-Rivas, Damià Gomila, Edgar Knobloch, Stéphane Coen, and Lendert Gelens
Optics Letters **41**, 2402-2405

Frequency combs are a very important tools for ultra-high precision measurements of optical frequencies, and their applications span arbitrary waveform synthesis, telecommunications and ultra-accurate clocks. Typically frequency combs are generated using mode locked lasers, which are relatively large devices. Recently optical frequency combs generated in passive Kerr microresonators have attracted a lot of interest for their potential for on-chip integration. Such devices usually generate Kerr frequency combs (KFC) in the anomalous group velocity dispersion (GVD) regime, where the formation of bright solitons inside the cavity are behind the generation of KFC. However, due to the difficulty in obtaining anomalous GVD in some spectral ranges, the generation of KFC from normal GVD is now also being sought.

In this work we analyze the generation of KFC in the normal dispersion regime using the Lugiato-Lefever equation model. We show that in this regime KFC correspond to interlocked switching waves between the upper and lower homogeneous states forming a dark pulse (see Fig. 1). This interpretation of KFC explains many of the experimentally observed properties of KFC in this regime. We also provide a bifurcation analysis of dark pulse KFC and map out their existence and stability conditions, as well as some of their dynamical instabilities.

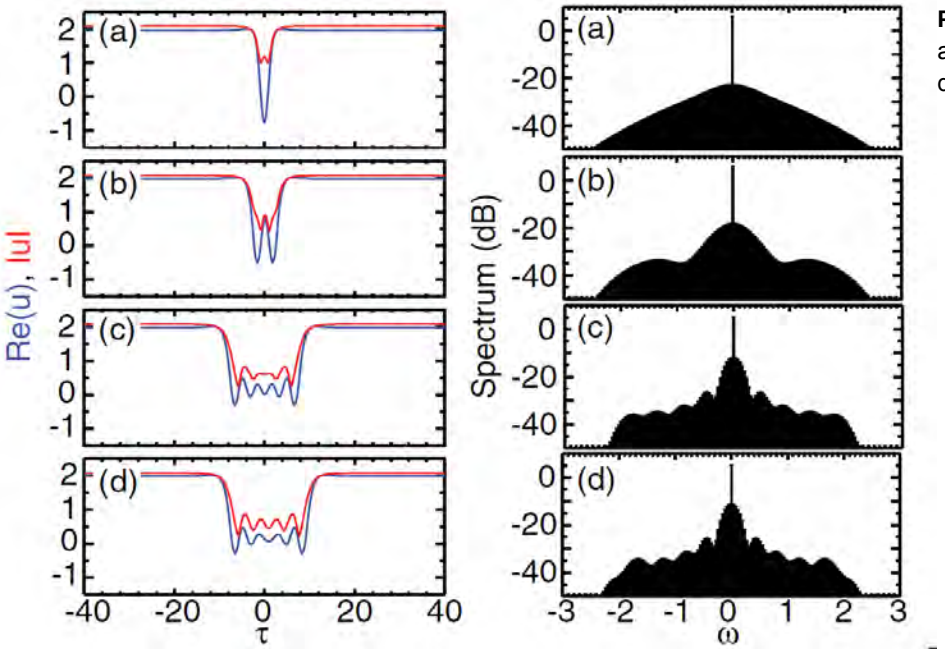


Figure. Temporal profiles (left) and spectral intensities (right) of dark pulse KFC.

Interdecadal Variability of Southeastern South America Rainfall and Moisture Sources during the Austral Summertime

Martin-Gomez, V.; Hernández-García, E.; Barreiro, M.; López, C.
Journal of Climate **29**, 6751-6763

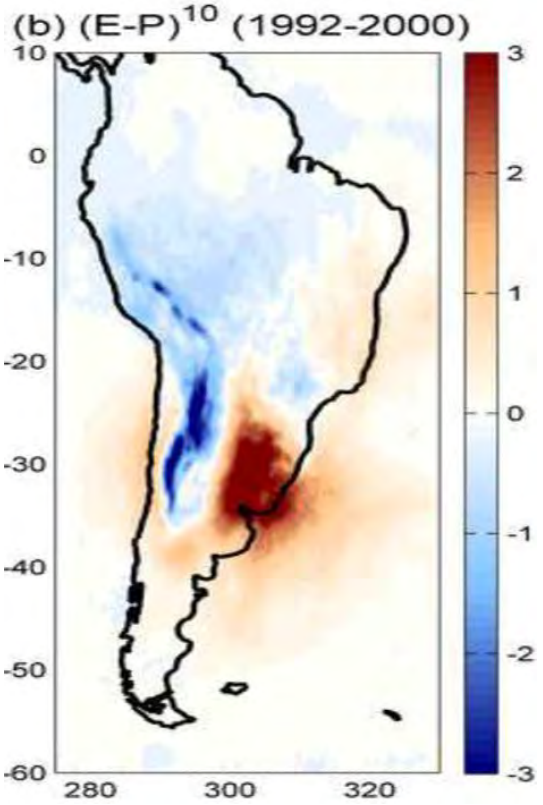
One of the most important characteristics of the climate of a region is its precipitation regime. To determine it, it is very relevant to understand the motion of air parcels over the region, as well as the gain, transport, and loss of humidity by air as it travels over different areas.

In this work we focus in the Southeastern South America (SESA) region during austral summer. This very populated area in South America is around the La Plata basin, and rain regimes are of fundamental importance for its economy. Using atmospheric reanalysis data of the last century, we evaluate inter-decadal variability in the atmospheric circulation linking them to different moisture changes at different periods.

We identify periods of different circulation regime by means of a synchronization-network approach and we identify the main moisture sources affecting SESA during them. These are computed by directly tracking the trajectories of moisture particles in the atmosphere. During all the century the main moisture sources of humidity over the SESA are the recycling over the region, the central-eastern shore of Brazil together with its surrounding Atlantic Ocean, and the southwestern south Atlantic surrounding the SESA domain. But the intensity of these sources is modulated in time.

Results identify two different precipitation regimes. For example there is contrast between the ‘80s and the ‘90s, being the principal differences the intensity of the recycling and the strength of the moisture input from the central-eastern shore of Brazil. Moreover, we find a region centered at (20ºS, 300ºE) which is a moisture source for SESA only during the '90s. These differences can be associated with the development of a low-level anti-cyclonic anomaly circulation over central-east Brazil in the '90s.

This type of analysis helps to quantify climatic variability and to understand changes of frequency in rain events, which can be catastrophic in some cases.



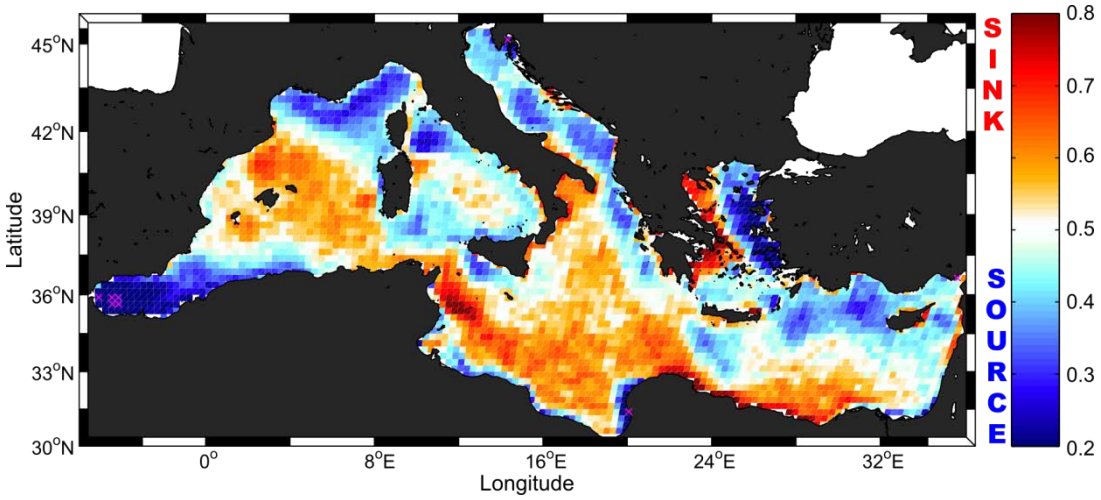
Net average budget of moisture (years 1992-2000) in the air circulating towards the SESA region. Red colors over some areas indicate dominant evaporation there, whereas blue colors indicate dominant precipitation.

Linking basin-scale connectivity, oceanography and population dynamics for the conservation and management of marine ecosystems

Dubois, M.; Rossi, V.; Ser-Giacomi, E.; Arnaud-Haond, S.; López, C.; Hernández-García, E.
Global Ecology and Biogeography 25, 503-515

Marine connectivity, defined as the interchange of individuals among distinct marine subpopulations, is an important concept in Ecology. These exchanges occur at all stages of the species life cycle, but the most important mechanism is thought to be the transport of larvae and eggs by ocean currents over long distances. They have important consequences for the structuring of marine populations and thus for their protection.

We have developed and used a tool based on Network Theory, the "*Lagrangian Flow Network*" approach, to estimate marine connectivity in the surface layers of the Mediterranean Sea as a function of various bio-physical factors such as the larval-state duration, the spawning season, the turbulent oceanic circulation and the sea bathymetry. Simulated ocean velocity fields over the last 10 years have been used to assess interchange of fluid and free-swimming larvae among thousands of small subregions. Different combinations of parameters have allowed us to study marine connectivity from an "ecosystem perspective", with special relevance for species with wide geographical distribution and potential for large-distance dispersal.



As an example of quantities extracted from the network approach, the figure shows mean patterns of regions acting as sources (blue) and sinks (red) of larvae during summer over the entire Mediterranean basin. This type of maps helps to improve hypotheses of population structure and gene flow and to design accordingly sampling strategies for population genetics. In addition, the extents to which marine subpopulations interexchange individuals and retain their own offspring have implications for their demography and persistence (long-term survival), two crucial concepts for their management and conservation.

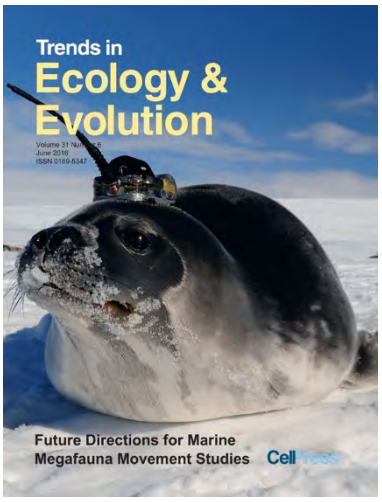
Key Questions in Marine Megafauna Movement Ecology

Hays, G.C.; Ferreira, L.C.; Sequeira, A.M.M.; Meekan, M.G.; Duarte, C.M.; Bailey, H.; Bailleul, F.; Bowen, W. D.; Caley, M.J.; Costa, D. P.; Eguliuz, V.M.; et al.
Trends in Ecology and Evolution 31, 463-475

Technological advances allow is to deploy smaller and more powerful devices equipped with sensors recording movement, physiology and environmental conditions. Still the deployment of tracking devices in marine megafauna organisms is costly (economically and on human effort) and can affect the wellbeing of animals. Thus there is a need to identify the most fundamental questions marine megafauna movement ecology.

To this end, we designed a collaborative approach. We invited experts to supply up to 10 key questions in movement ecology of marine megafauna. Questions were collected and grouped The full list was then distributed and participants asked to vote their top 10 questions. This is the list selected list:

- How Can Movement Data Be Used to Support Conservation and Management?
- Are there Simple Rules Underlying Seemingly Complex Movement Patterns and, hence, Common Drivers for Movement across Species?
- How Do Learning and Memory versus Innate Behaviours Influence Movement Patterns, including Ontogenetic Changes?
- To what Degree Do Social Interactions Influence Movements?
- How Does the Distribution of Prey Impact Movement?
- What Sensory Information Do Animals Use to Sense Prey, Breeding Partners, and Environmental Conditions?
- Can Movement Data Provide Information on the Ecosystem Role of Marine Megafauna?
- How Much Does the Physical Environment Influence Movement?
- How Will Climate Change Impact Animal Movements?
- How Can Risks, Consequences and Benefits of Biologging at the Level of Individuals and Populations Be Evaluated?
- How Do We Integrate Physiological Context into Tagging Studies to Gain a More Synoptic Picture of Movement and Behaviour?
- What Are the Major Drivers of Long-Distance Movements?
- How Does Predation Risk Influence Movement Strategies?
- What Areas Can Be Considered Hotspots for Multiple Species on a Global Scale?
- How Do Anthropogenic Activities (e.g., Shipping, Fishing, and Water Management) Affect Movements?

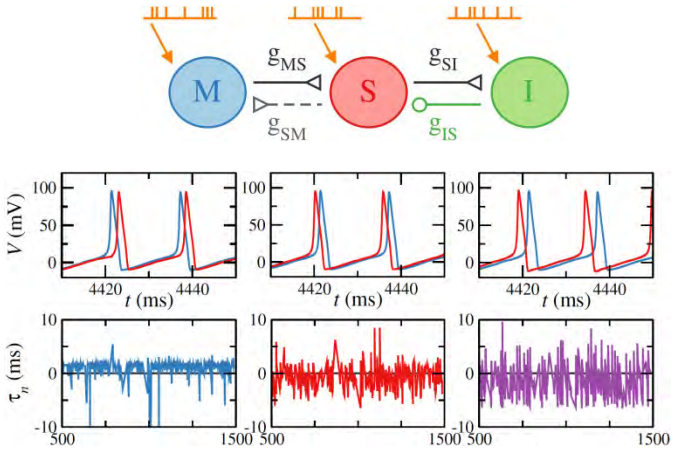


Neuronal inhibition induces anticipated synchronization

F. S. Matias, L. L. Gollo, P. V. Carelli, C. R. Mirasso, and M. Copelli
Inhibitory loop robustly induces anticipated synchronization in neuronal microcircuits,
Physical Review E 94, 042411

Anticipated synchronization (AS) is a form of synchronization that occurs when a unidirectional influence is transmitted from one dynamical element (a master) to another dynamical element (a slave), but the slave leads the master in time. This counterintuitive synchronization regime can be a stable solution of two dynamical systems coupled in a master-slave configuration when the slave receives a negative delayed self-feedback. AS was found in electronic circuits, optical systems, coupled inertial ratchets and more. In the last years, AS was found in neuronal models such as nonidentical chaotic neurons, map-based neurons with a memory term and two Hodgkin-Huxley neurons with different depolarization parameters. In particular, it was shown that periodically-spiking neurons can exhibit AS within a plausible biological scenario, in which the typical delayed self-feedback is replaced by an inhibitory loop mediated by chemical synapses. AS mediated by inhibition was also found in a model of neuronal populations, which can explain the observation of coherent oscillations with negative phase-lag between areas of the monkey cortex.

It was our aim in this paper to study the robustness of the synchronized solution of a master-slave-interneuron circuit by assuming a phase diversity induced by anticipated synchronization due to dynamical inhibition and noise in a neuronal motif described by the Hodgkin-Huxley equations. We found that, although the anticipation does not occur for every spike, it survives on average. Moreover, we found that the mean spike-timing difference between master and slave neurons is a continuous function of inhibitory conductance, which controls the phase diversity.



Upper Figure: Neuronal motif: master-slave-interneuron (MSI). Each node represents a neuron described by the Hodgkin-Huxley model connected to other neurons by chemical synapses.

Lower Figure: Characterization of the delayed synchronization regime (DS) and the anticipated synchronization regime (AS). Left panels: g_{IS} = 10 nS (DS, $\tau > 0$), middle panels: g_{IS} = 40 nS (AS, $\tau < 0$), right panels: modified Hodgkin-Huxley model (AS, $\tau < 0$, g_{MS} = 50 nS and g_{IS} = 150 nS). (a)–(c) The spike-timing differences (τ_{n-1} and τ_n) between a spike of the master neuron and a spike of the slave neuron in two consecutive periods. (d)–(f) τ_n as a function of the cycle number n.

The phenomenon of anticipated synchronization in this neuronal motif was also found to be robust against a mutual coupling between master and slave neurons. Indeed, if AS is present in a unidirectional master-slave connection, the nonzero slave-to-master synaptic conductance g_{SM} not only maintained, but also stabilized the phenomenon of anticipation. For $g_{SM} > g_{MS}$ the definitions of master and slave naturally interchanged. In that case, S, the neuron subject to the inhibitory feedback loop (as defined in the upper figure) leaded M. This reinforces the notion that when one excitatory and one inhibitory neuron are mutually connected, they can be considered as a functional unit whose dynamics will typically lead that of another single neuron with which it is connected via mutual excitation (provided that the single neuron does not have a self inhibitory loop).

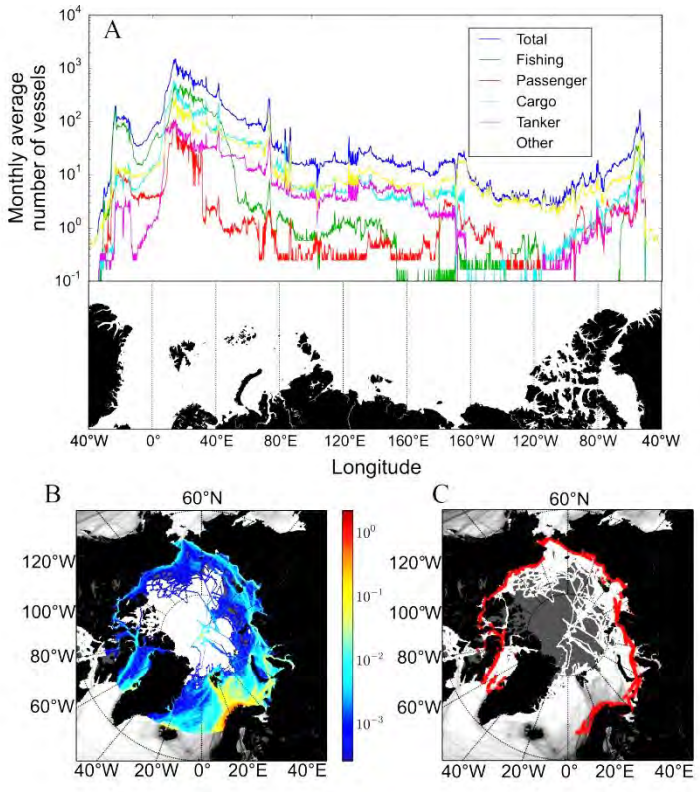
A quantitative assessment of Arctic shipping in 2010–2014

Victor M. Eguíluz, Juan Fernández-Gracia, Xabier Irigoien, and Carlos M. Duarte
Scientific Reports 6, 30682 (1-6)

The Arctic's sea ice maximum extent has dropped by an average of 2.8 percent per decade since 1979, with **a historical minimum last year 2016** and the minimum last year marked also a **historical record**, tied with that of 2007. Besides the global climate implications of rapid ice loss, this is opening up the Arctic Ocean to shipping, which is predicted to increase heavily by 2050, when many models predict the Arctic Ocean will be largely free of ice by the end of the summer. Nevertheless, quantitative validation of arctic shipping has been elusive due to the scarcity of data.

