ANNUAL REPORT 2018

IFISC

Universitat de les Illes Balears

CSIC

EXCELENCIA
MARÍA
DE MAEZTU

Institute for Cross-Disciplinary Physics and Complex Systems

CSIC
Consejo Superior de Investigaciones Científicas

UIB
Universitat de les Illes Balears

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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 Advanced 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.

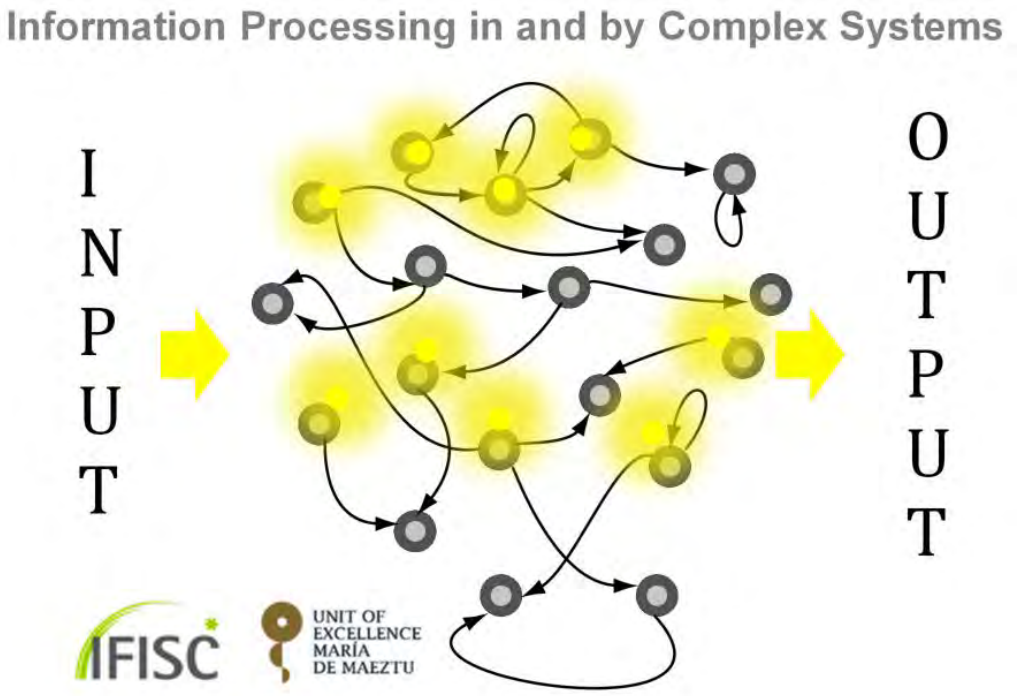
By *Cross-Disciplinary* Research we mean the transfer of knowledge, concepts and methods to create bridges among traditional disciplines. By *Strategic Research* we mean focusing on advanced studies in emerging strategic fields with a strong potential impact, avoiding the “basic-applied” polarization.

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

“MARIA DE MAEZTU” EXCELLENCE AWARD

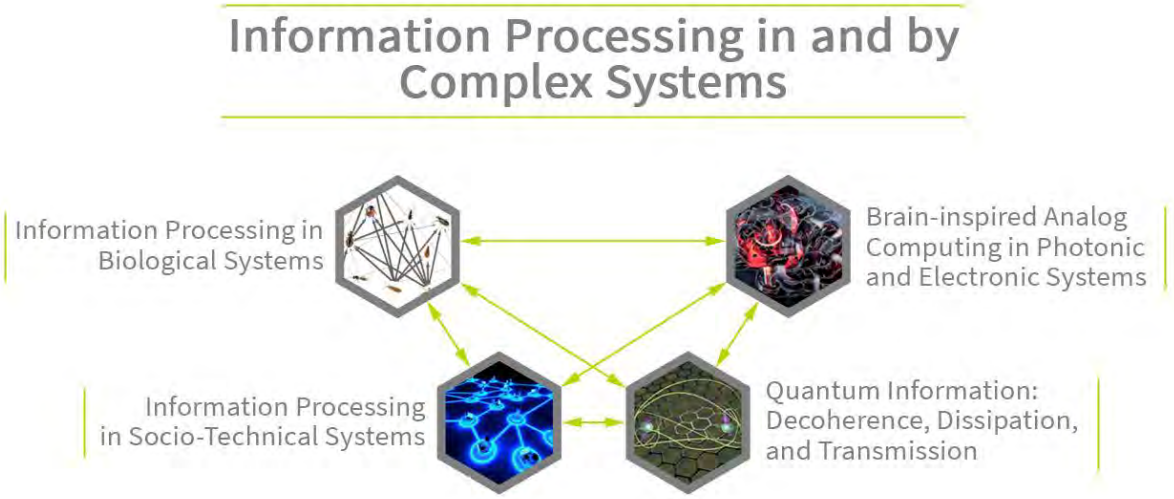
IFISC (Institute for Cross-Disciplinary Physics and Complex Systems) has been awarded the “**Unidad de Excelencia María de Maeztu**" distinction, entering the selective **SOMMa Alliance**. The award has been granted by the Agencia Estatal de Investigación (AEI), belonging to the Ministry of Science, Innovation and Universities, after a highly selective proccess and a thorough evaluation according to the highest standards by an international panel. This award consolidates IFISC as a reference institute in the research field of complex systems. The distinction is granted shortly after IFISC’s tenth anniversary, demonstrating its positive trajectory in research excellence.

According to the Ministry, being awarded as "Severo Ochoa" or "María de Maeztu" represents "the recognition and accreditation of the best centers and units that stand out for their international impact and the relevance of their results obtained in the last four years". Moreover, it targets "the financing of strategic research programmes with the aim of consolidating their scientific capacities and contributing to their international leadership". Since the inception of the program in 2011 and until 2017, 25 centers have been distinguished as "Severo Ochoa" and 16 units as "María de Maeztu". 73% of them were in the regions of Catalonia (19) and Madrid (11). In 2018, 5 Severo Ochoa and 7 Maria de Maeztu units have been selected within Spain. IFISC constitutes the first award in the Balearic region.



All distinguished centers and units stand out for the international impact of their scientific contributions, their postgraduate teaching activity, their innovative capacity and their intense relationship with the social and economic environment. They are categorized as world-class entities with highly competitive frontier research programs that are capable of attracting international talent.