We have analyzed Arctic shipping activity in the period 2011–2014, as it is already significant; and we have showed that it is concentrated around the Norwegian and Barents Seas, and predominantly accessed via the Northeast and Northwest Passages (see Fig. 1). Shipping activity is strongly seasonal, tied to the seasonal ice-coverage, which has a minimum every September and still hasn't disappeared as much as to open the direct trans-Arctic route. The fraction of ice-free open water used for shipping operations was highest in September, when more than 80% of the area free of continuous ice supported shipping, compared with only about 57% in January. Although models showing accessibility for transoceanic shipping could support the idea of transoceanic transport as the central factor for shipping in the Arctic, in general, access to Arctic resources, particularly fisheries, is the most important driver of Arctic shipping thus far.

Fig. 1: ***A global view on arctic shipping in 2014:*** *(A) number and (B) density of ships (units: number of vessels per square kilometer) present in the Arctic Ocean at different longitudes and (C) the main shipping routes in the Arctic in 2014.*



Comparing the modeling of delay propagation in the US and European air traffic networks

Campanelli, B.; Fleurquin, P.; Arranz, A.; Etxebarria, I.; Ciruelos, C.; Eguiluz, V.M.; Ramasco, J.J.
Journal of Air Transport Management 56, 12-18

Complex Systems are those in which a very large number of elements interact, usually in a non-linear fashion, producing emergent behaviors that are typically difficult to predict. Air transportation systems fall in this category, with a large number of aircraft following pre-scheduled programs. It has been shown that it is possible to understand and forecast delays propagation in these systems. The objective of this analysis is to compare the modeling in the US and in the European air traffic networks, analyzing the propagation of delays due to failures in the schedule or to disturbances. The wo networks are managed in a different way. The priorities in American airports are mostly based in first-arrived-first-served protocol for the flights asking services or windows to depart, while the European system is organized in the basis of a first-planned-first-served protocol in which flights scheduled at a certain time slot have priority in service during its slot. In this work, we use two different agent-based models recently developed to simulate the delays propagation and assess the effect of disruptions in the networks (US and ECAC areas). Our results show that a first-come-first-served protocol managing the flights produces larger congestion when compared with an ATFM (Air Traffic Flow Management) slots priority system.

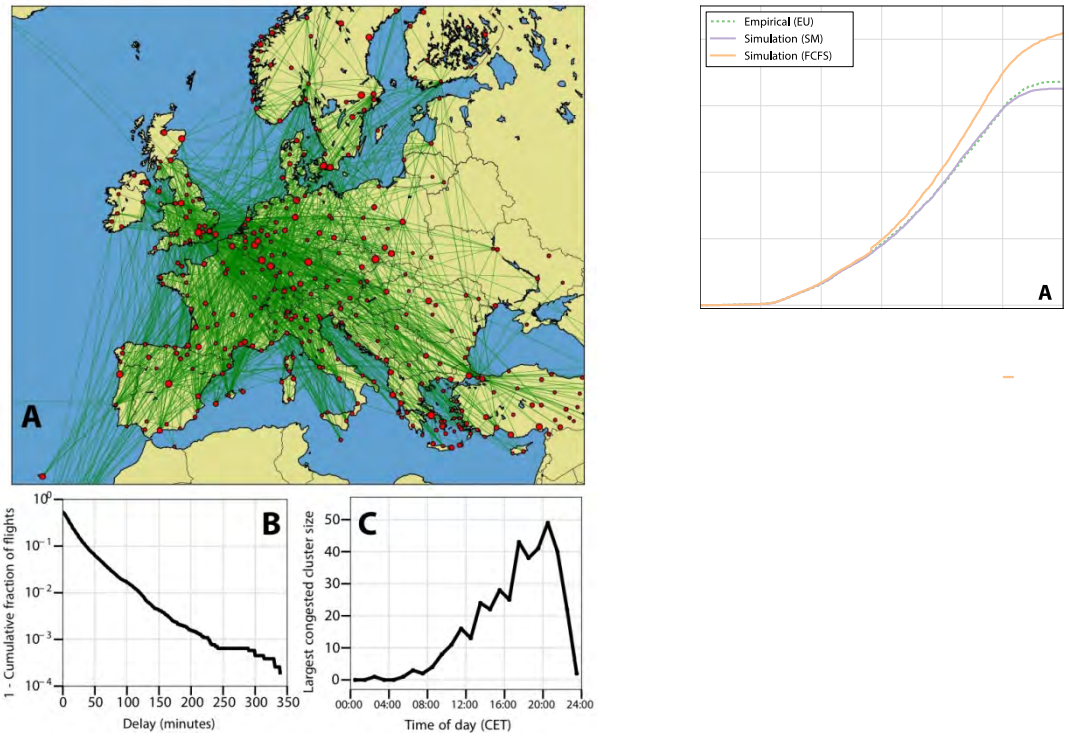


Figure. European air transport network and simulation results. On the left in A the European network, in B and C the distribution of the delays and the evolution of the cluster of congested airports on June 20, 2013. On the right, in A and B, a comparison of simulation results for the two protocols.

Touristic site attractiveness seen through Twitter

Bassolas, A.; Lenormand, M.; Tugores, A.; Gonçalves, B.; Ramasco, J.J.
EPJ Data Science 5, 12

Tourism is becoming a significant contributor to medium and long range travels in an increasingly globalized world. Leisure traveling has an important impact on the local and global economy as well as on the environment. The study of touristic trips is thus raising a considerable interest. In this work, we apply a method to assess the attractiveness of 20 of the most popular touristic sites worldwide using geolocated tweets as a proxy for human mobility. We first rank the touristic sites based on the spatial distribution of the visitors' place of residence. The Taj Mahal, the Pisa Tower and the Eiffel Tower appear consistently in the top 5 in these rankings. We then pass to a coarser scale and classify the travelers by country of residence. Touristic site's visiting figures are then studied by country of residence showing that the Eiffel Tower, Times Square and the London Tower welcome the majority of the visitors of each country. Finally, we build and analyze a network linking sites whenever a user has been detected in more than one site. This allow us to unveil relations between touristic sites and find which ones are more tightly interconnected.

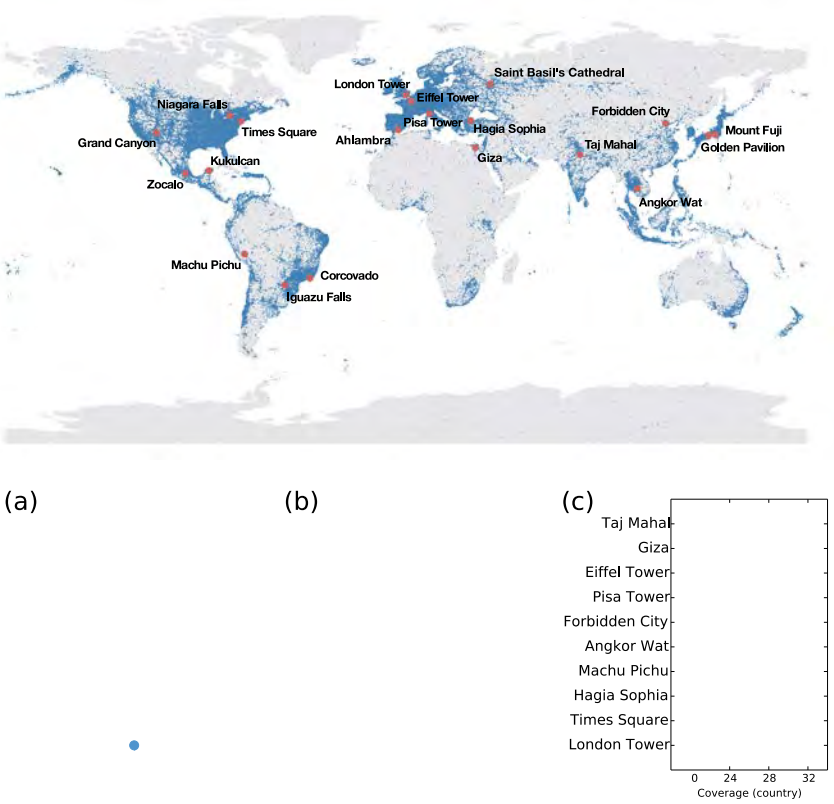


Figure. Sites considered in the analysis (top) and ranking (below). On the top, the distribution of geolocated tweets in blue over the map. As red circles, the location and names of the touristic places analyzed. Below, the rankings of the places by (a) average normalized radius of the trips of the visitors (how far they come from), (b) coverage (diversity in origins of the visitors at micro level) and (c) coverage at country level.

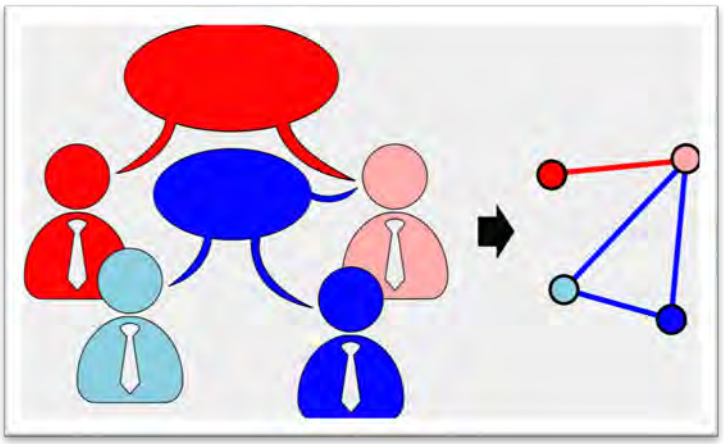
Coupled dynamics of node and link states in complex networks: A model for language competition

A. Carro, R. Toral, M. San Miguel
New Journal of Physics 18, 113056

This paper introduces an agent-based model for the the competition between two socially equivalent languages, and their probability of survival depending on the number of speakers. The model, which is based on a network of 'node' and 'link' states, accounts for both language preference and language use, as well as their coupled evolution. In other words, it represents language not just as a means of communication, but also as a property of the speakers themselves - shining a light on attributes such as cultural identity. One of the main advantages of this approach is that bilingualism appears as the natural consequence of individuals using different languages in different interactions.

As opposed to most of the previous literature, where language extinction is an inevitable outcome of the dynamics, the model predicts a broad range of possible asymptotic configurations which can be divided into three categories: frozen extinction of one of the languages, frozen coexistence of both languages, and dynamically trapped coexistence of both languages. Moreover, metastable coexistence states with very long survival times and displaying a non-trivial dynamics are found to be abundant for sufficiently large systems. Where both languages are shown to co-exist, a high proportion of bilingual speakers is found -- often arranged in triangular networks, which are considered to represent small groups of friends or strongly interacting individuals. These groups exhibit a strong preference for the minority language, and use it for their intra-group interactions, while they switch to the predominant language for communications with the rest of the population. As the population rises -- in terms of the parameters of the model -- the probability of language extinction is reduced.

Language competition is not the only 'complex system' that can be investigated taking this approach. The methodology applied in the paper -- a coevolution of node and link states -- could also benefit the study of trust, or ally versus enemy relationships, as well as the coupled dynamics of trade and economic growth.



1 PRESENTATION AND RESEARCH LINES

2

PERSONNEL

2.1 PERMANENT SCIIENTIFIC STAFF

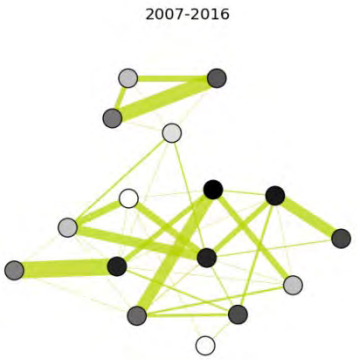
PERE COLET	CSIC Research Professor
VÍCTOR M. EGUÍLUZ	CSIC Tenured Scientist
INGO FISCHER	CSIC Research Professor
DAMIÀ GOMILA	CSIC Tenured Scientist
EMILIO HERNANDEZ-GARCÍA	CSIC Research Professor, IFISC Deputy Director
CRISTOBAL LÓPEZ	University Professor UIB
ROSA LÓPEZ	University Professor UIB
MANUEL MATÍAS	CSIC Senior Researcher
CLAUDIO MIRASSO	University Full Professor UIB
MAXI SAN MIGUEL	University Full Professor UIB, IFISC Director
JOSE J. RAMASCO	CSIC Permanent Scientist (since July)
DAVID SÁNCHEZ	University Professor UIB, IFISC Academic Secretary
LLORENÇ SERRA	University Professor UIB
TOMÀS SINTES	University Professor UIB
RAÚL TORAL	University Full Professor UIB
ROBERTA ZAMBRINI	CSIC Tenured Scientist

Contribution of the permanent staff to the IFISC research lines:

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. The following table summarizes the participation of the senior researchers in the different lines during 2016.

Coherence and Integration Interaction and Bridges	Pere Colet	Víctor M. Eguíluz	Ingo Fischer	Damia Gomila	Emilio Hernández-García	Cristóbal López	Rosa López	Manuel Matías	Claudio Mirasso	José J. Ramasco	David Sánchez	Maxi San Miguel	Lorenç Serra	Tomás Sintes	Raúl Toral	Roberta Zambrini
1) Complex Systems: Statistical and Nonlinear Physics.	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
2) Transport and Information in Quantum Systems							X				X		X			X
3) Nonlinear Photonics	X		X	X					X							
4) Nonlinear Dynamics in Fluids					X	X								X		
5) Biocomplexity		X	X		X	X		X	X					X	X	
6) Collective phenomena in Social and Socio-technical Systems	X	X			X					X		X			X	

IFISC INTERNAL COLLABORATION NETWORK



Network of co-authorship of research papers among IFISC permanent researchers (nodes of the network). Strength of the link indicates number of joint papers. Color gray scale of the node indicates total number of papers of the node.

2.2 POSTDOCTORAL RESEARCH ASSOCIATES

APOSTOLOS ARGYRIS	Marie Curie Contract
DOMENICO BULLARA	Postdoctoral Contract Project INTENSE@COSYP
MANUTEA CANDE	Postdoctoral Contract Project NOMAQ
MIGUEL C. SORIANO	Postdoctoral Contract Balear Government and Ramón y Cajal Fellow (since December)
JUAN JOSÉ CERDÀ	Postdoctoral Contract Balear Government
AGNIESZKA CZAPLICKA	Postdoctoral Contract Project INTENSE@COSYP
JEAN-BAPTISTE A. DELFAU	Postdoctoral Contract Project INTENSE@COSYP
MARINA DIAKONOVA	Postdoctoral Contract Project INTENSE@COSYP
RICCARDO GALLOTTI	Postdoctoral Contract Project BigData4ATM
FERNANDO GALVE CONDE	UIB Postdoctoral Contract
GIANLUCA GIORGI	Postdoctoral Contract Project QuProCS
JUAN CARLOS GONZALEZ AVELLA	Postdoctoral Contract
SUN-YONG HWANG	Postdoctoral Contract Project TIQS and Korean NRF
THOMAS JÜNGLING	Postdoctoral Contract Project GABA
YOSHIFUMI KAWASAKI	Japan Society for Promotion of Science(JSPS) Contract
NAGI KHALIL	UIB Lecturer
KONSTANTIN KLEMM	Ramón y Cajal Fellow
FABIO LAMANNA	Postdoctoral Contract Project EUNOIA
MAXIME LENORMAND	Postdoctoral Contract Balear Government
THOMAS LOUAIL	Postdoctoral Contract Project EUNOIA
BYUNGJOON MIN	Postdoctoral Contract Project ESOTECOS
SILVIA ORTIN	Postdoctoral Contract Project INTENSE@COSYP
ANTONIO PÉREZ LÓPEZ	Juan de la Cierva Contract
JOSÉ JAVIER RAMASCO	Ramon y Cajal Fellow (until June)
VINCENT ROSSI	Postdoctoral Contract Project ESCOLA

2.3 PHD STUDENTS

MIQUEL ALFARAS	Research Contract
MARIA ISABEL ALOMAR	UIB Teaching Assistant
ORIOL ARTIME	Contract Project INTENSE@COSYP
MOHAMED EL ARBI BASSALAH	ERASMUS Fellowship
ALEIX BASSOLAS	Contract Project INTENSE@COSYP
JULIAN BUENO MORAGUES	FPI Contract Project TRIPHOP
BRUNO CAMPANELLI	Contract Project TREE
ADRIÁN CARRO PATIÑO	FPU Contract
JILLIAN MARIE CLEMENTS	Wisenet Program, Duke University, USA
ANTONIO FERNÁNDEZ PERALTA	FPU Contract
GERARDO GÓMEZ	FPI Contract, EVOCOG group
GONZALO MANZANO	FPI Contract
JADE MARTÍNEZ	UIB Teaching Assistant
PEDRO MONROY	FPI Contract Project ESCOLA
JAVIER OSCA COTARELO	UIB Predoctoral Contract
PEDRO J. PARRA RIVAS	FWO Fellowship Brussels
MARIE R. POPIEL	La Caixa Fellowship
VÍCTOR M. RODRÍGUEZ	PhD Student
JORGE P. RODRIGUEZ	FPU Contract
GUILLEM ROSSELLÓ	PhD Student
DANIEL RUIZ REYNÉS	Contract Project INTENSE@COSYP
MIGUEL A. SIERRA	Balear Government Fellowship
EDER B. TCHAWOU TCHUISSEU	FPI Contract Project INTENSE@COSYP

2.4 TECHNICAL AND ADMINISTRATIVE SUPPORT

CARLOS M. ALVAREZ	Computing Lab Technician since May
INMA CARBONELL	Administration Unit Head
GEMMA CASABÓ	Communication and Dissemination
MARTA OZONAS	IFISC Secretary
EDUARD SOLIVELLAS	Computing Lab Technician
RUBÉN TOLOSA	Computing Lab Technician
M. ANTÒNIA TUGORES	Data Engineer

IFISC people - Winter Solstice 2016

2.5 VISITORS

LONG-TERM VISITORS (more than one month)

BRUNO BELLOMO	Universite Franche-Comte, France. July
MARIO COSENZA	Univ. de los Andes, Venezuela. May
FRANCESCO D´OVIDIO	LOCEAN-IPSL,Paris,France. Feb. and Nov.
BRUNO GONÇALVES	Aix-Marseille Université, France. Sept.
JONG SOO LIM	Inst. Advanced Studies KIAS, Korea. Sept.- Oct.
SERGIO HENRIQUE LIRA	Univ. Federal de Alagoas, Brazil. June
ANDREI MANOLESCU	Univ. Reykjavic, Iceland. May - June
RICARDO MARTINEZ GARCIA	Princeton, USA. June-August
NAOKI MASUDA	Univ. Bristol, UK. February
FERNANDA MATIAS	Univ. Federal de Alagoas, Brazil. June
EHSAN SADIGHRAD	Middle East Technical Univ., Turkey. June-July
FLORA SOUZA BACELAR	Univ. Federal da Bahia, Brazil. January-June
CHRISTIAN VAN DEN BROECK	Universiteit Hasselt, Belgium. Sept.
FEDERICO VAZQUEZ	Univ. La Plata, Argentina. July - August

SHORT-TERM VISITORS (Less than one month)

ALBERTO BAUDENA	LOCEAN-IPSL, Paris, France. February
GONZALO OLZINA	Univ. Valencia, Spain. March
PENELOPE HERNÁNDEZ	Univ. Valencia, Spain. March
JOSE LUIS PEREZ VELAZQUEZ	University of Toronto, Canada. March
RAMON AGUADO	Instituto de Materiales de Madrid, Spain. April
DANIEL CAVALCANTI	ICFO Barcelona, Spain. April
LUC STEELS	Universitat Pompeu Fabra, Spain. April
BENJAMIN CARRERAS	BACV Solutions Inc., USA. May
JORDI BASCOMPTE	University of Zurich, Switzerland. May
VICTOR LOPEZ MADRONA	Univ. Miguel Hernández Alicante, Spain. June.
JAN NAGLER	ETH Zürich, Switzerland. June
DANIEL GAUTHIER	The Ohio State University, USA. June
JOSEP CANYELLES PERICAS	Northumbria University Newcastle, UK. June
CARLO BEENAKKER	Leiden University, Netherlands. July
DANIEL BRUNNER	FEMTO-ST, Besancon, France. July
RAFAEL SANCHEZ	Univ. Carlos III, Madrid, Spain. July
ENRICO SER GIACOMI	Ecole Normale Superiore Paris, France. July
MAURO COPELLI	Univ. Federal de Pernambuco, Brazil. July
JUAN FERNANDEZ GRACIA	Harvard University, Boston, MA, USA. July
GOURAB GHOSHAL	University of Rochester, NY, USA. July
JAN DANCKAERT	Vrije Universiteit Brussel, Belgium. July
JUAN MR. PARRONDO	Univ. Complutense de Madrid, Spain. July
HAYDEE LUGO	Univ. Complutense de Madrid, Spain. Sept.
VITO LATORA	Queen Mary University of London, UK. Sept.
LUIZA ANGHELUTA	Univ. de Oslo, Norwey. Oct.
YANNE CHEMBO	FEMTO-ST, UBFC, Besancon, France. Oct.
ADRIÀ TAUSTE	IMIM, PRBB, U. Pompeu Fabra, Spain. Oct.

2.6 MASTER AND COLLABORATION STUDENTS

In addition to the IFISC personnel, Master and Collaboration students have been also involved in IFISC research:

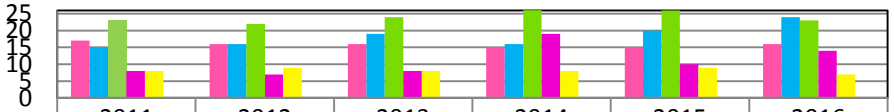
HENNING HUSEMANN	ERASMUS Fellowship, Univ. of Osnabrück, Germany
MATTHIAS HÄUSSLER	ERASMUS Fellowship, Univ. of Münster, Germany
ANGELA LOPRESTI	ERASMUS Fellowship, Univ. della Calabria, Italy
ANA ALONSO	IFISC Master
NURIA ARGUIMBAU	IFISC Master
ENTELA BUZI	IFISC Master
DANIEL CZEGEL	IFISC Master
REBECA DE LA FUENTE	IFISC Master
CRISTIAN ESTARELLAS	IFISC Master
ADRIAN GARCÍA	IFISC Master
JOAN LOSA	IFISC Master
LUCA MARCONI	IFISC Master
YASMINA MARÍN	IFISC Master
ALEX MOLAS	IFISC Master
ALEJANDRO MORAN	IFISC Master
PEDRO PARRADO	IFISC Master
GIANMARCO GIUSEPPE	IFISC Master
PATRICIO SANCHEZ	IFISC Master
FRANCESCA SCHÖNSBERG	IFISC Master
MIGUEL A. TRIGO	IFISC Master
EDUARDO VARELA	IFISC Master
VICTOR BUENDIA	SURF@IFISC Fellowship and IFISC Master
ALBERT CABOT	SURF@IFISC Fellowship and IFISC Master
XAVIER HOFFMANN	SURF@IFISC Fellowship and IFISC Master
CLAUDIA PAYRATÓ	SURF@IFISC Fellowship and IFISC Master
JOAN PONT	SURF@IFISC Fellowship and IFISC Master
CRISTIAN COGOLLOS	SURF@IFISC Fellowship
DAVID PEREÑÍGUEZ	SURF@IFISC Fellowship
ALBERTO PRADES	SURF@IFISC Fellowship
LAURA ROTGER	SURF@IFISC Fellowship
GABRIEL TORREGROSA	SURF@IFISC Fellowship

2.7 SUMMARY OF IFISC HUMAN RESOURCES

HUMAN RESOURCES IFISC 2016

	Total	Male	Female
Permanent staff	16	14	2
Postdoctoral fellows	24	21	3
PhD students	23	19	4
Long-term visitors	14	12	2
Support personnel	7	3	4
Total	84	69	15

PERSONNEL IFISC 2011-2016



	2011	2012	2013	2014	2015	2016
PERMANENT STAFF	17	16	16	15	15	16
POSTDOCTORAL AND ASSOCIATED	15	16	19	16	20	24
PhD STUDENTS	23	22	24	27	26	23
LONG TERM VISITORS	8	7	8	19	10	14
SUPORT PERSONNEL	8	9	8	8	9	7
TOTAL	71	70	75	85	80	84

VISITING SCIENTISTS AT IFISC 2011-2016

		Short visits	Long visits	Total visits
	SPAIN	71	4	75
	EUROPE	118	31	149
	REST OF THE WORLD	37	31	68
	TOTAL	226	66	292

3

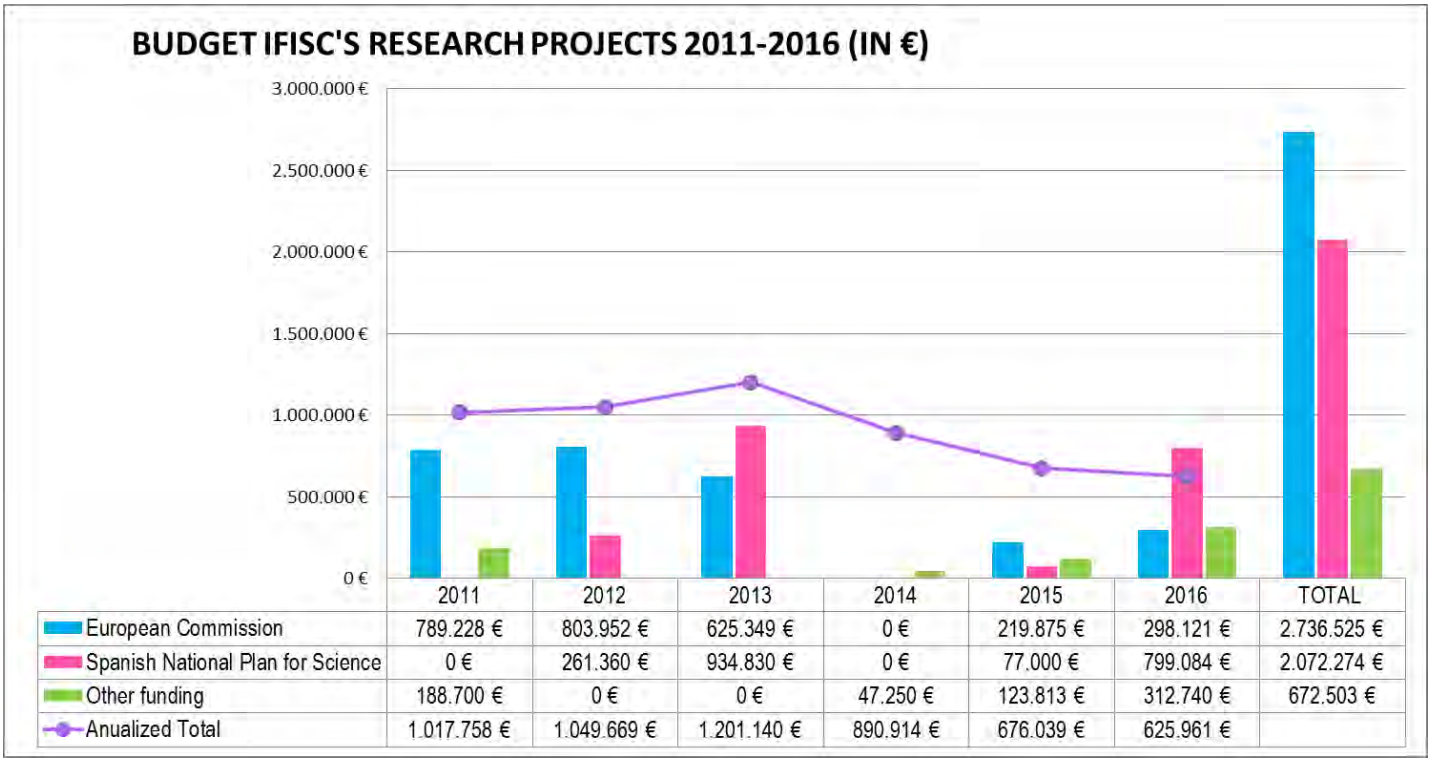
RESEARCH PROJECTS AND FUNDING

DURING 2016 IFISC HAS RECEIVED FUNDING VIA THE ACTIVE RESEARCH PROJECTS LISTED IN THE FOLLOWING PAGES. IN BRIEF:

- European Commission Framework Program projects: **5**
- Spanish National Plan: **7**
- Collaboration Networks: 8
- Research Contracts: **4**

- Grand total budget of active projects in 2016: **2.526.169€**
- Grand total budget of European Commission Framework Programs active projects in 2016: **1.143.346 €**
- Budget of EC-funded active projects in 2016: **45,26 %** of total

BUDGET FIGURES FOR THE PERIOD 2011-2016 ARE SUMMARIZED IN THE FOLLOWING TABLE
(With budget of a project assigned to the year it is granted. The *Annualized total* is the sum of one-third of the budged granted in that year and in the two previous years):



	2011	2012	2013	2014	2015	2016	TOTAL
European Commission	789.228 €	803.952 €	625.349 €	0 €	219.875 €	298.121 €	2.736.525 €
Spanish National Plan for Science	0 €	261.360 €	934.830 €	0 €	77.000 €	799.084 €	2.072.274 €
Other funding	188.700 €	0 €	0 €	47.250 €	123.813 €	312.740 €	672.503 €
Anualized Total	1.017.758 €	1.049.669 €	1.201.140 €	890.914 €	676.039 €	625.961 €	

3.1 RESEARCH PROJECTS FUNDED BY THE EUROPEAN COMISSION

TREE

Data-driven modelling of network-wide extension of the Tree of Reactionary delays in ECAC area. European Comission and Eurocontrol. RTD Project. IFISC Principal Investigator: José J. Ramasco. (2013-2016). UIB Budget: 270.000€

INSIGHT

Innovative policy modelling and governance tools for sustainable post-crisis urban development. FP7-ICT-2013-10 proposal 611307. European Union STREP Project. IFISC Principal Investigator: José J. Ramasco. (2013-2016). UIB Budget: 274.820 € and CSIC Budget: 80.530 €

QuProCS

Quantum Probes for Complex Systems. H2020-FETPROACT-2014. Proposal: 641277. STREP Project. PrIncipal Investigator: Roberta Zambrini. (2015-2018). UIB Budget: 219.875 €

BigData4ATM

Passenger-centric Big Data Sources for Socio-economic and Behavioural Researc in ATM. SESAR Subproject. European Commission [699260]. IFISC Principal Investigator: Jose J. Ramasco (2016-2018) . UIB Budget: 128.000€

CENTURION

Signal processing in optical communication NeTworks Using Reservoir cOmputiNG. Marie Curie Intra-European Fellowships for carreer development. [7070768]. Principal Investigator: Ingo Fischer (2016-2018). UIB Budget: 170.121,60€

3.2 RESEARCH PROJECTS OF THE SPANISH NATIONAL PLAN FOR SCIENCE

EPheQuCS

Emergent Phenomena and decoherence in quantum complex systems.
Spanish Government. Principal Investigator: Roberta Zambrini. (2016-2019). CSIC Budget: 102.850€

NOMAQ

Non-Markovian quantum evolutions in structured enviroments.
[FIS2014-60343-P]. Principal Investigator: Roberta Zambrini. (2015-2017). CSIC Budget: 27.000 €

SET@QT

Espintrónica, Energía y Topología en el Transporte Cuántico.
[FIS2014-52564]. Principal Investigator: Rosa López. (2015-2017). UIB Budget: 50.000€

ESoTECoS

Emergent social, technical and ecological complex systems. CSIC [FIS2015-63628-C2-1-R] . UIB [FIS2015-63628-C2-2-R] Principal Investigators: Pere Colet and Maxi San Miguel. (2016-2018). CSIC Budget: 187.550€. UIB Budget: 211.750€

IDEA

Improving data Decoding in optical communication networks All-optically using neuro-inspired photonic systems. CSIC [TEC2016-80063-C3-1-R] and UIB [TEC2016-80063-C3-3-R]. Principal Investigators: Ingo Fischer and Claudio Mirasso (2016-2019). CSIC Budget: 66.550€. UIB Budget: 46.585€

LAOP

Estudios lagrangianos de fenomenos oceanicos: patrones de conectividad, barreras al transporte y poblaciones marinas.
[CTM2015-66407-P]. Principal Investigator: Cristóbal Lopez (2016-2018).
UIB Budget: 171.941€

QuStruct

Quantum Information preserving with structured embbedings.
[FIS2015-66860-P]. Principal Investigator: Fernando Galve Conde (2016-2018). UIB Budget: 11.858€

3.3 OTHER IFISC RESEARCH PROJECTS

Eighties

Experimental information for the Geographical and Historical study of urban Territories with Complexity Science. French National Research Network on Complex Systems. Principal Investigator: Thomas Louail. (2015-2016).

HYDROGENCONNECT

Hydrodynamic networks, population Genetics and oceanic connectivity for the design of Marine Protected Areas in the Mediterranean Sea. ENVIMED Project (France). Principal Investigator: Vincent Rossi. (2015-2016)

ND-PHOT

Nonlinear Dynamics in photonics for future information and communication technologies. CNRS-CSIC. Prinicipal Investigator: Damià Gomila (2016-2018). CSIC Budget: 10.000€

3.4 RESEARCH PROJECTS AND COLLABORATION NETWORKS WITH PARTICIPATION OF IFISC MEMBERS

KNOWeSCAPE

Analyzing the dynamics of information and knowledge landscapes. COST ACTION TD1210. European Coordinator: Andreas Schamhorst. IFISC Spanish member of management committee: Maxi San Miguel. (2012-2017)

QTD

Thermodynamics in the Quantum Regime. COST 1209 Project. IFISC Spanish member of management committee: Roberta Zambrini. (2013-2017)

COSTNET

European Cooperation for Statistics of Network Data Science. COST Plan Project. European Union. COST Action [CA15109]. IFISC Spanish member of management committee: Maxi San Miguel (2016-2020)

FIS2014-REDT

Red de Física Estadística de no Equilibrio y sus Aplicaciones Multidisciplinares. MINECO. [FIS2014-57117-REDT]. IFISC Principal Investigator: David Sánchez. (2014-2016)

COMSOTEC

Red de Sistemas Complejos Socio-tecnológicos. FIS2015-71795-REDT. MINECO (2015-2017). IFISC Principal Investigator: Maxi San Miguel.

RICE

Quantum Information Network in Spain. FIS2014-53592-REDT. IFISC Principal Investigator: Roberta Zambrini. (2015-2016).