The units that have been selected in the "Maria de Maeztu" category, like IFISC, will receive a total funding of 2,000,000 Euros for the next four years plus several contracts for pre-doctoral researchers and access to funding sources restricted to the units of excellence.



On November 21, 2018, the president of the Government of the Balearic Islands, Francina Armengol, accompanied by the vice-president and minister for Innovation, Research and Tourism, Isabel Busquets, the minister for Education and University, Martí March, and other members of her government, together with the vice-president of Scientific and Technical Research of the Spanish National Research Council (CSIC), Jesús Marco de Lucas, the rector of the University of the Balearic Islands (UIB), Llorenç Huguet, and the president of the UIB Social Council, Francesca Mas, attended the presentation of the distinction "Unit of Excellence Maria de Maeztu" to IFISC (UIB-CSIC).

Balearic president F. Armengol

UIB Rector Ll. Huguet

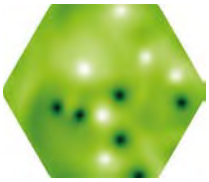
CSIC vice-president J. Marco

During the event, Claudio Mirasso, scientific director of the research programme María de Maeztu, and Maxi San Miguel, IFISC Director, explained what this recognition means for IFISC and how the new resources associated with the Unit of Excellence will be invested, being the first entity of excellence in the Balearic Islands.

Video of the event: https://www.youtube.com/watch?v=idIeWsEhbXI

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

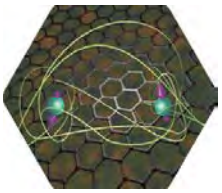
The Computing Services Unit manages the computational resources at IFISC. Capabilities to perform intensive numerical calculations are provided by an IBM iDataPlex cluster with 48 dx360M4 diskless nodes and a total of 576 computational cores and 1.8 TB of RAM configured for High Throughput Computing (HTC). This is complemented by two servers with 256GB of RAM used for memory intensive scientific calculations.

Big Data storage and management is handled using a MongoDB non-relational database on a two servers, one with 16 cores, 512 GB of RAM, 2 2TB SSD for indexes and 20 2TB SSD for data and the other with 20 cores, 256GB of RAM, 2 2TB SSD for indexes and 20 4TB HD for data.

A Data repository is available on a IBM DS4700 disk cabinet with 96 TB of raw storage capacity, connected via fiber channel to four 8-core servers and using GPFS as file system. Private Cloud virtualization is implemented as a opennebula cluster with a 4 compute nodes each with 36 cores, 384GB of memory and 4TB disk and a management node with 16 cores, 96GB of memory and 16TB disk. IFISC network is complemented with an NFS and a backup server, about 100 linux desktops, mac and windows desktops and laptops and a number of peripherals, and it is integrated to provide a transparent environment.

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.

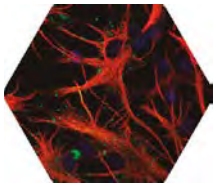
PHOTONICS LAB

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

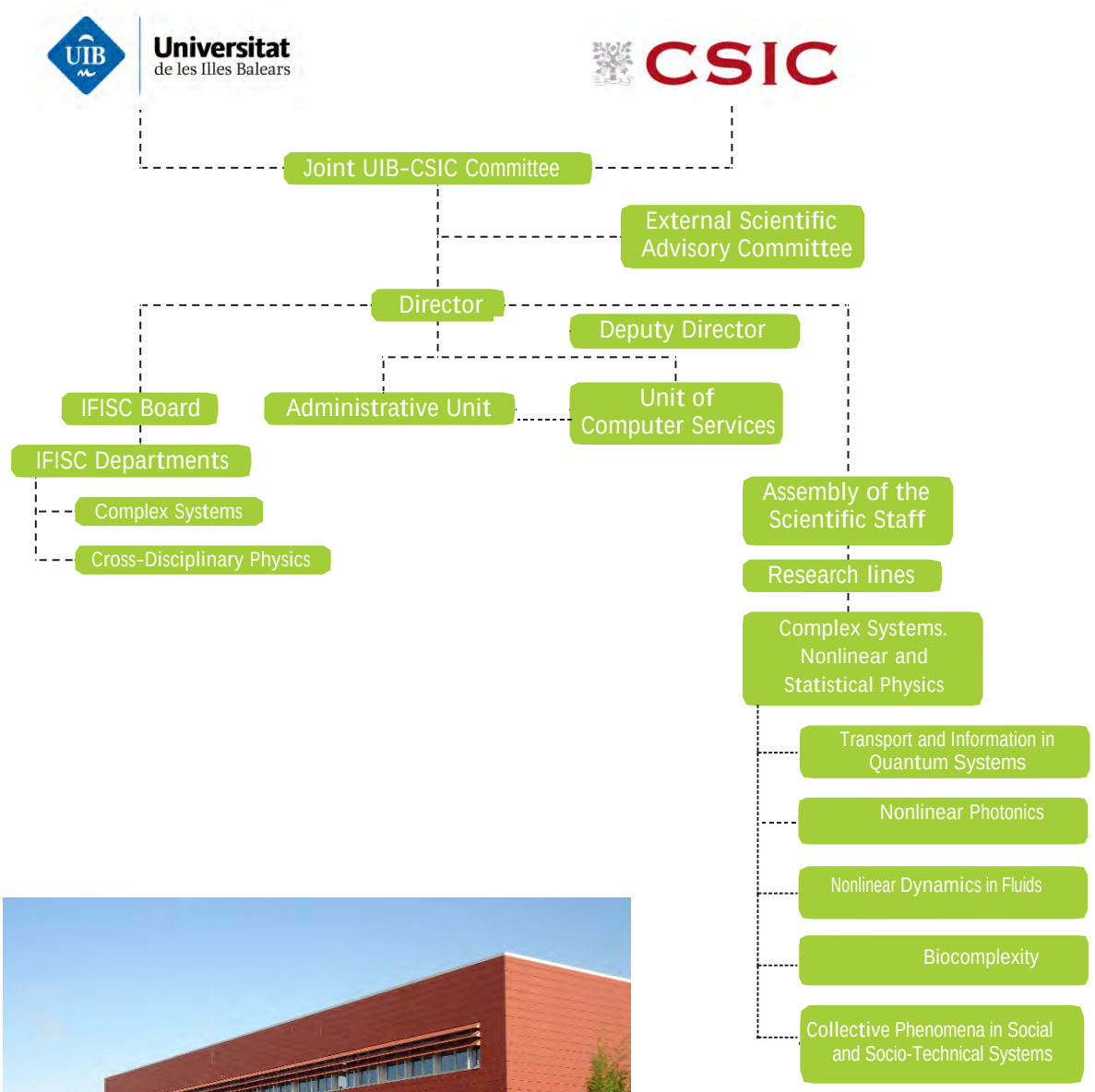
Living systems are the paradigm of complex systems, with nonlinear interactions occurring at all spatial and temporal scales, from molecules and genes to the planetary scales defining the global biosphere. One of the focus of our research is the ecological level where we consider modes of organisms' 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 2018 REPRESENTATIVE RESEARCH RESULTS

Here are some research results published during 2018. They are representative of the different research lines and thus illustrate the range of topics studied at IFISC.