IBERSINC

Red sobre dinámica y sincronizacion en redes complejas. [FIS2015-71929-REDT]. Principal Investigator: Miguel C. Soriano (2016-2017)

IN-TREE

INCT in Interdisciplinary and Transdisciplinary Studies in Ecology and Evolution.
CNPq, CAPES, FAPESB Brazil. Principal Investigator: Emilio Hernández García.

3.5 OTHER PUBLIC FUNDING

Twiter and Tourism

Estudi d´indicadors turístics a través de Twitter. Convenio. Consell de Mallorca. Principal Investigator: Jose J. Ramasco (2016) Budget: 2.949,98€

DERR@IFISC

Ajudes especials de recerca, desenvolupament tecnológic I innovació del Govern Balear. Principal Investigator: Claudio Mirasso (2016). Budget: 18.950€

SESC

Seminaris d´excel·ència en sistemes complexos. Ajudes especials de recerca, desenvolupament tecnològic I innovació del Govern Balear. [AAEE55/2015] Principal Investigator: Llorenç Serra (2016). Budget: 5.000€

3.6 RESEARCH CONTRACTS

NUUBO

ECG classification using reservoir computing. Research Cooperation Agreement. Principal Investigator: Miguel C. Soriano. (2015-2016). Budget: 75.000 €

CAASE

Coupled Animal and Artificial Sensing for Sustainable Ecosystems: The Red Sea as a CAASE Study. Office of Suported Research. KAUST (Saudi Arabia). Principal Investigator: Victor M. Eguíluz. (2016-2018). Budget: 160.840€

NeuroQNet

Neuromorphic Computing using Quantum Dot- Networks. Wokswagen Foundation (Germany). Principal Investigator: Ingo Fischer (2016-2018). Budget: 115.000€

Red Eléctrica

Il·lumina´t: Exhibition on the International year of light and light-based technologies. Agreement with Red Electrica Española. FUEIB. Principal Investigator: Claudio Mirasso. (2015-2016). Budget: 20.000 €

3 RESEARCH PROJECTS AND FUNDING

4

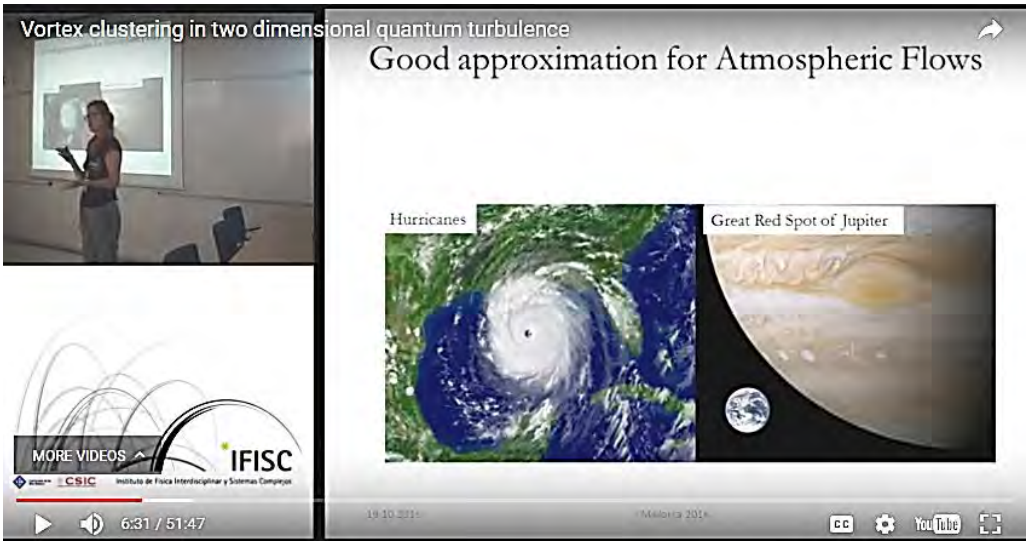
IFISC SEMINARS

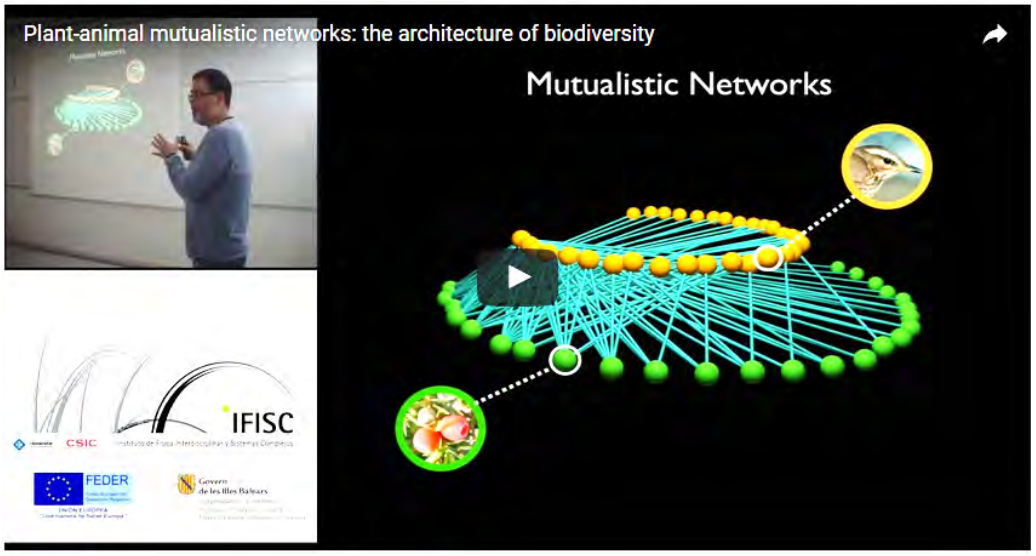
Coordinators:

Llorenç Serra
Ingo Fischer

The full listing of the 58 seminars given at IFISC during 2016 can be found in **http://ifisc.uib-csic.es/en/events/seminars/** and in the Appendix of this Report.

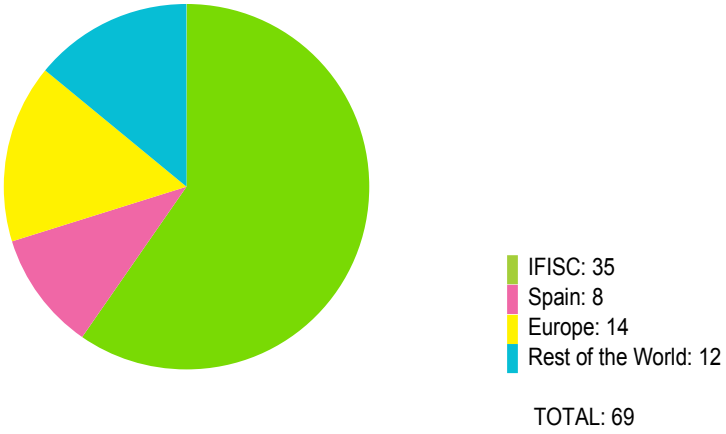
Seminars are broadcasted live and recorded.They are globally available at **http://ifisc.uib-csic.es/en/events/seminars/**, and also in the youtube channel **https://www.youtube.com/user/IFISCseminars/**



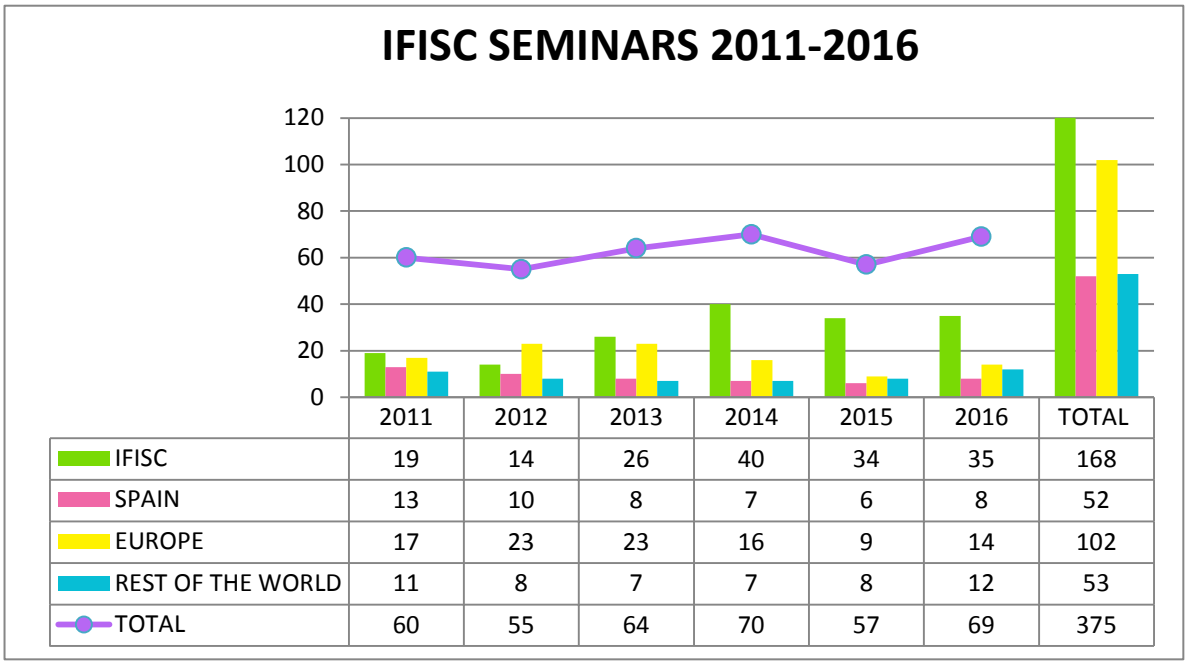


The following graphs show the distribution of seminars by geographic procedence of the speaker for 2016 and for the previous years:

PROCEDENCE OF SPEAKERS AT IFISC SEMINARS 2016



IFISC SEMINARS 2011-2016



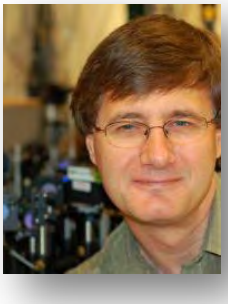
	2011	2012	2013	2014	2015	2016	TOTAL
IFISC	19	14	26	40	34	35	168
SPAIN	13	10	8	7	6	8	52
EUROPE	17	23	23	16	9	14	102
REST OF THE WORLD	11	8	7	7	8	12	53
TOTAL	60	55	64	70	57	69	375

The **Colloquia of Excellence** represent a special series of seminars by eminent speakers who are working at the forefront of complex systems and are inspiring the evolution of the field. Introduced in 2016, this series of Colloquia allows students and scientists of **IFISC** and the UIB to interact with leaders in Complex Systems science in the intimate environment of our Institute and to discuss the challenges and future directions of this cross-disciplinary research field.

Apr 13
Language as a complex adaptive system.
Luc Steels, Universitat Pompeu Fabra, CSIC, Spain

May 04
The electric grid and the risk of large cascading blackouts.
Benjamin Carreras, BACV Solutions Inc., USA

May 11
***Plant-animal mutualistic networks: the architecture of biodiversity*.**
Jordi Bascompte, University of Zurich, Switzerland



Jun 15
***Dynamics of autonomous time-delay Boolean networks*.**
Dan Gauthier, The Ohio State University, USA

Jul 06
***Topology and superconductivity: complexity without complex numbers*.**
Carlo Beenakker, Leiden University, Netherlands

4 IFISC SEMINARS

5

PUBLICATIONS

IFISC RESEARCH RESULTS HAVE BBEN REPORTED IN THE FOLLOWING PUBLICATIONS DURING 2016:

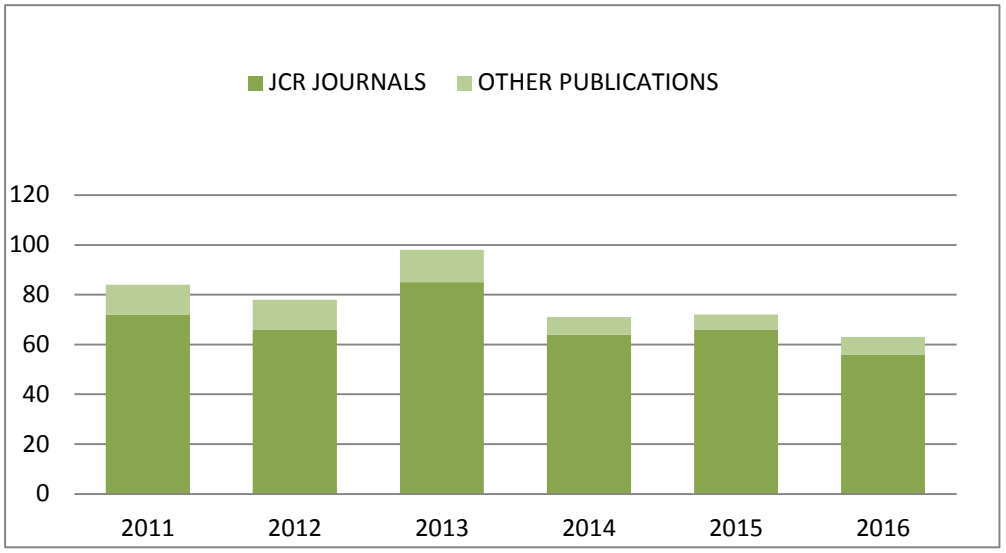
- Papers in journals indexed in the Journal Citation Reports: **56**
- Other publications: **8**

The following tables put these numbers in the context of the publication activity during the past years, and specify which are the main journals in which IFISC papers are published. It is a strategic commitment of IFISC to target cross-disciplinary research areas lying outside the domain of traditional physics. The success in this objective is highlighted in the tables by indicating the number of publications in *non-physics journals*.

With respect to publications in high impact journals, in the period 2011-2016 IFISC has published 1 paper in Reviews of Modern Physics, 1 paper in Science, 2 papers in PNAS, 5 papers in Nature Communications, 1 paper in Nature Geophysics, and 26 papers in Physical Review Letters.

Full listing of publications and links to the full text are in **http://ifisc.uib-csic.es/en/publications/** and in the Appendix of this Report.

IFISC PUBLICATIONS 2011-2016



	2011	2012	2013	2014	2015	2016	TOTAL
JCR JOURNALS	72	66	85	64	66	56	409
OTHER PUBLICATIONS	12	12	13	7	6	8	58
TOTAL	84	78	98	73	72	64	467

JOURNALS WITH THE LARGEST NUMBER OF PUBLICATIONS

IFISC PUBLICATIONS	2011	2012	2013	2014	2015	2016	TOTAL
Physics journals							
Physical Review E	11	11	9	14	12	9	66
Physical Review B	5	2	8	7	7	5	34
Physical Review Letters	6	4	8	3	4	1	26
Physical Review A	4	3	5	5	2	3	22
New Journal of Physics	0	3	2	3	1	5	14
Physica A	2	3	2	2	0	0	9
Multidisciplinary journals							
Plos One	7	4	0	5	6	2	24
Scientific Reports	0	3	4	2	3	7	19
Nature Communications	1	0	1	0	3	0	5
IEEE journals	4	1	4	0	3	2	14
Other non-physics journals	8	10	13	13	8	8	60

The journals included in the “other non-physics journals” category are the following:

Biosciences:

Trends in Ecology and Evolution, Journal of Theoretical Biology, Journal of the Royal Society Interface, Neuroimage, Interface Focus, PLoS Computational Biology, Ecological Complexity, BMC evolutionary Biology, BMC Medicine, Macromolecular Theory and Simulations, Macromolecules, Ecography, Frontiers in Computational Neuroscience, Frontiers in Human Neuroscience, Journal of Heredity, Physiological Reports, Journal of Applied Ecology, Theoretical Biology and Medical Modelling, and Global Ecology and Biogeography.

Geosciences:

Nature Geoscience, Journal of Geophysical Research, Geophysical Research Letters, Deep-Sea Research I, Nonlinear Processes in Geophysics, Ocean Modelling, Continental Shelf Research, Environmental fluid mechanics, and Journal of Climate.

Social and sociotechnical systems:

Journal of Artificial Societies and Social Simulation, Quantitative Finance, International Journal of the Sociology of Language, Transportation Journal, Transportation, Journal of Air Transport management, and Journal of Transport Geography.

Data science:

Computing and Informatics, EPJ Data Science, Journal of Machine Learning Research.

5 PUBLICATIONS

6

CONFERENCES AND WORKSHOPS

6.1 IFISC WORKSHOPS

ICE-3 Quantum Information in Spain

APRIL 13 - 15
SCIENTIFIC ORGANIZERS: Roberta Zambrini (IFISC, Spain) and Fernando Galve (IFISC, Spain).

The 3rd edition of Quantum Information in Spain **ICE-3** was organized by IFISC (CSIC-UIB) at the university campus of Palma de Mallorca **13-15 April 2016**. This conference was part of a series of itinerant events aiming to be a reference for the Spanish community working in Quantum Information. The **program** included 27 contributed talks, several posters (with flash plenary presentations), and an*international* collection of 9 invited talks, and discussion time was planned. The conference series was promoted by the "Red de Excelencia" **RICE**. The 2-days school**"New trends in quantum information"**, funded by RICE, was held the days before: April 11-12.

Web site: **ice3.ifisc.uib-csic.es**

6.2 SCHOOLS

RICE School: New Trends in Quantum Information

The first **RICE School "New trends in Quantum Information"** was held between April 11-12, **2016,** at **IFISC (Institute for Cross-interdisciplinary Physics and Complex Systems)** in Palma de Mallorca (Spain) and was followed by the **ICE-3 Conference**.. The school was designed for PhD students and postdocs who were interested in learning about both experimental and theoretical aspects of quantum phenomena and information.

The **Spanish Network on Quantum Information (RICE)** promotes research in quantum information, simulations and technologies, through the establishment of collaborations inside the network and with international groups, and the training of new scientists in these topics. Among RICE activities, the organization of conferences has been particularly successful and this year a further step is taken with the organization of a RICE school. Twenty participants and the lecturers will be funded (travel, accommodation, meals) by RICE. **Funding** will also cover the attendance (*not the registration fee*) to the conference.