Video presentation of some of these results: **https://ifisc.uib-csic.es/en/news/ifisc-winter-solstice-scientific-session-2018/**

The boundaries of consistency

Jüngling,T.; Soriano, M. C.; Oliver, N.; Porte, X.; Fischer, I.
Physical Review E 97, 042202.

Consistency refers to the property of an externally driven dynamical system to respond in similar ways to similar inputs. It is of particular importance in information processing systems like the brain or reservoir computing implementations. In a chaotic delay system with long delay, the delayed feedback can be considered to act as an external drive to the un-delayed subsystem. Here, we study the complete consistency properties in such systems, occurring as delay signatures in their correlation functions (correlation or delay echoes), and compare them to other correlation properties in a replica configuration.
The replica scheme is depicted in figure (A) below. A first nonlinear node X is subjected to delayed feedback and the second node Y (replica system) is driven by the first one. The correlation functions in this replica scheme reflect either causal or spurious contributions. In the top two panels of figure (B), we depict the first delay echoes of the auto-correlation AC(X) and the cross-correlation CC(X,Y). The delay echoes in AC(X) and the left peak in CC(X,Y) represent the relationship between the delayed signal X(t-τ) and the instantaneous signals X(t) and Y(t), respectively. These echoes possess the same causal relationship since the signal generated by X arrives simultaneously in both X and Y after a propagation time τ. These two signatures are expected to be equal under ideal conditions (X≡Y). From the height of the peak in this common delay echo we extract the so-called *transformation correlation* α. Moreover, the central peak of the cross-correlation function (central peak in CC(X,Y)) corresponds to the so-called *consistency correlation* γ^2. This central peak indicates the instantaneous correlation in the drive-response system, and therefore the degree of complete consistency. Finally, the so-called *spurious correlation* peak β compares the state of the replica system at two different times, Y(t- τ) and Y(t). Since the Y system has no feedback, this echo only reflects the underlying correlation between X(t- τ) and X(t).

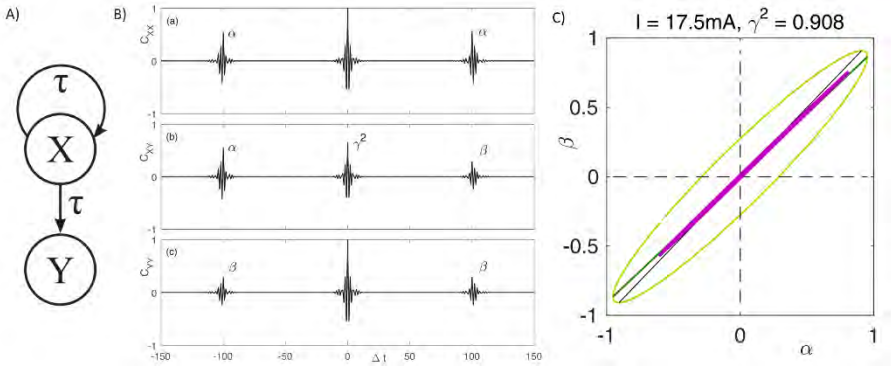


Figure. A) Schematic illustration of a replica scheme with two nonlinear nodes unidirectionally coupled with delay. B) Auto-correlation and cross-correlation functions of the replica scheme with the delay logistic map as nonlinear systems. C) Consistency ellipse for an experiment of delay-coupled semiconductor lasers.

Based on the definition of the correlation functions in this scheme, we derive relationships between the correlation measures in the form of outer limits. We find that, for a constant level of consistency, the correlation measures form an elliptic domain of allowed correlation values:

$$\beta_{\pm} = \gamma^2 \left[\alpha \pm \sqrt{(1-\gamma^2)\left(1 - \frac{\alpha^2}{\gamma^2}\right)} \right]$$

Therefore, we have refined the term of consistency and developed tools to gain new insights into chaotic delay dynamics by means of well-known correlation measures. Experimental correlations from laser experiments fit well into the elliptic boundaries for consistency as shown in figure (C). Following this analysis based on consistency properties, we demonstrate the link between consistency and synchronization in delay dynamical systems.

Stochastic pair approximation treatment of the noisy voter model

Peralta, Antonio F.; Carro, Adrian; San Miguel, Maxi; Toral, Raul
New Journal of Physics 20, 103045

The dynamics of many systems of interest in different fields can be phrased in terms of interacting agents that hold a binary state variable and whose evolution is random. These *agent-based stochastic binary-state models* have been widely used to study the emergence of collective phenomena in systems of stochastically interacting components. In general, these components are modeled as binary-state variables—spin up or down—sitting at the nodes of a network whose links represent the possible interactions among them. A full mathematical description of these systems is lacking and several approximations have been devised in the literature—a notorious one is the so-called *annealed approximation*. Our own approach, developed in this paper, is the most complete and accurate up to date. The starting point is a reduction of the dynamical rules to master equations for a set of variables including the number of agents in a given state and that hold a certain number of neighbors. After these variables are identified, we use the so-called *pair approximation* that assumes that the probability of having *q* nodes in the up state among the *k* nodes connected to a given node is a sequence of *q* independent processes and thus binomial. Using these ingredients we develop a full stochastic treatment of the resulting master equations. They are solved using two techniques: (i) S1PA, or a van Kampen-type ansatz (splitting the variables in their deterministic and stochastic contributions, both scaling differently with the number of agents N); and (ii) S2PA, using a more sophisticated scheme based on an expansion around a dynamical attractor. We next apply our methods to the noisy voter (or Kirman) model on different complex networks. We focus on the dependence of the density of active links ρ with the noise parameter a of the model. While for random networks (both heterogeneous or homogeneous) the S2PA offers a very good agreement for all values of a, the annealed approximation fails qualitatively for intermediate values and S1PA gives non-physical results for small a.