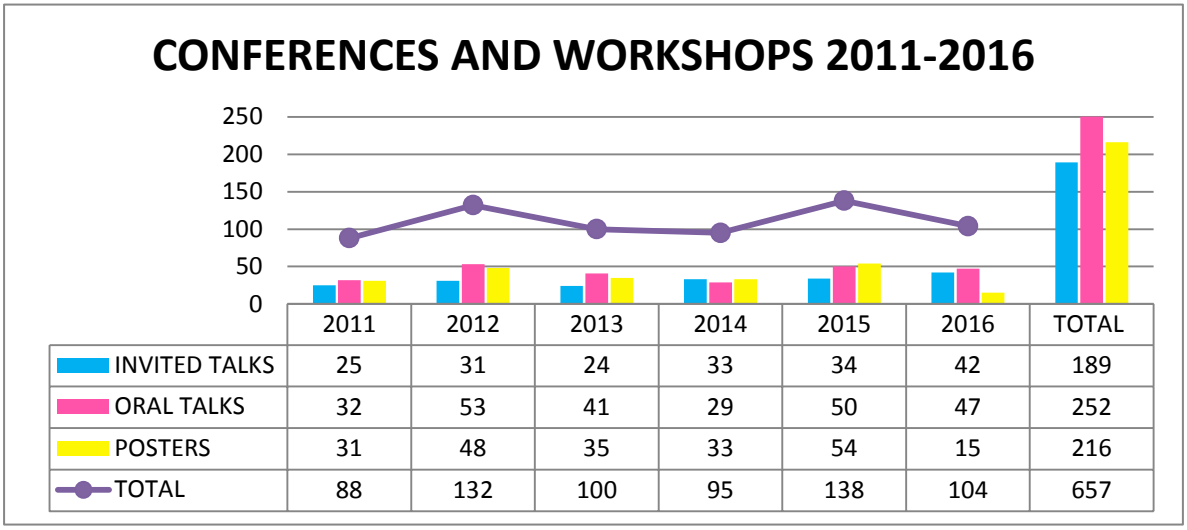
The IFISC Scientific Organizers were: Roberta Zambrini and Gian Luca Giorgi

6.3 COMMUNICATIONS TO SCIENTIFIC CONFERENCES 2016

- Invited talks: **42**
- Oral Communications: **47**
- Posters: **15**
- Total: **104**

Full listing in the Appendix of this Report.

PRESENTATIONS AT CONFERENCES AND WORKSHOPS 2011-2016



	2011	2012	2013	2014	2015	2016	TOTAL
INVITED TALKS	25	31	24	33	34	42	189
ORAL TALKS	32	53	41	29	50	47	252
POSTERS	31	48	35	33	54	15	216
TOTAL	88	132	100	95	138	104	657

6.4 SCIENTIFIC COMMITTEES AND ORGANIZATION OF CONFERENCES AND WORKSHOPS

San Miguel, Maxi; Klemm, Konstantin
Members of the Program Committte of NetSci-X 2016, Wroclaw, Poland.
January 11-13

Zambrini, Roberta; Giorgi, Gian Luca
Organization of the First RICE School "New trends in Quantum Information", Palma de Mallorca, Spain.
April 11-12

Galve, Fernando; Zambrini,Roberta
Organization of ICE-3 (Información Cuántica en España), Palma de Mallorca, Spain.
April 13-15

Hernandez-Garcia, Emilio; Ramasco, Jose J.
Members of the Program Committee of COMPLEXIS 2016.
April 22-24

C. Soriano, Miguel
Minisymposium organizer on "Consistency and Chaos in Complex Photonic Systems".XXXVI Dynamics Days Europe 2016 Corfu, Greece.
June 6-10

Eguiluz, V.M.
Member of the Program Committee of the 2nd International Conference on Computational Social Science IC2S2. Evanston, USA
June 24-26

Colet, Pere
Member of the Scientific Commitee of the VI Summer school on statistical physics and complex systems, Pamplona, Spain.
June 20 – July 01

Hernandez-Garcia, Emilio; Lopez, Cristobal.
Scientific and Organizing Commitee of the Third International Workshop on Nonlinear Processes in Oceanic and Atmospheric Flows: NLOA2016, Madrid, Spain.
July 6-8

Lamanna, Fabio; Ramasco, JJ
Organization of the workshop UrbanNet 2016 Satellite, Conference of Complex Systems 2016, Amsterdam, Netherlands.
September 21

Eguiluz, V.M.
Member of the Program Committee of the 8th International Conference on Social Informatics SocInfo 2016.
Bellevue, WA, USA
November 14-17

6 CONFERENCES AND WORKSHOPS

7

OTHER ACTIVITIES

7.1 MASTER THESIS

Khadka, Jason
Dynamics of vascular branching morphogenesis
Supervisors Sintes, Tomas; Matias, Manuel A.
July 29

Hoffman, Xavier
Cooperative Epidemic Spreading
Supervisors: Boguñá, M. ; Toral, Raul
September 15

Payrató, Claudia
Robustness of Plant-Pollinator Mutualistic Networks to Phenological Mismatches
Supervisor: Ramasco, Jose J.
September 15

De la Fuente, Rebeca
Network properties of genotype-phenotype mappings
Supervisor: Hernández-García, Emilio
September 20

Estarellas, Cristian
Modeling the Entorhinal Cortex - Dentate Gyrus Circuit
Supervisor: Mirasso, Claudio
September 27

Schönsberg, Francesca
Pattern formation in clonal plants
Supervisors: Gomila, Damià; Hernández-Garcia, Emilio
September 30

Gómez, Juan Luis
Noise Effects in Kerr Frequency Combs
Supervisor: Gomila, Damià
September 30

Cabot, Albert
Synchronization and Quantum Correlations in Optomechanical Systems
Supervisors: Zambrini, Roberta; Galve Conde, Fernando
November 25

7.2 PHD THESIS

Fleurquin, Pablo
Systemic propagation of delays in the air-transportation network
Supervisors: Eguiluz, Victor M.; Ramasco, Jose J.
March 11

Carro, Adrián
Individual-based models of collective dynamics in socio-economic systems
Supervisors: Toral, Raúl; San Miguel, Maxi
October 13

Osca, Javier
Majorana physics in hybrid nanowires, topological phases and transport
Supervisors: Serra, Llorenç; López, Rosa
November 9

Martínez-Llinás, Jade
Photonic Systems with Multiple Delay Times: Synchronization, Square-Wave Switching and State-Dependent Delay
Supervisor. Colet, Pere
November 15

7.3 AWARDS

Konstantin Klemm and Roberta Zambrini
Recognized as 'Outstanding Referees' of the American Physical Society journals for their work during 2015

7.4 MEMBERS OF EDITORIAL BOARD OF SCIENTIFIC JOURNALS

Member of the Editorial Advisory Board of the Journal Ecological Complexity.
Hernandez-Garcia, Emilio

frontiers

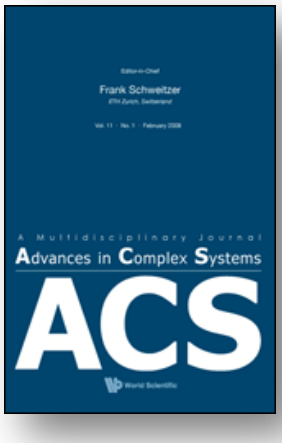
Members of the editorial board of Frontiers in Physics (Interdisciplinary Physics section):
Ramasco, J.J. and Eguiluz, Victor M.

Member of the editorial board of PLoS ONE
Ramasco, JJ

PLOS ONE

SCIENTIFIC REPORTS

Member of the editorial board for Nature Scientific Reports.
Ramasco, JJ



Editorial board member of the Journal Advances in Complex Systems.
Klemm, Konstantin; Eguíluz, Victor M.

7.5 OTHER COMMITTEESS

San Miguel, Maxi
Member of C3 Commission of Statistical Physics of IUPAP.
2011 - 2016

Colet, Pere
Member of the Board of the Computational Physics Group of the European Physical Society.
2016-

Toral, Raul
Member of the Board of the Statistical and Nonlinear Physics of the European Physical Society.
2016-

Toral, Raul
President of the Board of the Group of Statistical and Nonlinear Physics (GEFENOL) of the Spanish Physical Society
2013-2017

Ramasco, JJ
Elected member of the council of the Complex Systems Society.
2013 – 2017

Sintes, Tomas
Member of Scientic Committee of FisEs
2016-2018

Fischer, Ingo
International Collaborator of the Graduate Training in Wireless Intelligent Sensor Networks (WISeNet), Duke University, U.S.

7.6 RESEARCH STAYS IN OTHER CENTERS

UWA Oceans Institute. Perth, Australia.
Rodríguez, Jorge P.
January 7-22

Physics department, Universidade Federal de Pernambuco, Brazil.
Estancia dentro del programa Investigadores Visitantes Extranjeros, Brazil.
Mirasso, Claudio
January 21 – February 7

ICMM Madrid, Spain.
Proposal for a chiral Maxwell Demon.
Rosselló, Guillem
March 8 – April 30

Vrije Universiteit Brussel, Belgium.
Soriano, Miguel Cornelles
April 28-30

Teschniche Universität Berlin, Germany.
Inelastic effects on quantum transport.
Rosselló, Guillem
May 16- 31

National Chiao Tung University. Hsinchu, Taiwan.
Stay in the Department of Applied Mathematics, under the supervision of Jonq Juang. Funding from Summer Program in Taiwan for Graduate Students 2016.
Rodríguez, Jorge P.
June 26 – August 22

Department of Chemistry and Biochemistry, University of California at San Diego, USA.
Toral, Raul
July 25 – August 10

EAWAG Kastanienbaum, Switzerland.
Stay under the supervision of Carlos J. Melián.
Rodríguez, Jorge P.
July 29 – September 29

Physics Department, Universidade Federal de Pernambuco, Brazil.
Mirasso, Claudio
September 1-17

Femto-ST, Besancon, France.
Visit of the Femto-ST Institute in the framework of the PICS project ND-Phot.
Fischer, Ingo
November 17-22

Technische Universitat Berlin, Germany.
Visit to Department of Theoretical Physics, invited by Fakhteh Ghanbarnejad.
Rodríguez, Jorge P.
November 21-23

Departament de Matéria Condensada, Unviersitat de Barcelona, Spain.
Colet, Pere
November 25

Femto-ST Institute (CNRS-Université Franche-Compté), Besançon, France.
Scientific collaboration with Dr. Yanne K. Chembo.
Gomila, Damià; Colet, Pere
November 28 – December 1

Max Planck Institute for the Physics of Complex Systems, Dresden, Germany.
Collaboration with members of the Institute.
Matias, Manuel A.
December 5-11

ETH Zürich, Switzerland.
Visit to Prof. J. Home's group.
Galve Conde, Fernando
December 14-16

Physics Department, Vrije Universiteit Brussel, Belgium.
Gomila, Damià; Colet, Pere
December 16-17

7. 7 IFISC MASTER

IFISC Master in *Physics of Complex Systems*

https://ifisc.uib-csic.es/master/

In October 2012 IFISC started a Master program in Physics of Complex Systems. It is a one year (60 ECTS) official Master of the University of the Balearic Islands, in collaboration with CSIC. The courses provide an innovative entry point to Complex Systems fundamentals and applications and introduce the students in the research lines developed at IFISC. They are though by IFISC researchers.

This is the 2016-2017 Master syllabus:

Structural module courses (39 credits):

Complex networks (3 credits)	V. M. Eguíluz
Cooperative and critical phenomena (6 credits)	T. Sintes E. Hernández García
Dynamical systems and chaos (6 credits)	M. Matías, K. Klemm
Introduction to complex systems (3 credits)	M. San Miguel, E. Hernández-García, R. Zambrini
Pattern formation (3 credits)	D. Gomila
Scientific presentation and visualization (3 credits)	J. J. Ramasco
Stochastic processes (3 credits)	P. Colet, R. Toral
Stochastic simulation methods (6 credits)	R. Toral, P. Colet
Quantum physics for complex systems (6 credits)	L. Serra, R. Zambrini

Specific module courses (9 credits minimum)

Collective phenomena in social dynamics (3 credits)	M. San Miguel, J. J. Ramasco
Information theory (3 credits)	D. Sánchez
Modelling and dynamics of neural systems (3 credits)	C. Mirasso
Non equilibrium collective phenomena (3 credits)	C. López
Nonlinear photonics (6 credits)	I. Fischer; M.C. Soriano
Quantum and nonlinear optics (3 credits)	R. Zambrini
Quantum transport and quantum noise (3 credits)	R. López
Spatiotemporal dynamics (3 credits)	D. Gomila
Statistical physics in biological systems (3 credits)	T. Sintes
Systems biology (3 credits)	M. Matías
Turbulence and nonlinear phenomena in fluid flows (3 credits)	C. López

Master thesis (12 credits)	P. Colet

Other Postgraduate Courses tought in 2016

The following courses were also taught in the Master of Advanced Physics and Applied Mathematics, University of the Balearic Islands:

- **Cooperative and critical phenomena**
  Tomàs Sintes, Emilio Hernández-García

- **Stochastic simulation methods**
  Pere Colet, Raúl Toral

- **Scientific presentation and visualization**
  José J. Ramasco

- **Spintronics**
  Rosa López, Llorenç Serra, David Sánchez

Master in Human Evolution and Cognition, University of the Balearic Islands:

- **Neural networks**
  Claudio Mirasso

7 OTHER ACTIVITIES

8

OUTREACH ACTIVITIES

8.1 CONFERENCE SERIES

Conference Series
"Exploring Boundaries Between Disciplines IX"

In 2016 the subject of the Conference Series was "From Human to Artifitical Intelligence".

PROGRAMME

MAY 4

La Inteligencia: una capacidad integradora de la mente humana.
Intelligence: integrative capacity of human mind.

Prof. Robert Colom, Universidad Autónoma, Madrid, Spain
Intelligence is one of the most relevant psychological variants to understand human behavior. It is the psychological trait that can be measured with greater reliability. Scientists have wondered about the basic elements that define this psychological variable, on which are the processes on which our intelligent behavior is based, on its biological basis and have also explored the contribution of genetic and non-genetic factors to the observed variability In performance. The conference presents a series of evidences on this integrating capacity of the human mind.

MAY 11

El cerebro es una red social
Brain is a social network

Prof. Javier Martín Buldú, Universidad Rey Juan Carlos, Madrid, and Centro de Tecnologías Biodmédicas de Madrid, Spain.
Since the beginning of the 21st century the Science of Networks has been a small revolution in applied physics and mathematics. By combining graph theory, nonlinear dynamics and statistical physics, it is possible to analyze an infinite number of real problems where a large number of systems are organized in the form of a network. In this way, we can understand the structure of systems as diverse as social networks, means of transport or networks of genetic interaction. In this paper we will explain how to apply different methodologies from the Science of Networks to study one of the complex systems par excellence: The brain. We will see how the different brain regions connect to form a great "social network" that adapts and evolves over time, and whose components interact and organize in a similar way as do users of Facebook or Twitter.

MAY 18

Inteligencia artificial y “Deep learning”, ¿liberando al kranen?

Artificial Intelligence and deep learning, releasing the kranen?

Prof. Raúl Vicente, Faculty of Mathematics and Computer Science, Tartu University, Estonia. Computational Neuroscience Group Director.

What kind of algorithm is capable of translating conversations between Chinese and English in real time, driving cars without a driver, or learning to play video games better than humans? The last major revolution in the field of Artificial Intelligence is called Deep Learning. During this talk, and after a visit to the different "tribes" that inhabit the world of artificial intelligence, we will be entertaining to discover the applications that Deep Learning has revolutionized and why they work so well. We will also talk about what ingredients of the human brain we still need to incorporate into the recipe of true Artificial Intelligence. Finally we will discuss the race towards a general artificial intelligence and if this entails some real danger for our society.

IFISC organized the Conference Series in collaboration with Fundació La Caixa (Obra Social).

8.2 OPEN DAYS @ IFISC

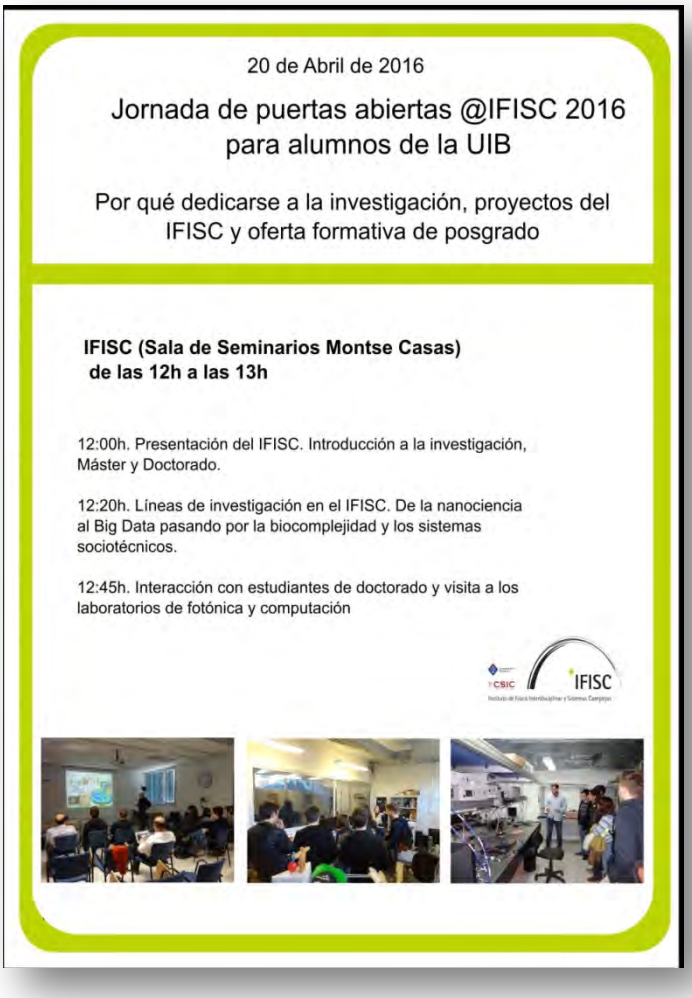
IFISC organized an open doors day for the students of the University of the Balearic Islands. Students of any grade were invited to attend (mostly lasts years students), especially open-minded youngsters, who have an intellectual and scientific concern. The aim of the visit was to explain what the IFISC is and what means to work on research here, as well as to transmit the interdisciplinary spirit of this Center.

The activity took place on Thursday, February the 25th, at 3:30 pm. The different research lines were explained likewise the projects that are we currently working on. We also informed about our Master in Complex Systems and the different ways to get to a PhD degree. Visits at the Photonics Laboratory and computing rooms were also included. The talks were given by IFISC researchers, who explained their experiences.

This was a very good chance for students to speak directly to doctoral students, share opinions and resolve any doubts.

The "Poster Party" also took place at IFISC on Thursday February 25th, in the IFISC basement. The Poster Party is an ideal occasion for presenting the research of IFISC team in a relaxed environment and to get to know what other members of the IFISC community do. There were two sessions for presenting posters, with beer-breaks and some appetizers between the two sessions. In addition, there was a "Posters Contest" to choose the best among them for representing the different IFISC research lines on the poster's corridor next to the IFISC Seminar room.

On April 20 IFISC organized another Open Doors Day at IFISC for UIB students presenting the Institute as a way to start on the research field with its master and PhD. Research lines were explained and students could talk with PhD students and visit de laboratories.



8.3 OTHER CONFERENCES AND EVENTS

IFISC participated in the "**Fira de la Ciència i la Tecnologia d'Inca**" (October 29-30).

The participation included a Laser-Grafitti exhibition by C. Mirasso and local artists, and a stand with the following experimental set-ups:

- Aerial laser communications
- Crookes radiometer
- Infinite Mirrors
- Levitating water
- 3D images

http://incaciutat.com/fira-ciencia-tecnologia-2016/


IFISC

8.4 PRESS & MEDIA

IFISC research has received attention from newspapers and other media.

During 2016, IFISC activities produced 43 press releases and appearances in written and digital press, and 4 clips in radio and TV. See the full lists in the Appendix.

SOCIAL NETS IMPACT SUMMARY

TWITTER

Total twits 2.015

Total Followers 999 (increasing 20% followers in 2016)

67% men / 33% women interested in science, technology, politics and events

Languages most used: Spanish and English

68% located in Spain

FACEBOOK

Facebook fans 549 (increasing 54% fans in 2016)

62% men / 37% women between 18 and 44 years old (42% of them)

Languages most used: Spanish, English, Portuguese, Catalan

Mostly Located in Spain, Mexico and Brazil

8 OUTREACH ACTIVITIES

APPENDIX

a.4. IFISC seminars and talks 2016

In the electronic version of this report, titles are hyperlinked to the recording of the seminar, if available. IFISC colloquia are already listed in page 50.

Jan 12
Modelling the dynamical sinking of biogenic particles in oceanic flow.
Pedro Monroy, IFISC.

Jan 27
Synchronization of Heterogeneous Oscillators by Noninvasive Time-Delayed Cross Coupling.
Thomas Jüngling, IFISC.

Feb 03
Quantum Darwinism and non-Markovian evolution.
Fernando Galve, IFISC

Feb 10
Machine learning with photonic delay systems.
Silvia Ortin, IFISC

Mar 02
Boolean network dynamics: applications and challenges.
Konstantin Klemm, IFISC.

Mar 11
Systemic propagation of delays in the air-transportation network,
Pablo Fleurquin, IFISC.

Mar 15
Organising principles of brain function, or how to control brain behaviour with minimal effort.
José Luís Pérez Velázquez, University of Toronto, Canada.

Mar 23
Transmission of bipartite quantum entanglement through a random medium.
Manutea Cande, IFISC.

Apr 06
Coulomb drag effect in coupled quantum dots.
Rosa López, IFISC.

Apr 14
Majorana Zero Modes in Graphene.
Ramón Aguado, Instituto De Materiales De Madrid (CSIC) Spain.

Apr 20
Quantum Information with untrusted devices.
Daniel Cavalcanti, ICFO Barcelona, Spain.

Apr 26
Chimeras in systems with global interactions.
Mario Cosenza, Universidad de Los Andes, Mérida, Venezuela.

Apr 27
Presentation of new IFISC projects.
Various IFISC members

May 05
Recent research topics in plasma turbulence and induced transport.
Benjamin A. Carreras, BACV Solutions Inc., USA.

May 18
Pattern forming instabilities leading to the formation of hexagonal clusters.
Jean-Baptiste Delfau, IFISC.

May 19
Why human mobility is not a Levy walk.
Riccardo Gallotti, IPhT, CEA, Paris-Saclay, France.

May 25
Journey to the center of genetics. The experience of a physicist in Iceland.
Andrei Manolescu, Reykjavik University, Iceland.

Jun 01
Geometry dependent electronic states in core-shell nanowires.
Andrei Manolescu, Reykjavik University, Iceland.

Jun 08
Exploring causality and phase diversity in brain signals.
Fernanda Matias, Universidade Federal De Alagoas, Maceió, Brazil.

Jun 16
Pattern formation and nonlinear dynamics in ferrofluids.
Sérgio A. Lira, Instituto de Física, Universidade Federal de Alagoas, Maceió, Brazil.

Jun 22
The evolution of dispersal of reproducing competitive individuals.
Flora S. Bacelar, IFISC and Universidade Federal de Bahia, Salvador, Brazil.

Jun 29
Anomalous critical and supercritical connectivity transitions.
Jan Nagler, ETH Zürich, Switzerland.

Jun 30
A decomposition method to reduce low dimensional chaotic systems into a linear harmonic oscillator with nonlinear feedback.
Josep Canyelles Pericas, Northumbria University Newcastle, UK.

Jul 13
Image and video noise removal.
Antoni Buades, UIB, Mallorca, Spain.

Jul 14
Neuromorphic Computing Using Networks of Quantum Dot Emitters.
Daniel Brunner, FEMTO-ST, Besançon, France.

Jul 20
Speech Graphs as a Tool for Psychiatric Diagnosis.
Mauro Coppelli, Universidade Federal de Pernambuco, Brazil.

Jul 27
Brownian Carnot Engine.
Juan MR Parrondo, Universidad Complutense de Madrid, Spain

Jul 28
Ranking as a low-dimensional signal of socio-economic processes in complex systems.
Gourab Ghoshal, University of Rochester, NY, USA.

Jul 29
Dynamics of vascular branching morphogenesis.
Jason Khadka, IFISC.

Sep 06
The non-linear noisy voter model.
Antonio Fernández-Peralta, IFISC.

Sep 07
Online games: a novel approach to explore how partial information influences random search processes.
Ricardo Martínez-García, Princeton University, NJ, USA.

Sep 14
Large deviations in Taylor dispersion.
Christian Van Den Broeck, Universiteit Hasselt, Belgium.

Sep 15
Cooperative Epidemic Spreading.
Xavier Hoffmann, IFISC.

Sep 15
Robustness of plant-pollinator mutualistic networks to phenological mismatches.
Cláudia Payrató, IFISC.

Sep 20
Network properties of genotype-phenotype mappings.
Rebeca de la Fuente, IFISC. .

Sep 27
Modeling the entorhinal cortex-Dentate gyrus circuit.
Cristian Estarellas, IFISC.

Sep 14
Individual-based models of collective dynamics in socio-economic systems.
Adrian Carro , IFISC.

Sep 30
Noise Effects in Kerr Frequency Combs.
Juan Luis Gómez, IFISC.

Sep 30
Pattern formation in clonal plants.
Francesca Schonsberg, IFISC.

Sep 30
Interdisciplinarity and Funding in Modern Science.
Vito Latora, School Of Mathematical Sciences, Queen Mary University Of London, UK.

Sep 30
Space, Time, and Visual Analytics.
Natalia And Gennady Andrienko, Fraunhofer Institute, Germany.

Oct 05
Semiconductor laser based networks and applications.
Apostolos Argyris, IFISC.

Oct 13
Tunnel spectroscopy in a normal metal-quantum dot-superconductor hybrid system.
Jong Soo Lim, Korea Institute for Advanced Studies KIAS, Korea.

Oct 14
Bound states in the continuum and thermoelectric effects in interacting double quantum dots.
Miguel A. Sierra, IFISC.

Oct 17
Pattern formation and directional growth distribution for clonal growth plants.
Daniel Ruiz, IFISC.

Oct 18
Interaction of magnetic atoms with superconducting materials.
Ignacio Pascual, CIC NanoGune, Donostia, Spain.

Oct 19
Vortex clustering in two dimensional quantum turbulence.
Luiza Angheluta, Univ. Of Oslo, Norway.

Oct 21
Overview and experiences of SENTINEL-1 and LISA Pathfinder: two successful European space missions.
César García and Ramón Torres, European Space Agency, France.

Oct 25
Anticipated synchronization in neuronal circuits.
Claudio Mirasso, IFISC.

Oct 26
Transport properties of all-electric all-semiconductor spin transistors.
M. Isabel Alomar, IFISC.

Oct 27
Time-dependent functional alteration of neural networks before epileptic seizures.
Adrià Tauste, IMIM, PRBB, U. Pompeu Fabra, Barcelona, Spain.

Oct 27
Recent advances in WGM resonators theory and applications.
Yanne Chembo, FEMTO-ST, UBFC, Besançon, France.

Oct 28
Dynamics on networks: competition of temporal and topological correlations.
Oriol Artime, IFISC.

Nov 02
Lost in transportation: when public transport maps are too complex for our brain.
Riccardo Gallotti, IFISC.

Nov 07
All-optical reservoir computing using semiconductor lasers with optical feedback: fundamental properties and possible extensions.
Julián Bueno, IFISC.

Nov 09
Majorana physics in hybrid nanowires, topological phases and transport.
Javier Osca, IFISC.

Nov 15
Photonic Systems with Multiple Delay Times.
Jade Martínez Llinàs, IFISC.

Nov 16
A quantum Hall Maxwell Demon.
Guillem Rossello, IFISC.

Nov 23
A model of robust network of networks inspired by brain activities.
Byungjoon Min, IFISC.

Nov 25
Synchronization and Quantum Correlations in Optomechanical Systems.
Albert Cabot Martorell, IFISC.

Nov 30
Human mobility and transport networks.
Aleix Bassolas, IFISC.

Dec 12
Dynamic Demand Control applied to electric power grid networks.
Eder Batista Tchawou, IFISC.

Dec 15
Presentation of new IFISC projects.
Various IFISC Members.

Dec 21
Nonlinear strategies to estimate synaptic conductances.
Catalina Vich, UIB, Mallorca, Spain.

a.5. Publications

In the electronic version of this report, titles are hyperlinked to the summary and PDF file of the publications

a.5.1 JCR Publications

Cotunneling Drag Effect in Coulomb-Coupled Quantum Dots
Keller, A. J.; Lim, J.S.; Sánchez, D.; López, R.; Amasha, S.; Katine, J. A.; Shtrikman, H.; Goldhaber-Gordon, D.
Physical Review Letters **117**, 066602 (1-5)

Key questions in marine megafauna movement ecology
Hays, G.C.; Ferreira, L.C.; Sequeira, A.M.M.; Meekan, M.G.; Duarte, C.M.; Bailey, H.; Bailleul, F.; Bowen, W.D.; Caley, M.J.; Costa, D.P.; Eguíluz, V.M.; et al
Trends in Ecology & Evolution **31**, 463–475

Rescue of endemic states in interconnected networks with adaptive coupling
Vazquez,Federico;Serrano, M. Angeles; San Miguel, Maxi
Scientific Reports **6**, 29342

Non-Markovianity hinders Quantum Darwinism
Galve,Fernando;Zambrini,Roberta;Maniscalco,Sabrina
Scientific Reports **6**, 19607 (1-7)

Competition in the presence of aging: dominance, coexistence, and alternation between states
Perez, Toni; Klemm, Konstantin; Eguiluz, Victor
Scientific Reports **6**, 21128

The noisy voter model on complex networks
Carro, Adrián; Toral, Raúl; San Miguel, Maxi
Scientific Reports **6**, 24775

Complex quantum networks as structured environments: engineering and probing
Nokkala, Johannes; Galve, Fernando; Zambrini, Roberta; Maniscalco,Sabrina; Piilo, Jyrki
Scientific Reports **6**, 26861 (1-7)

Percolation-based precursors of transitions in extended systems
Rodriguez-Mendez, Victor; Eguiluz, Victor M.; Hernandez-Garcia, Emilio; Ramasco, Jose J.
Scientific Reports **6**, 29552 (1-10)

A quantitative assessment of Arctic shipping in 2010–2014
Eguíluz, VM; Fernández-Gracia, J; X Irigoien, X; Duarte, CM
Scientifc Reports **6**, 30682

Dynamical origins of the community structure of an online multi-layer society
Klimek, Peter; Diakonova, Marina; Eguiluz, Victor M.; San Miguel, Maxi; Thurner, Stefan
New Journal of Physics **18**, 083045

Irreducibility of multilayer network dynamics
Diakonova, Marina; Nicosia, Vincenzo; Latora, Vito; San Miguel, Maxi
New Journal of Physics **18**, 023010

Temporal interactions facilitate endemicity in the susceptible-infected-susceptible epidemic model
Speidel, Leo; Klemm, Konstantin; Eguíluz, Víctor M.; Masuda, Naoki
New Journal of Physics **18**, 073013 (1-18)

A hybrid superconducting quantum dot acting as an efficient charge and spin Seebeck diode
Hwang, S.-Y.; Sanchez, D.; Lopez, R.
New Journal of Physics **18**, 093024 (1-8)

Coupled dynamics of node and link states in complex networks: A model for language competition
Carro, Adrián; Toral, Raúl; San Miguel, Maxi
New Journal of Physics **18**, 113056

Correlation networks from flows. The case of forced and time-dependent advection-diffusion dynamics
Tupikina, L.; Molkenthin, N.; Lopez, C.; Hernandez-Garcia, E.; Marwan, N.; Kurths, J.
PLoS One **11**, e0153703 (1-12)

Collective intelligence: aggregation of information from neighbors in a guessing game
Perez, Toni; Zamora, Jordi; Eguiluz, Victor M.
PLoS One **11(4)**, e0153586

Collective behavior of strongly confined suspensions of squirmers
Delfau,Jean-Baptiste;Molina,John;Sano, Masaki
Europhysics Letters **114**, 24001 (1-5)

Minimal model for spontaneous quantum synchronization
Benedetti, C.; Galve,F.; Mandarino, A.; Paris,M.G.A.; Zambrini,R.
Physical Review A **94**, 052118 (1-10)

Probing the spectral density of a dissipative qubit via quantum synchronization
Giorgi, Gian Luca; Galve, Fernando; Zambrini Roberta
Physical Review A **94**, 052121 (1-9)

Dark solitons in the Lugiato-Lefever equation with normal dispersion
Parra-Rivas, Pedro; Gomila, Damià; Knobloch, Edgar; Gelens, Lendert
Physical Review A **93**, 063839 (1-17)

Coulomb-blockade effect in nonlinear mesoscopic capacitors
Alomar, M. I.; Lim, J. S.; Sánchez, D.
Physical Review B **94**, 165425 (1-14)

Large thermoelectric power and figure of merit in a ferromagnetic–quantum dot–superconducting device
Hwang, S.-Y.; Lopez, R.; Sanchez, D.
Physical Review B **94**, 054506 (1-9)

Interplay between resonant tunneling and spin precession oscillations in all-electric all-semiconductor spin transistors
Alomar, M. I.; Serra, L.; Sánchez, D.
Physical Review B **94**, 075402 (1-11)

Dynamics of energy transport and entropy production in ac-driven quantum electron systems
Ludovico, M. F.; Moskalets, M.; Sánchez, D.; Arrachea, L.
Physical Review B **94**, 035436 (1-13)

Interactions and thermoelectric effects in a parallel-coupled double quantum dot
Sierra, M. A.; Saiz-Bretin, M.; Dominguez-Adame, F.; Sanchez, D.
Physical Review B **93**, 235452 (1-9)

Synchronization of coupled noisy oscillators: Coarse-graining from continuous to discrete phases
Escaff,D.; Rosas, A.;Toral, R.;Lindenberg,K.
Physical Review E **94**, 052219

Pattern formation with repulsive soft-core interactions: Discrete particle dynamics and Dean-Kawasaki equation
Delfau, Jean-Baptiste; Ollivier, Hélène; López, Cristóbal; Blasius, Bernd; Hernández-García, Emilio
Physical Review E **94**, 042120 (1-13)

Performance of autonomous quantum thermal machines: Hilbert space dimension as a thermodynamical resource
Silva, Ralph; Manzano, Gonzalo; Skrzypczyk, Paul; Brunner, Nicolas
Physical Review E **94**, 032120

Inhibitory loop robustly induces anticipated synchronization in neuronal microcircuits
Matias, F. S.; Gollo, L. L.; Carelli, P., Mirasso, C., Copelli, M.
Physical Review E **94**, 042411 (1-8)

Competition of simple and complex adoption on interdependent networks
Czaplicka,A; Toral,R;San Miguel,M;
Physical Review E **94**, 062301

Entropy production and thermodynamic power of the squeezed thermal reservoir
Manzano,Gonzalo;Galve,Fernando;Zambrini,Roberta; Parrondo,Juan M. R.
Physical Review E **93**, 052120

Resonant Anderson localization in segmented wires
Estarellas, Cristian; Serra, Llorenç
Physical Review E **93**, 032105 (1-6)

Universal behavior of crystalline membranes: Crumpling transition and Poisson ratio of the flat phase
Cuerno, R.;Gallardo Caballero,R.; Gordillo-Guerrero, A.; Monroy, P.; Ruiz-Lorenzo,J. J.
Physical Review E **93**, 022111 (1-9)

Competition between drift and spatial defects leads to oscillatory and excitable dynamics of dissipative solitons
Parra-Rivas, P.; Gomila, D.; Matias M.A.; Colet, P.; Gelens, L.
Physical Review E **93**, 012211 (1-17)