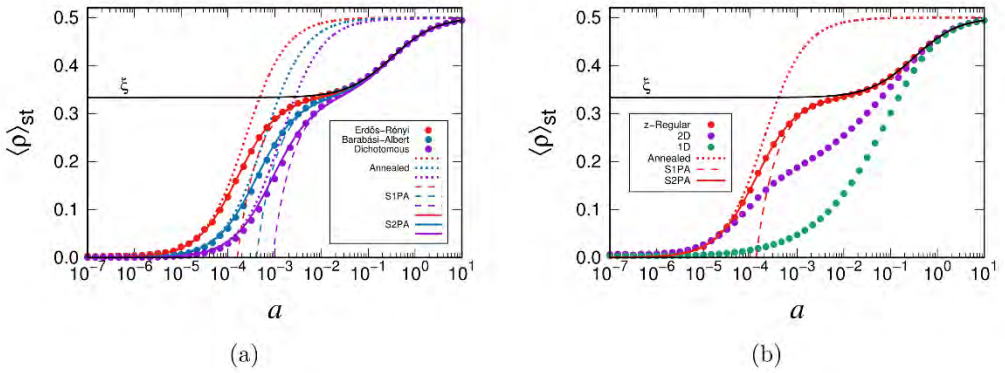


Figure: Stationary average density of active links ρ as a function of noise intensity a for different networks with average connectivity $\mu = 4$ and number of agents $N = 2500$. Panel (a) focuses on heterogeneous random networks and panel (b) on homogeneous networks. Dots correspond to numerical simulations while lines are analytical results according to the legend.

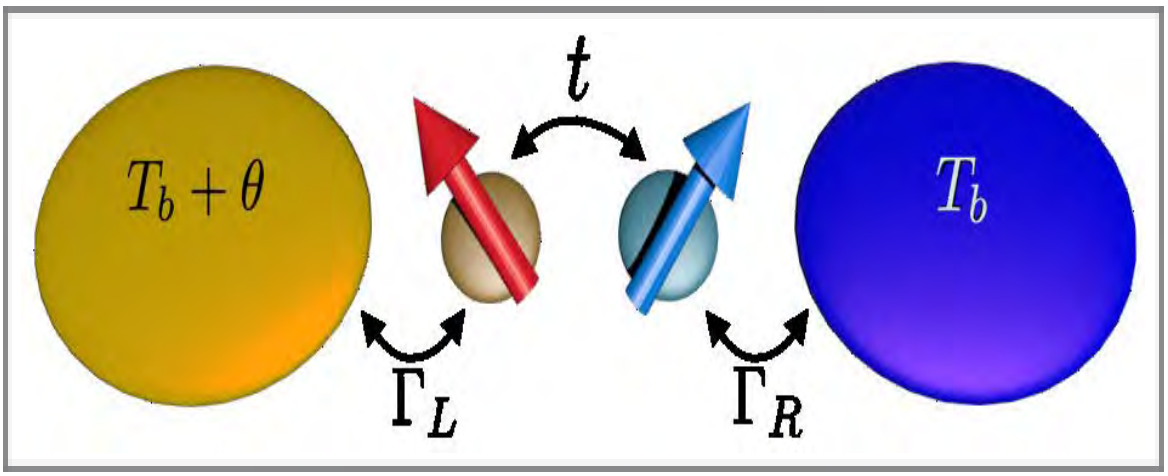
Thermally Driven Out-of-Equilibrium Two-Impurity Kondo System

Sierra, Miguel A.; López, Rosa; Lim, Jong Soo
Physical Review Letters 121, 096801

We investigate the archetypal two-impurity Kondo problem in tunnel coupled double quantum dot arranged in a series [1]. We consider the presence of a thermal bias denoted by θ. By using a theoretical description based on the Fermi Liquid behavior we obtain the nonlinear thermal and thermoelectrical responses.

We predict that when Kondo correlations prevail over the antiferromagnetic coupling **J,** that is the spin-spin coupling between the dot spins for low thermal the setup exhibits negative differential thermal conductance regions behaving as a thermal diode. Moreover, we show the sign tenability of the thermoelectric current I (θ) controlled by t/Γ (t and Γ denote the interdot tunnel and reservoir-dot tunnel couplings, respectively) and θ. All these characteristics are explained since at large θ both the heat current Q(θ) and the electrical one I (θ) are suppressed independently on the value of t/Γ. This is because the double dot decouples at high thermal biases. Finally, for a finite spin-spin interaction J, we analyze how the Kondo-to-antiferromagnetic crossover is modify by θ.

Fig. 1 Schematic of the double quantum dot

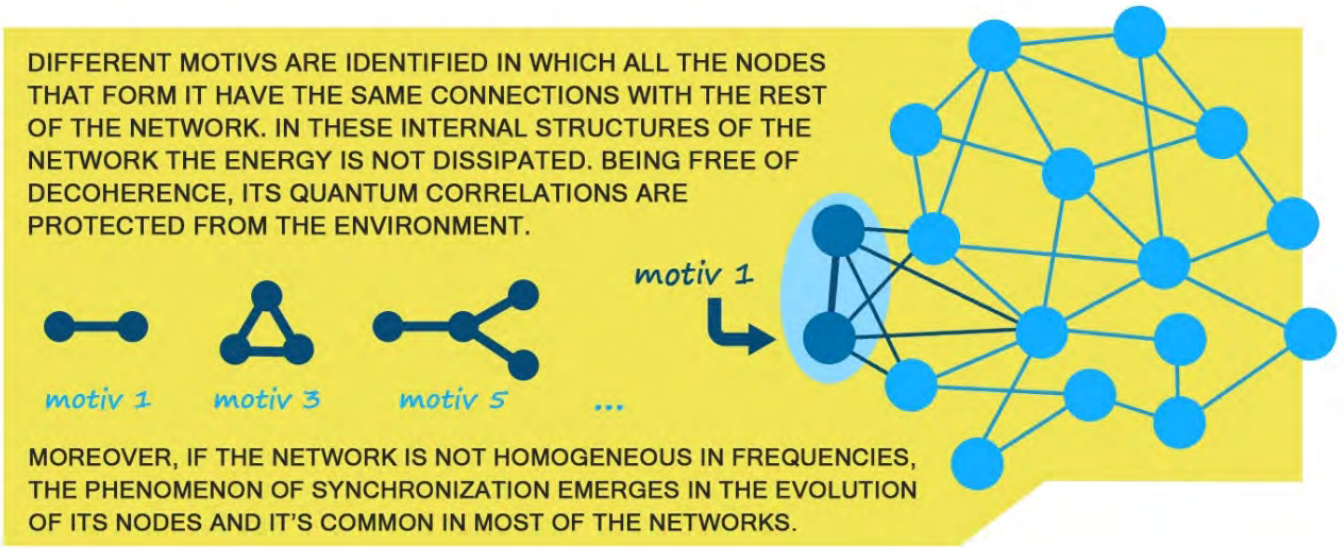


Unveiling noiseless clusters in complex quantum networks

Cabot, A.; Galve Conde, F.; Eguiluz, V. M.; Klemm, K.; Maniscalco, S.; Zambrini, R.
Quantum Information 57, 4

Exchanges of energy and information between systems and their environments are unavoidable, often are necessary for their proper operation (like, for instance, for friction or equilibration in engines) and, when moving into the quantum regime, can respresent a major obstacle in preserving quantum coherences and correlations. An opportunity to avoid these detrimental effects arises when some system degrees of freedom are actually shielded by decoherence. Indeed noiseless degrees of freedom are known in the simple case of a pair of identical, interacting qubits dissipating into a common bath. If we consider larger structures, but always in regular and symmetric configurations, these noiseless subspaces survive and are an interesting option for the storage or transport of quantum states, excitations or entanglement and can be exploited in quantum computation, metrology, communications and thermodynamics.

What happens if we consider more complex architectures beyond regular lattices, like complex quantum networks? In this work we take this challenge, looking at the abundance, extension and configuration of noiseless clusters embedded in medium size complex networks, such as random or small world ones. We address the resilience of these shielded degrees of freedom for irregular networks and experimental imperfections, showing also the existence of a family of quasi-noiseless modes. Large noiseless components involve even number of nodes and are more resilient to the presence of detuning than to inhomogeneities in their coupling strengths. We also show a robust presence of stationary and transient quantum synchronization in these protected clusters.



Reinforcement learning in a large-scale photonic recurrent neural network

Bueno, J.; Maktoobi, S.; Froehly, L.; Fischer, I.; Jacquot, M.; Larger, L.; Brunner, D.
Optica 5 (6) pp. 756-760

Neural network and cognitive computing implementations based on photonic hardware have been gaining considerable attention as a potentially disruptive future technology. Their appeal is related to the versatile optical platforms, good performance in classification and nonlinear prediction tasks, potentially high speed and low energy consumption. However, photonic neural networks with many nonlinear nodes in a fully parallel and efficient learning hardware have been lacking so far.

In this publication, a collaboration of researchers of the Femto-ST Institute in Besançon (France) and IFISC demonstrate a network of up to 2025 optically coupled nodes, forming a large-scale recurrent neural network and implementing reinforcement learning.

The neural network state is encoded on a spatial light modulator, an Ikeda ($\cos^2$) nonlinearity is realized using polarization optics, the spatial coupling is realized via a diffractive optical element and the readout layer is implemented using a digital micromirror device (DMD) and a detector. The authors overcome the limitations of strictly positive connection weights and the DMD being digital, by harnessing the non-monotonous slope of the Ikeda nonlinearity, randomly dividing the nodes into those with negative and positive slopes of their response function. In this way, the authors obtain very good performance in a nonlinear prediction task.

Ultimately, their work opens the door to novel and versatile photonic neural networks concepts.

The research has been selected by Optica edited by OSA (Optical Society of America), as the cover of the journal, illustrating a digital micro mirror device trained by reinforcement learning for photonic neural network implementation.

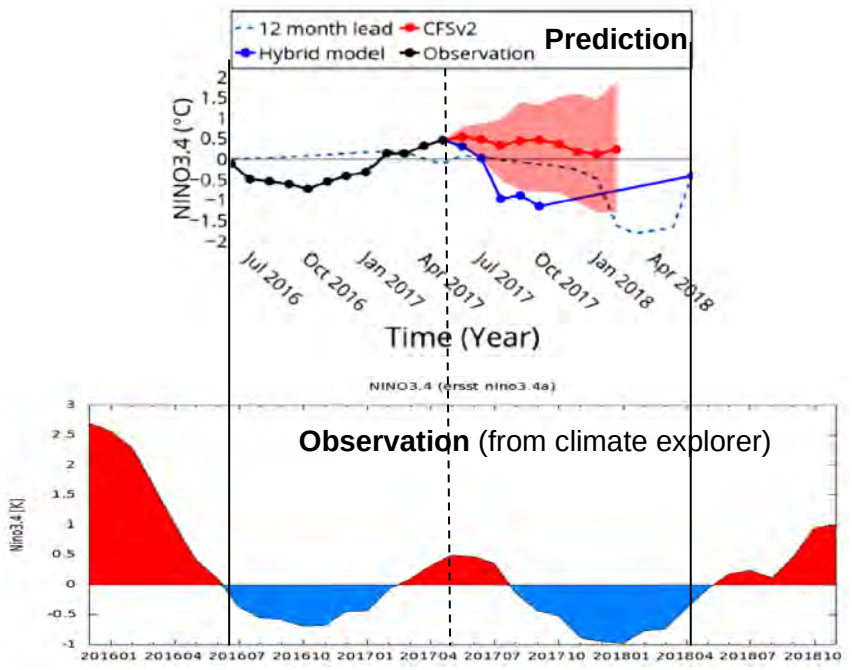
Using Network Theory and Machine Learning to predict El Niño

By Nooteboom, P.D.; Feng, Q.Y.; Lopez, C.; Hernandez-Garcia, E.; Dijkstra, H.A.
Earth System Dynamics 9, 969-983

El Niño-Southern Oscillation is a climatic phenomenon mostly identified by the appearance of anomalously warm waters in the central and east-central equatorial Pacific. It is in fact a coupled ocean-atmospheric oscillation with many consequences across the globe, as for example enhanced rain and floods in western America, and droughts in Australia, having thus major effects on agriculture, fisheries or public health. The phenomenon repeats irregularly each 2-8 years, which makes both important and difficult its prediction well in advance. State-of-the-art prediction techniques face the 'spring predictability barrier', meaning that they fail to give reliable predictions of the phenomenon (usually occurring around December) before June.