The behavior of a magnetic filament in flow under the influence of an external magnetic field
Lüsebrink, Daniel; Cerdà, Joan J.; Sánchez, Pedro A.; Kantorovich, Sofia; Sintes, Tomas
The Journal of Chemical Physics **145**, 234902

Periodic Energy Transport and Entropy Production in Quantum Electronics
Ludovico, M. F.; Arrachea, L.; Moskalets, M.; Sánchez, D.
Entropy **18**, 419 (1-19)

Ensemble Equivalence for Distinguishable Particles
Fernández-Peralta, Antonio.; Toral, Raúl
Entropy **18**, 259

Gb/s One-Time-Pad Data Encryption With Synchronized Chaos-Based True Random Bit Generators
Argyris, Apostolos; Pikasis, Evangelos; Syvridis, Dimitris
Journal of Lightwave Technology **34**, 5325-5331

Nonlinear phenomena in quantum thermoelectrics and heat
Sánchez, D.; López, R.
Comptes Rendus Physique **17**, 1060-1071

Comparing the modeling of delay propagation in the US and European air traffic networks
Campanelli,B; Fleurquin, P; Arranz,A; Etxebarria, I; Ciruelos, C; Eguiluz, V M; Ramasco, J J
Journal of Air Transport Management **56**, 12-18

Consistency in experiments on multistable driven delay systems
Oliver, Neus; Larger, Laurent; Fischer, Ingo
Chaos **26**, 103115 (1-7)

Synchronization unveils the organization of ecological networks with positive and negative interactions
Girón, Andrea; Saiz, Hugo; Bacelar, Flora S.; Andrade, Roberto F. S.; Gómez-Gardeñes, Jesús
Chaos **26**, 065302

Heat flux of a granular gas with homogeneous temperature
Khalil, Nagi
Journal of Statistical Mechanics: Theory and Experiment **2016**, 103209

Towards a better understanding of cities using mobility data
Lenormand, M; Ramasco, JJ
Built Environment **42**, 356-364

Interdecadal Variability of Southeastern South America Rainfall and Moisture Sources during the Austral Summertime
Martin-Gomez, V.; Hernandez-Garcia, E.; Barreiro, M.; Lopez, C.
Journal of Climate **29**, 6751-6763

Multipartite quantum and classical correlations in symmetric n-qubit mixed states
Giorgi, Gian Luca ; Campbell, Steve
Quantum Information processing **15**, 4599–4611

CONDENSE: A Reconfigurable Knowledge Acquisition Architecture for Future 5G IoT
Vukobratovic, Dejan; Jakovetic, Dusan; Skachek, Vitaly; Bajovic, Dragana; Sejdinovic, Dino; Karabulut Kurt, Gunes; Hollanti, Camilla; Fischer, Ingo
IEEE Access **4**, 3360-3378

Linking basin-scale connectivity, oceanography and population dynamics for the conservation and management of marine ecosystems
Dubois, M.; Rossi, V.; Ser-Giacomi, E.; Arnaud-Haond, S.; Lopez, C.; Hernandez-Garcia, E.
Global Ecology and Biogeography **25**, 503-515

Origin and stability of dark pulse Kerr combs in normal dispersion resonators
Parra-Rivas, Pedro; Gomila, Damià; Knobloch, Edgar; Coen, Stephane; Gelens, Lendert
Optics Letters **41**, 2402-2405

Bidirectional private key exchange using delay-coupled semiconductor lasers
Porte, Xavier; Soriano, Miguel C.; Brunner, Daniel; Fischer, Ingo
Optics Letters **41**, 2871-2874

Touristic site attractiveness seen through Twitter
Bassolas, A; Lenormand, M; Tugores, A; Goncalves, B; Ramasco, JJ
EPJ Data Science **5**, 12

Coevolution of information processing and topology in hierarchical adaptive random Boolean networks
Górski,J.P.;Czaplicka, A.; Hołyst,J.A.
The European Physical Journal B **89**, 33 (1-9)

Signal bi-amplification in networks of unidirectionally coupled MEMS
Tchakui, Murielle Vanessa; Woafo, Paul; Colet, Pere
European Physical Journal B **89**, 22

Systematic comparison of trip distribution laws and models
Lenormand, M; Bassolas, A; Ramasco, JJ
Journal of Transport Geography **51**, 158-169

Magnetic filament brushes: tuning the properties of a magnetoresponsive supracolloidal coating
Sánchez, Pedro A.; Pyanzina, Elena; Novak, Ekaterina; Cerdà, Joan J.; Sintes, Tomas; Kantorovich, Sofia
Faraday Discussions **186**, 241-263

Flexible magnetic filaments under the influence of external magnetic fields in the limit of infinite dilution
Cerdà, Joan J.; Sánchez, Pedro A.; Lusebrink, Daniel; Kantorovich, Sofia; Sintes, Tomas
Physical Chemistry Chemical Physics **18**, 12616--12625

a.5.2 Other publications in journals

Learning about Spanish dialects through Twitter
Gonçalves, B.; Sánchez, D.
Revista Internacional de Lingüística Iberoamericana, XIV (2), 65-75

La teoría de particiones explicada por los físicos estadísticos
Toral, Raúl
Revista Española de Física 30 (4), 37-40

a.5.3 Book Chapters and Others

All-Optical Neuromorphic Computing in Optical Networks of Semiconductor Lasers
Brunner, Daniel; Reitzenstein, Stephan; Fischer, Ingo
Proceedings of the IEEE International Conference on Rebooting Computing 2016, IEEE, 978-1-5090-1370-8/16

Photonic Reservoir Computing for Ultra-Fast Information Processing Using Semiconductor Lasers
Fischer, Ingo; Bueno, Julian; Brunner, Daniel; Soriano, Miguel C.; Mirasso, Claudio
Proceedings of ECOC 2016 (42nd European Conference and Exhibition on Optical Communications , VDE VERLAG GMBH · Berlin · Offenbach, 336-338

Is spatial information in ICT data reliable?
Lenormand, M; Louail, T; Barthelemy, M; Ramasco, JJ
Procs. of the Spatial Accuracy Conference, Montpellier, France, 2016. , 9-17

Semantic Space as a Metapopulation System: Modelling the Wikipedia Information Flow Network
Masucci, A.Paolo; Kalampokis, Alkiviadis; Eguíluz, Víctor M.; Hernández-García, Emilio
Towards a Theoretical Framework for Analyzing Complex Linguistic Networks (edited by A. Mehler, A. Lücking, S. Banisch, Ph. Blanchard and B. Job) , Springer (Berlin, Heidelberg), 133-151

Big data: a new perspective on cities
Gallotti, Riccardo; Louail, Thomas; Louf, Rémi; Barthelemy, Marc
Big data over networks, Edited by Cui, Hero, Luo and Moura (eds.), Cambridge University Press, 247-277

Lagrangian Flow Networks: a new framework to study the multi-scale connectivity and the structural complexity of marine populations
Rossi, Vincent; Ser-Giacomi, Enrico; Dubois, Mélodie; Monroy, Pedro; Hidalgo, Manuel; Hernandez-García, Emilio; López, Cristobal
In CIESM Workshop Monograph 48: Marine connectivity - migration and larval dispersal, Edited by F. Briand, CIESM Publisher, Monaco, 39-51

a.6. Communications to conferences and talks in other centers

a.6.1 Invited talks in conferences and workshops

San Miguel, Maxi
What can we learn from simple models of social interaction.
Winter workshop on complex systems, Madrid, Spain.
January, 25-29

San Miguel, Maxi
Big Data and Human Mobility.
VII jornadas sobre ITS en Cataluña, Barcelona, Spain.
February, 03

Fischer, Ingo
Delay-coupled lasers: from fundamental physics to ultra-fast information processing.
Symposium on Controlling complex systems and networks: interplay of structure, dynamics and delay, Berlin, Germany
February, 12

Louail, Thomas
Uncovering the spatial structure of urban mobility networks.
LIP6, Paris, France.
February, 19

López, Cristóbal
Clustering of organisms interacting via repulsive forces.
Lagrangian transport: from complex flows to complex fluids, Lecce, Italy.
March, 07-10

Rossi, Vincent
Lagrangian Flow Networks: a new framework to study the multi-scale connectivity and the structural complexity of marine populations.
CIESM International Research Workshop no 48 entiteld "Marine Connectivity - Migratory routes, stepping stones, larval dispersal", Soller, Mallorca, Spain.
March, 09

Ramasco, Jose J.
A radiography of human mobility using ICT data.
NECTAR Cluster 8 Meeting "Big data: a new opportunity for urban transport and mobility policies", Sevilla, Spain.
March, 10-11

Ramasco, Jose J.
Socio-economic considerations about urban mobility.
7th International Workshop on Complex Networks Complenet 2016, Dijon, France.
March, 23

Fischer, Ingo
Ultra-fast Reservoir Computing with Semiconductor Lasers and Autonomous Boolean Networks.
International Workshop: Beyond! von Neumann, Berlin , Germany.
May, 18-21

Brunner, Daniel
Neuromorphic Computing Using Networks of Quantum Dot Emitters.
International Workshop: Beyond! von Neumann, Berlin , Germany.
May, 18-21

San Miguel, Maxi
Vision for Complexity.
Opening Conference of the Complexity Science Hub, Vienna, Austria.
May, 23

Hernández-García, Emilio
Fairy circles under the sea: Pattern formation in meadows of marine plants.
CSNDD'2016: Third International Conference on Structural Nonlinear Dynamics and Diagnosis . Marrakech, Morocco.
May, 24

Parra-Rivas, Pedro
Bright and dark localized structures in the Lugiato-Lefever equation.
CSNDD'2016: Third International Conference on Structural Nonlinear Dynamics and Diagnosis. Marrakech, Morocco.
May, 24

Soriano, Miguel C.
Reservoir Computing with Photonic Delay Systems.
XXXVI Dynamics Days Europe. Corfu, Greece.
June, 06-10

Jüngling, Thomas
Consistency in Chaotic Systems Driven by Time-Delayed Feedback.
XXXVI Dynamics Days Europe. Corfu, Greece.
June, 06-10

Jüngling, Thomas
Determining the sub-Lyapunov exponent from chaotic dynamics of photonic delay systems.
XXXVI Dynamics Days Europe in Corfu, Greece.
June, 06-10

Toral, Raul
Network effects on an agent-based market model with herding behavior.
COMSOTEC 2016, Valencia, Spain.
June, 08-10

Louail, Thomas
Understanding human mobility from ICT data.
Complex systems institute of Toulouse (ISCT), Toulouse, France.
June, 22

Rossi, Vincent
Dispersal and Connectivity in Evolutionary Biology.
XVI Jornada de Biologia Evolutiva, organizado por la Societat Catalana de Biologia, Barcelona, Spain.
June, 27

San Miguel, Maxi
Transitions in Network coevolution dynamics.
Solvay workshp on Nonequilibrium and nonlinear phenomena in statistical mechanics, Brussels, Belgium.
July, 11-13

Toral, Raul
Macroscopic effects in heterogeneous stochastic systems.
Solvay workshop Nonequilibrium and nonlinear phenomena in statistical mechanics, Brussels, Belgium.
July, 11-13

Bullara, Domenico
Turing patterns from Differential Growth: A minimal model for pattern formation in zebrafish skin.
SIAM Conference on the Life Science, Boston, MA, USA.
July, 11-14

Ramasco, Jose J.
Digital imprints reveal integration of migrant communities in world cities.
Symposium on Cities as Complex Systems CTCS, Hanover, Germany.
July, 13-15

Louail, Thomas
Crowdsourcing the Robin Hood effect in cities.
Symposium on Cities as Complex Systems CTCS, Hanover. Germany.
July, 13

Bullara, Domenico
Turing patterns without diffusion: how immobile pigment cells can color the skin of zebrafish.
Summer@ICERM 2016: Dynamics and Stochastics, ICERM, Brown University, Providence, RI, USA.
July, 15

Fischer, Ingo
Complex Dynamics of a Laser System with State-Dependent Delay.
International Conference on: Perspectives in Nonlinear Dynamics 2016 (PNLD 2016), Berlin, Germany.
July, 24-29

Fischer, Ingo
Photonic information processing using semiconductor lasers.
International Tandem Workshop: Pattern Dynamics in Nonlinear Optical Cavities (PDNOC 2016), Dresden, Germany.
August, 15-19

Sánchez, David
Quantum dynamical heat in mesoscopic conductors.
New Trends in Quantum Heat and Thermoelectrics, ICTA. Triestre, Italy.
August, 22-26

Ramasco, José J.
Socio-economic considerations about urban mobility.
Complex networks: from socio-economic systems to biology and brain, Lipari, Sicily, Italy.
August, 29- September, 03

Bullara, Domenico
Turing patterns without diffusion: how immobile pigment cells can color the skin of zebrafish.
2nd BCAM workshop on Nonlinear Dynamics in Biological Systems, Bilbao, Spain.
September, 01-02

Mirasso, Claudio
Anticipated Synchronization in Neuronal Circuits.
Encontro de Física 2016, Natal, Brazil.
September, 03-07

Fischer, Ingo
Optical turbulence and Chimera states in semiconductor lasers with delayed feedback.
International Conference on Control of Complex Systems and Networks, Heringsdorf, Germany.
September, 04-08

Zambrini, Roberta
Emergence of collective decoherence in extended systems.
Workshop Taming Quantum Noise 2016, Mazara del Vallo, Italy.
September, 05-09

Soriano, Miguel C.
Dynamics and applications of delay-coupled semiconductor lasers.
International Symposium on Physics and Applications of Laser Dynamics (IS-PALD) 2016. Hsinchu, Taiwan.
September, 07-09

Fischer, Ingo
Photonic Reservoir Computing for Ultra-Fast Information Processing Using Semiconductor Lasers.
CLEO-FOCUS Meeting on Optical Information Processing, ECOC 2016, Düsseldorf, Germany.
September, 18-22

Hernandez-Garcia, Emilio
Network approaches to oceanic and atmospheric transport.
DAMES 2016: Data Analysis and Modeling in Earth Sciences. Hamburg, Germany.
September, 27

Brunner, Daniel
All-Optical Neuromorphic Computing in Optical Networks of Semiconductor Lasers.
IEEE International Conference on Rebooting Computing 2016, San Diego, USA.
October, 17-19

San Miguel, Maxi
Mathematical modelling of social dynamics.
Series of lectures at Latin American School on Data Analysis and Mathematical Modelling of Social Sciences, Buenos Aires, Argentina.
November, 07-11

San Miguel, Maxi
What can we learn from simple models of social interaction.
Latin American Workshop on Data Analysis and Mathematical Modelling of Social Sciences, Buenos Aires, Argentina.
November, 08

Mirasso, Claudio
Anticipated Synchronization in neuronal populations: the case of the cat primary visual system.
Society for Neuroscience Meeting, San Diego, California, USA.
November, 11-16

San Miguel, Maxi
Human mobility studies from Big Data.
Encuentro Big Data y Sociedad, Univ. Complutense, Madrid, Spain
December, 01-02

Toral, Raul
Effects of network heterogeneity in agent-based models.
Medyfinol 2016, Valdivia, Chile.
December, 05-09

a.6.2 Other talks in conferences and workshops

Sakryukin, Andrej; Klemm, Konstantin
Finding attractors by shrinking and growing Boolean networks.
Netsci-X, International School and Conference on Network Science. Wroclaw, Poland.
January, 11-13

Czaplicka, Agnieszka; Toral, Raul; San Miguel, Maxi
Competition of simple and complex adoption on interdependent networks.
NetSci-X: International School and Conference on Network Science. Wroclaw, Poland.
January, 11-13

Fischer, Ingo
Complex Dynamical Systems for Computation: How to get the best from brain and machine.
International Photonic Brain Workshop. Bendinat, Spain.
February, 22-23

Rossi, Vincent
Lagrangian Flow Network: a new tool to evaluate connectivity and understand the structural complexity of marine populations.
Ocean Science Meeting (AGU/ASLO), New Orleans, USA .
February, 23

Klemm, Konstantin; Sakryukin, Andrey
Growing Boolean networks together with their attractors.
DPG Spring Meeting, Regensburg, Germany.
March, 06-11

Galve, F.; Mandarino, A.; Paris, M.G.A.; Benedetti, C.; Zambrini , R.
Microscopic description for the emergence of collective decoherence in extended systems.
QuProCS annual meeting. Milan, Italy.
March, 07-10

Rosselló, Guillem; López, Rosa; Sánchez, Rafael
Role of inelasticity in the symmetry of the Onsager matrix.
Nonequilibrium condensed matter and biological systems. Madrid, Spain.
March, 09-11

Alomar, M. I.; Serra, Llorenç; Sánchez, David
Theory of thermopower for spin-orbit coupled graphene and 2D spin transistors.
Nonequilibrium condensed matter and biological systems. Madrid, Spain.
March, 09-11

Osca, Javier
Local currents in quasi-1d Majorana nanowires.
Nonequilibrium condensed matter and biological systems, Madrid, Spain.
March, 10

Colet, Pere
Tweets on land transportation networks.
NECTAR CL8 Workshop: Big data: a new opportunity for urban transport and mobility policies, Seville, Spain.
March, 10-11

Parra-Rivas, P.; Gomila, D.; Gelens, L.
Characterizing the dynamics of cavity solitons and frequency combs in the Lugiato-Lefever equation.
SPIE Photonics Europe, Brussels, Belgium.
April, 03-07

Alomar, M. I.; Lim, Jong Soo; Sánchez, David
Time-dependent response of interacting quantum capacitors in the Coulomb blockade regime.
The 12th Capri Spring School on Transport in Nanostructures. Capri, Italy.
April, 10-17

Lamanna, Fabio; Lenormand, Maxime; Salas-Olmedo, Maria; Romanillos, Gustavo; Tugores, Antònia; Gonçalves, Bruno; Ramasco, José J.
Strangers' Tweets in Strange Lands.
Data Driven Approach to Networks and Language. ENS, Lyon, France.
May, 11-13

Ramasco, Jose J.
Crowdsourcing the Robin Hood effect in cities.
Second Meeting of the Spanish Community for the Study of Complex Systems COMSOTEC, Valencia, Spain.
June, 08-10

Bassolas, Aleix; Lenormand, Maxime; Ramasco, José Javier
Touristic site attractiveness seen through twitter.
Second Meeting of the Spanish Community for the Study of Complex Systems, COMSOTEC 2016, Valencia, Spain.
June, 08-10

Matias, F.; Gollo, L.; Carelli, P.; Bressler, S.; Copelli, M.; Mirasso, C.
Anticipated synchronization between cortical areas: reconciling unidirectional causality and negative phase lag.
Barcelona Computational, Cognitive and Systems Neuroscience (BARCCSYN) 2016. Barcelona, Spain.
June, 16-17

Fernández Peralta, Antonio; Toral, Raúl
Role of non-linearity in the transition rates for Kirman model: tricritical behaviour.
21st Workshop on the economic science with heterogeneous interacting agents, WEHIA 2016, Castellón, Spain.
June, 22-24

Toral,Raul
Network effects on an agent-based market model with herding behavior.
21st Workshop on the economic science with heterogeneous interacting agents, WEHIA 2016, Castellón, Spain.
June, 22-24

Tchawou Tchuisseu, E.B.; Gomila, D.; Colet, P.
Effects of Dynamic Demand Control Appliances on the Grid Frequency Stabilization.
2016 IEEE Workshop on Complexity in Engineering-COMPENG 2016. Catania, Italy.
July, 04-06

Parra-Rivas, P.; Gomila, D.; Knobloch, E.; Gelens, L.; Coen, S.
Stability analysis of dark pulse Kerr frequency combs in normal dispersion optical microresonators.
CLEO: QELS Fundamental Science 2016 San Jose, California, USA.
July, 05-10

Rossi, Vincent
Lagrangian Flow Network: theory and applications.
Third International Workshop on Nonlinear Processes in Oceanic and Atmospheric Flows (NLOA2016), Madrid, Spain.
July, 06

Ramasco, Jose J.
Percolation-based precursors of transitions in spatially extended systems.
Complex Networks: from theory to interdisciplinary applications,Marseille, France.
July, 11

Bassolas,Aleix; Lamana,Fabio; Lenormand,Maxime; Ramasco, José Javier
Collapse of public transport networks under stress.
Cities as Complex Systems, Hannover, Germany.
July, 12-15

Bullara, Domenico
Chemomechanical oscillations in reactive porous media from monostable non-oscillating chemical reactions: a theoretical prediction.
Gordon Research Seminar on Oscillations and Dynamic Instabilities in Chemical Systems, Stowe, VT, USA.
July, 16-17

Lamanna, Fabio; Lenormand, Maxime; Salas-Olmedo, Maria; Romanillos, Gustavo; Tugores, Antònia; Gonçalves, Bruno; Ramasco, José J.
Digital Imprints of International Communities in World Cities.
1st International Conference on Geographies of Migration and Mobilties. Loughborough University, UK.
July, 18-20

Sánchez, David
Spin and charge thermoelectric transport in a ferromagnetic-superconductor quantum dot device.
Interfacial spintronics and spin waves. San Sebastian, Spain.
July, 18-21

Czaplicka, Agnieszka; Toral, Raul; San Miguel, Maxi
Competition of simple and complex adoption on interdependent networks.
STATPHYS26: International conference on Statistical Physics, Lyon, France.
July, 18-22

Toral, Raul
The noisy voter model on complex networks.
STATPHYS26: International conference on Statistical Physics, Lyon, France.
July, 18-22

Klemm, Konstantin
Temporal interactions facilitate endemicity in the susceptible-infected-susceptible model.
Perspectives in Nonlinear Dynamics 2016, Berlin, Germany
July, 25-29

Bacelar, Flora S.; Kiziridis, Danis; López, Cristóbal; Hernández-García, Emilio
The evolution of dispersal of reproducing competitive individuals.
XXXIX National Meeting on Condensed Matter Physics: Statistical physics approach to ecological systems. Natal, Brazil .
Setember, 03-07

Parra-Rivas, P.; Gomila, D.; Knobloch, E.; Gelens, L.; Coen, S.
Origin and stability of dark pulse Kerr frequency combs in normal dispersion microresonators.
Nonlinear Photonics 2016: Photonics and Fiber Technology 2016, Sydney, Australia.
September, 05-08

Tchawou Tchuisseu, E. B.; Gomila, D.; Colet, P.
Effects of interacting Dynamic Demand Controlled Appliances on the Power grid frequency stabilization.
2016 International Conference on Power and Energy Engineering (PEENG 2016) Barcelona, Spain.
September, 07-09

Artime, Oriol
Dynamics on Networks: Competition between temporal and topological correlations.
III School on Complex Systems, CCS Warm-Up in Amsterdam, Netherlands.
September, 16-18

Artime, Oriol; Ramasco, Jose Javier; San Miguel, Maxi
Dynamics on Networks: Competition between temporal and topological correlations.
The 2016 Conference on Complex Systems, CCS, Amsterdam, Netherlands.
September, 19-22

Campanelli, Bruno; Ramasco, José
Backward Exploration of Delay Propagation in Air Transportation Networks.
The 2016 Conference on Complex Systems, CCS, Amsterdam, Netherlands.
September, 19-22

Bassolas,Aleix; Lenormand,Maxime; Lamana,Fabio; Ramasco,José Javier
Collpase of public transport networks under stress.
The 2016 Conference on Complex Systems, CCS, Amsterdam, Netherlands.
September, 19-22

Lamanna, Fabio; Lenorman, Maxime; Salas-Olmedo, María-Henar; Romanillos, Gustavo; Gonçalves, Bruno; Ramasco, José Javier
The streets all looked so strange: looking up digital imprints of immigrants' spatial integration in cities.
The 2016 Conference on Complex Systems, CCS, Amsterdam, Netherlands.
September, 19-22

Giorgi, Gian Luca; Galve, Fernando; Zambrini, Roberta
Probing a dissipative process through quantum synchronization.
IQIS 2016; 9th Italian Quantum Information Science Conference. Rome, Italy
September, 20-23

Galve, F.; Mandarino, A.; Paris, M.G.A.; Benedetti, C.; Zambrini , R.
Microscopic description for the emergence of collective decoherence in extended systems.
IQIS 2016; 9th Italian Quantum Information Science Conference. Rome, Italy
September, 20-23

López, Cristobal
Lyapunov lines and flow networks: new tools to study marine ecosystems.
XXXII Trobades cientifiques de la Mediterrània, Menorca, Spain.
October, 05-07

Soriano, Miguel C.; Ortín, Silvia; Mirasso, Claudio R.
Clasificación automática de tipos de epilepsia a partir de la actividad MEG de sujetos en reposo.
I Ibersinc Meeting. Tarragona, Spain.
October, 06-07

Tugores, Antònia
Using social media geotagged data to estimate railway use.
PyConES2016. Almeria, Spain
October, 07-09

Hernandez-Garcia, Emilio
Lagrangian Flow Networks: Theory and applications.
2nd international HYDROGENCONNET workshop (hosted by the Institute of Marine Sciences IMS/METU), Erdemli, Turkey .
October, 12

Rossi, Vincent; Chenuil, Anne
Introduction to the HYDROGENCONNECT project: Dispersal and Connectivity.
2nd international HYDROGENCONNET workshop (hosted by the Institute of Marine Sciences IMS/METU), Erdemli, Turkey .
October, 12

Monroy, Pedro
Sensitivity and robustness of larval connectivity diagnostics obtained from Lagrangian Flow Networks.
2nd international HYDROGENCONNET workshop (hosted by the Institute of Marine Sciences IMS/METU), Erdemli, Turkey .
October, 12

Alomar, M. I.; Lim, Jong Soo; Sánchez, D.
Dynamical response of nonlinear quatum capacitors in the Coulomb blockade regime.
3rd Meeting de la Red de Física Estadística de No Equilibrio. Pamplona, Spain.
November, 23-25

Tchawou Tchuisseu, E.B.; Gomila, D.; Colet, P.
Effects of interacting Dynamic Demand controlled appliances on the power grid frequency stabilization.
Recontree des Jeunes Chercheurs Africains en Paris, France.
December 1

a.6.3 Poster presentations

Keller-Schmidt, S.; Tugrul, M.; Eguiluz, V.M.; Hernandez-Garcia, E.; Klemm, K.
Age-dependent branching as a model of evolutionary trees.
NetSci X 2016, International School and Conference on Network Science. Wrochlau, Poland.
January, 11-13

Rosselló, Guillem; López, Rosa; Sánchez, Rafael
Role of inelasticity in the symmetry of the Onsager matrix.
4th Quantum Thermodynamics Conference (COST MP1209 Erice). Erice, Italy.
May, 08-14

Rodríguez, Jorge P.; Ghanbarnejad, Fakhteh; Eguíluz, Víctor M.
Cooperative disease spreading with mobile agents.
NetSci 2016. Seoul, Southern Korea.
June, 01

Matias, F.; Carelli, P.; Copelli, M.; Mirasso, C.
Inhibitory loop robustly induces anticipated synchronization in neuronal microcircuits.
Barcelona Computational, Cognitive and Systems Neuroscience (BARCCSYN) 2016. Barcelona, Spain.
June, 16-17

López, V; Pereda, E; Moratal, D.; Mirasso, C.; Canals, S.
Information flow in the hippocampus: evidence for an effective cross-frequency coupling.
10th FENS-Forum of Neuroscience. Copenhagen, Denmark.
July, 02-06

Hernandez-Garcia, Emilio; Enrico Ser-Giacomi; Ruggero Vasile; Cristobal Lopez
Pathways of dominant transport in atmospheric and oceanic flows.
Third International Workshop on Nonlinear Processes in Oceanic and Atmospheric Flows. NLOA2016, Madrid, Spain.
July, 06-08

Monroy, Pedro; López,Cristóbal; Hernández-García, Emilio; Rossi, Vincent
Sinking of Inertial Particles in Ocean Flows.
Third International Workshop on Nonlinear Processes in Oceanic and Atmospheric Flows. NLOA2016, Madrid, Spain
July, 06-08

Lopez, C.; Bettencourt, J.H.; Hernandez-Garcia, E.; Montes, I.; Sudre, J.; Dewitte, B.; Paulmier A.; Garcon, V.
Boundaries of the Peruvian Oxygen Minimum Zone shaped by coherent mesoscale dynamics.
Third International Workshop on Nonlinear Processes in Oceanic and Atmospheric Flows. NLOA2016, Madrid, Spain.
July, 06-08

Bullara, Domenico
Chemomechanical oscillations in reactive porous media from monostable non-oscillating chemical reactions: a theoretical prediction.
Gordon Research Conference on Oscillations and Dynamic Instabilities in Chemical Systems. Stowe, VT, USA.
July, 17-22

Bacelar, F.S.; Kiziridis, D.; Lopez, C.; Hernandez-Garcia, E.
The evolution of dispersal of reproducing competitive individuals.
Statphys26, Lyon, France.
July, 18-22

Delfau, Jean-Baptiste
Pattern forming instabilities arising from non-local interactions.
STATPHYS26, Lyon, France.
July, 18-22

Serra, Llorenç; Osca, Javier
Spatial distribution of density and current in 2D Majorana nanowires.
Topological states of matter, San Sebastian, Spain
September, 05-09

Galve, F.; Giorgi, G.; Maniscalco, S.; Zambrini, R.
Quantum Darwinism and memory effects in bosonic and spin environments.
IQIS 2016; 9th Italian Quantum Information Science Conference. Rome, Italy
September, 19-23

Campanelli, Bruno; Ramasco, José
A Simulation-Based Characterization of the Impact of Delayed Intercontinental Flights.
The Sixth SESAR Innovation Days (TU Delft). Delft, Netherlands.
November, 08-10

Rodríguez, Jorge P.; Ghanbarnejad, Fakhteh; Eguíluz, Víctor M.
How mobility affect cooperative spreading diseases.
Complex Networks 2016. Milano, Italy.
November, 30-02

a.6.4 Seminar talks in other research centers

Sierra, Miguel A.; Sánchez, David
Nonlinear current and heat in thermally biased quantum dots.
Universidad Complutense de Madrid, Spain.
June 26

Klemm, Konstantin
Growing Boolean networks together with their attractors.
Center for Models of Life, Niels Bohr Institute, University of Copenhagen, Denmark.
February 17

Delfau, Jean-Baptiste
Pattern forming instabilities leading to the formation of hexagonal clusters.
Laboratory Matter and Complex Systems (MSC) in Paris, France.
April 04

Vincent, Rossi
Studying connectivity and the structural complexity of marine populations with Lagrangian Flow Networks.
Mediterranean Institute of Oceanography (MIO - CNRS/IRD/AMU).
September 28-30

Fischer, Ingo
Complex Dynamics of Semiconductor Lasers with State-Dependent Delay.
UPC Terrassa, Spain.
November 30

Zambrini, Roberta
Collective decoherence in extended systems: origins and some effects.
University of Freiburg, Germany.
December 12

a.8. Press & Media

Titles are hyperlinked to he corresponding PDF file, or the audio/video clip

a.8.1 Written and Digital Media

Las azarosas rutas de las larvas.
B@leópolis, El Mundo.
February 15

Científicos trazan mapas de larvas marinas que ayudarán a proteger especies.
ABC.
February 2

Mapas de dispersión de larvas marinas, nueva herramienta para planificar la protección de especies.
noticiasdelaciencia. com.
February 15

Mapes de dispersió de larves marines, nova eina per planificar la protecció d'espècies.
Nota de premsa UIB.
February 15

Científicos trazan mapas de dispersión de larvas marinas que ayudarán a proteger especies.
La verdad de Murcia.
February 15

El IFISC organiza el primer Colloquia or Excellence.
Nota de prensa UIB.
April 4

Ciclo de coloquios en el IFISC.
GEFES-RSEF.
April 11

Becas de introducción a la investigación.
Web Universidad de Córdoba.
April 20

El instituto de física IFISC convoca becas para jóvenes.
Última Hora.
April 25

Claudio Mirasso "Oportunidades de la crisis: hagamos una universidad mejor".
Columna en El País.
April 29

El profesor Benjamín Carreras participa hoy en los "colloquia of excellence".
Diario de Menorca.
April 30

Inteligencia, una red distribuida.
El Mundo, entrevista a Robert Colom.
May 4

De la intel·ligència humana a la intel·ligència artificial.
Ara Balears.
May 4

Cicle de conferències al Caixa Fòrum.
Nota de premsa UIB.
May 5

Entrevista a Javier Buldú.
El Mundo.
May 10

El máster en Física de Sistemas Complejos.
El Mundo.
May 11

Máster en Física de Sistemas Complejos.
Nota de prensa CSIC.
May 12

Análisis matemático de los sueños.
El Mundo, B@leópolis.
July 26

Mientras menos capas de hielo, más tráfico marítimo.
renovablesverdes. es.
August 5

Deshielo y tráfico marítimo.
Noticias de la ciencia y la tecnología.
August 5

Científicos españoles demuestran que el tráfico marítimo afecta al deshielo en el Ártico.
La opinión A Coruña.
August 5

Científicos de España mostran que o tráfico marítimo afecta o desxeo do Ártico.
farodevigo. es.
August 5

El deshielo incrementa el tráfico marítimo en el océano Ártico.
El Mundo.
August 5

El aumento del tráfico marítimo en el Ártico está relacionado con la disminución de la capa de hielo.
Mercurio digital.
August 5

Demuestran la relación entre el tráfico marítimo y reducción del hielo ártico.
EfeFuturo.
August 5

El aumento del tráfico marítimo en el Ártico confirma el deshielo a causa del cambio climático.
Diariosur.
August 5

El tráfico marítimo en el Ártico influye en el deshielo.
Diariodenavarra. es.
August 5

A mayor tráfico marítimo, menos concentración de hielo en el ártico.
industriaspesqueras. com.
August 5

El aumento del tráfico marítimo en el Ártico está relacionado con la disminución de la capa de hielo.
Informaria Digital.
August 5

El aumento del tráfico marítimo en el Ártico está relacionado con la disminución de la capa de hielo.
bajoelagua. com.
August 5

El aumento del tráfico marítimo en el Ártico está relacionado con la disminución de la capa de hielo.
Presspeople. com.
August 5

Primera medida real del aumento del tráfico marítimo en el Ártico.
naukas. com.
August 5

El aumento del tráfico marítimo confirma el deshielo a causa del cambio climático.
larioja. com.
August 5

Aumento del tráfico marítimo en el Ártico.
ambientum. com.
August 5

El IFISC y la Universidad de Stanford demuestran el arrastre de carga entre puntos cuánticos.
eleconomista. es.
August 5

El IFISC y la universidad de Stanford demuestran el arrastre de carga entre puntos cuánticos.
ecodiario. es.
August 9

El Ifisc demuestra el arrastre de carga entre puntos cuánticos.
europapress.es
August 10

El IFISC y la universidad de Stanford demuestran el arrastre de carga entre puntos cuánticos.
lainformacion. com.
August 11

El aumento del tráfico marítimo en el Ártico está relacionado con la disminución de la capa de hielo.
diariodeavila. com.
August 16

Demuestran el efecto de arrastre entre puntos cuánticos.
noticiasdelacienciaylatecnologia.
August 16

El IFISC y la universidad de Stanford demuestran el arrastre de carga entre puntos cuánticos.
20 minutos.
August 31

a.8.2 Radio and TV

Interview to Vincent Rossi: mapes dispersió larves marines.
"Al Dia", IB3 Ràdio.
Februrary 2

Interview to José Ramasco: los monumentos turísticos según Twitter.
IB3 Radio, "Al Dia".
May 3

El aumento del tráfico marítimo en el Ártico está relacionado con la disminución de la capa de hielo.
rtve. es.
August 5

Aumento del tráfico marítimo en el Ártico debido a la disminución de la capa de hielo.
Radio Intereconomia.
August 5