In this work we develop a new machine learning methodology, using a hybrid model composed of a feed-forward neural network and an ARIMA linear predictor, which was able to make good predictions of representative equatorial Pacific surface temperatures one year in advance. The key points to achieve this were two: first to feed the neural model with past data of variables known to be physically relevant for the phenomenon, such as wind stress or the amount of water in the upper ocean surface layers. And second to feed it also with quantities characterizing a network-theory characterization of the climatic correlations in the Pacific. For predictions up to six months ahead, the results of our hybrid model give a better skill than the well accepted CFSv2 ensemble prediction by the US National Centers for Environmental Prediction. More importantly, results for a twelve-month prediction, beyond the 'spring barrier' have a skill similar to the shorter lead time predictions.

In the upper figure we show the CFv2 prediction (red line with associated shaded reliability interval) done in May 2017 (the last date we had reliable observations before starting our work) for the NINO3.4 index, which is a representative value of mean temperatures in the central equatorial Pacific. In blue we show our prediction (the blue lines, extending for one year). The lower panel shows observed data, including temperatures measured after submission of our paper in early 2018. We see how the machine-learning hybrid method improves temperature prediction at long times.



Patterning the insect eye: from stochastic to deterministic mechanisms

Ebadi, Haleh; Perry, Michael; Short, Keith; Klemm, Konstantin; Desplan, Claude; Stadler, Peter F.; Mehta, Anita
PLoS Computational Biology 14, e1006363

At first glance, the eyes of insects have little in common with the human eye. Interestingly, however, the retinas of flies and other insects also contain photoreceptor cells of distinct types. Each of the few (2 or 3) types reacts to light in a specific wavelength (colour) range. In the common fruit fly Drosophila, like in humans, the spatial distribution of each colour types has low correlation: the locations of receptors of a colour type are essentially random (cf Figure 1a). Other types of flies such as the long legged flies Dolichopodidae (Doli) do exhibit pronounced spatial patterns as stripes across the retina alternating between the two color types (Figure 1b). Though mostly deterministic, a certain low fraction of random errors is observed in these patterns. When several errors occur close by in the same stripe, the error may spread to the next stripe and on to further stripes across the whole retina (Figure 1c). A structure intermediate between random and patterned colour type arrangement is observed in Crysosoma.

Here we account for these phenomena in one simple model. We hypothesize that the control mechanism for retina formation is conserved across fly species. The vastly different observations ranging from fully random to strongly ordered retinas are thus generated by modifying a mixing parameter. We implement this idea in a model akin to a cellular automaton with a rule as a tunable superposition of stochastic and deterministic choices of photoreceptor type. Figure 2 shows typical results of photoreceptor patterns obtained by the model. Finally we quantitatively validate the model in the context of real data. Maximum likelihood estimation of the model parameters for several fly retinas gives consistent and plausible results.

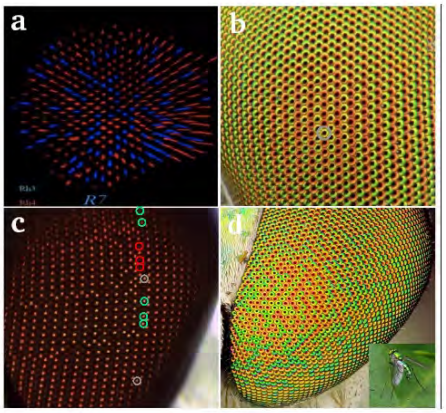


Figure 1:
(a) Stochastic distribution of photoreceptor types in the Drosophila retina.
(b) Striped pattern of red alternating with yellow/green receptors in the retina in a Condylostylus species fly, family Dolichopodidae. Single error circled in grey.
(c) Image of another Condylostylus individual eye with several errors. Anterior is to the left. In some cases, especially where several errors occur in proximity, the fate of the next most anterior column (to the left) is also modified. Such errors propagate across the eye from posterior to anterior. Note that isolated errors (marked with grey circles) do not propagate.
(d) Retina of a partially ordered Doli species in the Crysosoma genus.

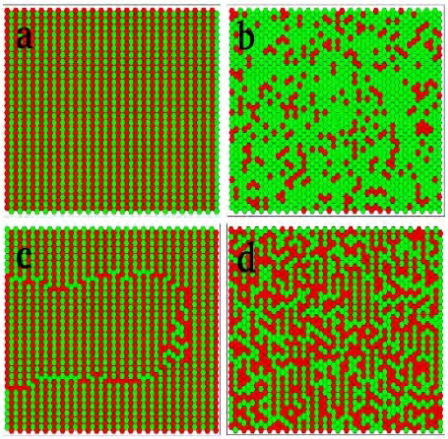


Figure 2:
Simulation results for a model fly eye of size 30 times 50.
The mixing parameter quantifies the relative importance of stochastic decisions, with (a) fully stochastic and (b) fully deterministic, modeling Drosophila and Doli retinas, respectively. Panel (c) models a Doli fly with a small probability of stochastic perturbations. Notice that the perturbations propagate leftward to the end, giving rise to a domain with a discernible boundary. In panel (d), parameters are chosen with a view to match the patterning of the intermediate, partially organised Chrysosoma shown in Figure 1d.

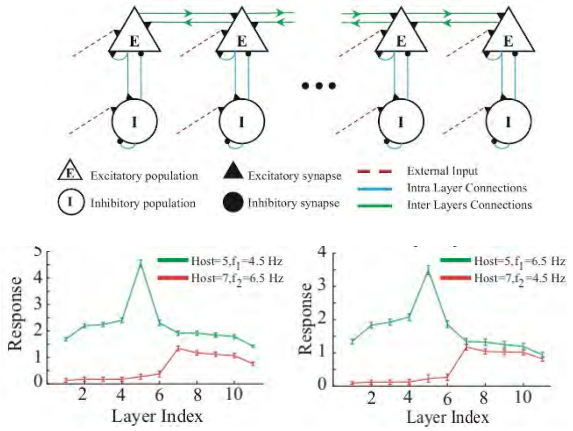
Dynamic information routing in neuronal networks

Pariz, A.; Esfahani, Z.G.; Parsi, S.S.; Valizadeh, A.; Canals, S.; Mirasso, C. R.
Neuroimage 166, 349–359.

The emergence of flexible information channels in brain networks is a fundamental question in neuroscience. Understanding the mechanisms of dynamic routing of information would have far-reaching implications in a number of disciplines ranging from biology and medicine to information technologies and engineering.

In this work, we showed that the presence of node (in our model a neuronal population) firing at a higher frequency (high-frequency node, HFN), as compared to the homogeneous frequency of all other nodes, in a network with local bidirectional connections leads to reliable transmission of signals and establishes a preferential direction of information flow.

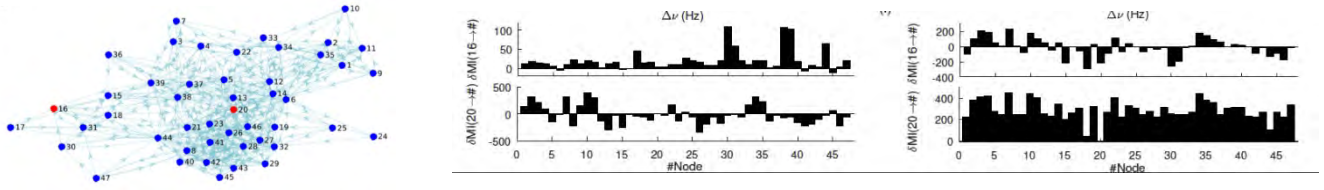
We found, in several network configurations with symmetric bidirectional connections, that a signal injected into a node would propagate in the network, being detected by other nodes, if the node receiving the perturbation has a higher intrinsic frequency as compared to the other nodes (the HFN). In the same network, a second signal applied into a normal-frequency node, would only propagate away from the HFN. In such a network, the HFN seems to play the role of a source, being highly influential in activity propagation despite the symmetric homogeneous structure.



Upper Figure: Basic network configuration. The network is composed of 11 nodes, each containing 80 excitatory (triangles) and 20 inhibitory (circles) neurons. Neurons within the nodes are randomly connected to each other with probability 0.1. Excitatory neurons of adjacent nodes are mutually connected with a probability 0.1 (green arrows).

Lower Figure: Left Panel: Response of all the nodes to a signal with frequencies f_1 (f_2) applied to node 5, the HFN (7, a normal node). The green curve indicates that the signal of frequency f_1 reaches all nodes while the signal of frequency f_2 (red curve) only propagates in the direction away of the high-frequency node. Right Panel: Results similar to those presented in the left panel but with the external signal frequencies interchanged.

Our simulations with heterogeneous networks, including the CoCoMac connectome network, confirm that high frequency nodes can act as functional hubs despite the presence of structural hubs in the network.



Left Panel: Graphical representation of the connectome network. Nodes 16 and 20 (red) are used as host nodes. **Middle Panel:** the outgoing delayed mutual information (δMI) of node 16 (the HFN) is positive at almost every node indicating that the information propagates outward from node 16 to all other nodes. On the contrary, the information generated in node 20 propagates only to some of the nodes. **Right Panel:** Outgoing δMI of node 16 is positive for some nodes and negative for others while the δMI measured from the signal generated at node 20 (the HFN) is positive to almost all other nodes indicating that this node is not only a structural hub but also a functional hub.

Convergence of marine megafauna movement patterns in coastal and open oceans

Sequeira, A. M.M.; Eguiluz, Victor M.; et al.
Proc. Natl. Acad. Sci. USA 115, 3072–3077

The development of smaller, cheaper and more powerful devices for tracking animal movement is increasing the amount and variety of data, and raising the opportunity to apply Big Data analytics. Within this context, we collected and analyzed the largest and most diverse dataset on marine animal tracking at the time (Fig. 1). Specifically, our dataset contains more than 2,000 individual tracks of 50 marine species. To compare across the range of scales, from birds to whales, we characterized the movement of each animal with the distribution of daily displacements and its normalized spread of the distribution.

We then used these results in two ways: (i) we compared the distributions using KS distances and constructed dendrograms representing the similarity of the observed movement patterns, and (ii) we used statistical modelling to show that, among a large set of variables (including guild, mass, locomotion mode, home range), the variation in the normalized spread of the distributions was mostly explained by species and coastal affinity, which measures the proportion of time that an animal roams close to the coast. Our main findings indicate tht while in open sea, the animals tend to move in a directed mode, while when close to shore they display more complex patterns with variable speed and continuous changes of direction (Fig. 2). Our results highlight the importance of the different habitats on the observed movement patterns and show a convergence across species.

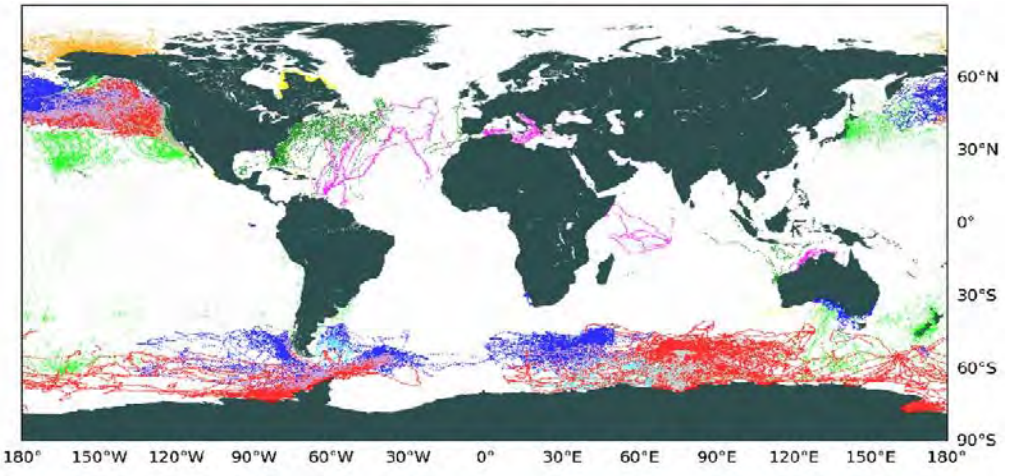


Fig.1 Global tracking dataset used for the analysis. Colors represent each of the nine guilds with data: cetaceans (yellow), eared seals (blue), flying birds (green), penguins (cyan), polar bears (orange), sharks (dark green), sirenians (purple), true seals (red), and turtles (pink).

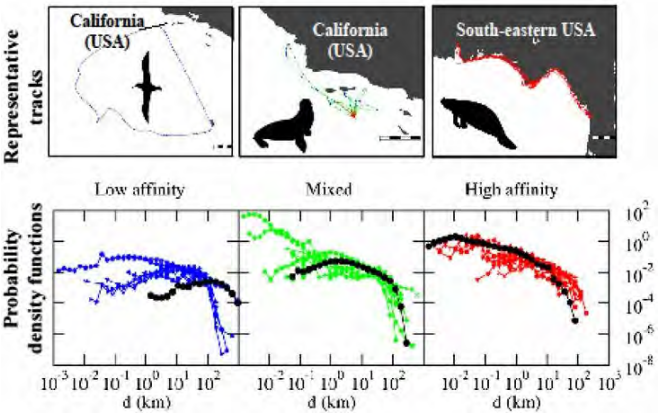
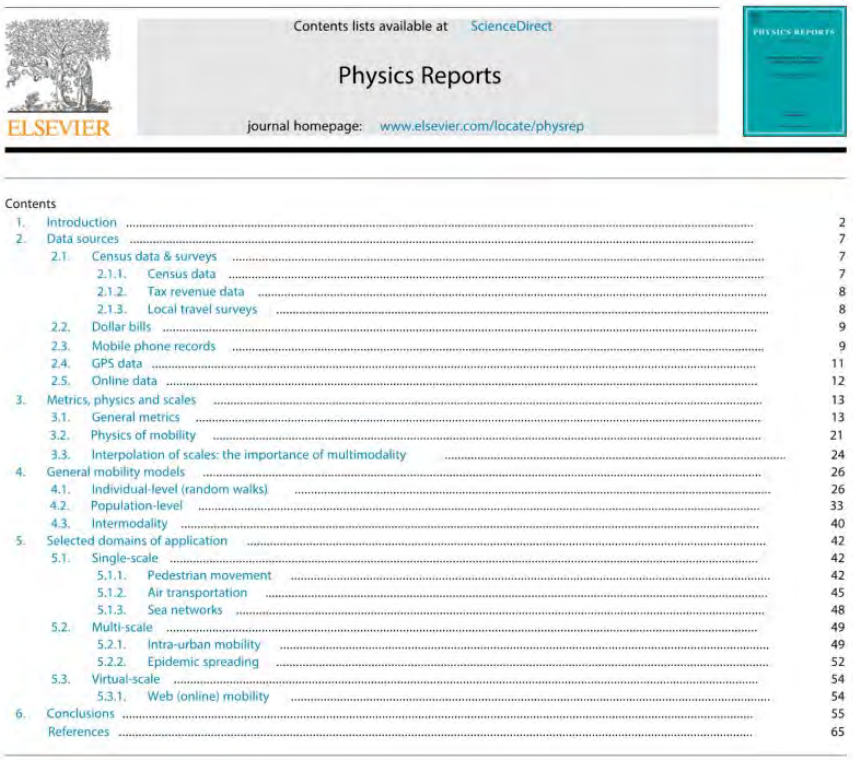


Fig.2 PDF of displacements (d, km) at the species level with 1-d time windows for species with low (mean < 0.3; Left), mixed (Center), and high (mean > 0.7; Right) coastal affinity (Bottom), and example tracks for each group (Top; black and white scale bars represent 100 km; black dotted lines: PDF for the example track shown).

Human mobility: Models and applications

Barbosa-Filho, H.; Barthelemy, M.; Goshal, G.; James, C.R.; Lenormand, M.; Louail, T.; Menezes, R.; Ramasco, J.J.; Simini, F.; Tomasini, M.
Physics Reports 734, 1-74

Recent years have witnessed an explosion of extensive geolocated datasets related to human movement, enabling scientists to quantitatively study individual and collective mobility patterns, and to generate models that can capture and reproduce the spatiotemporal structures and regularities in human trajectories. The study of human mobility is especially important for applications such as estimating migratory flows, traffic forecasting, urban planning, and epidemic modeling. In this survey, we review the approaches developed to reproduce various mobility patterns, with the main focus on recent developments. This review can be used both as an introduction to the fundamental modeling principles of human mobility, and as a collection of technical methods applicable to specific mobility-related problems. The review organizes the subject by differentiating between individual and population mobility and also between short-range and long-range mobility. A sketch with the main structure of the paper is displayed in the Figure. The analysis tools as well as the theoretical concepts strongly vary according to the type of mobility considered: from ideas based on random walks for individual displacements to flow models as the gravity or radiation for the aggregated information. Throughout the text the description of the theory is intertwined depending on the scale and type of mobility. The review compresses also applications to the main mobility modes such as air transport, cargo, etc., and to questions such as epidemic spreading that rely on mobility information and the advances that have taken place in the last years to obtain in an efficient and cheaper way this information.



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Contents

Figure.- Extract from the index page of the review. Besides the introduction and motivation, the main divisions of the text are a section to revise data sources and the features of the mobility information acquired, a section on metrics to characterize mobility, one for modeling frameworks from individual to population mobility flows, and then some selected applications.

Curing Braess' paradox by secondary control in power grids

Tchawou Tchuisseu, Eder Batista; Gomila, Damià; Colet, Damià; Witthaut, Dirk; Timme, Marc; Schäfer, Benjamin
New J. Phys. 20, 083005

The power grid is a complex interconnected network in which supply and demand have to match at all times since there is no significant amount of electrical energy storage. To guarantee this balance different control mechanisms are used. For unscheduled mismatches, e.g. random fluctuations, disturbances, or extreme weather, fast control mechanisms are required. Such control actions are becoming increasingly important due to the rising share of renewable generation integrated into the grid. In the case of a sudden disturbance in the system, the first seconds are essentially uncontrolled, and the spinning reserve of the generators is used as an energy buffer. Within the next tens of seconds, the primary control sets in to stabilize the frequency and to prevent a larger drop. To restore the frequency back to its nominal value, secondary control is necessary.

Grid topology plays also an important role in the stability of the system against fluctuations or sudden disturbances. Grid adaptations include adding transmission lines, e.g. to connect distant renewable generators, or increasing capacity of existing lines, e.g. to prevent cascading failures. Contrary to expectations, not all upgrades are beneficial to the stability of a grid. Instead, adding a line or extra capacity to an existing one may cause the generators to lose their synchrony causing a system failure (Fig. 1, a,b,c), what is known as Braess' paradox, which was initially discovered for transportation networks but may also occur in power grids. In recent studies of the grid stability, however, the effects secondary control and its interaction with network topology have not been fully investigated.

In this work we show how a simple implementation of secondary control reliably prevents Braess' paradox if all nodes are controlled (Fig. 1 d,e,f). However, controlling only generators still allows Braess' paradox, as it happens in all case with primary control only, thereby highlighting the importance of demand-side control in future grids.

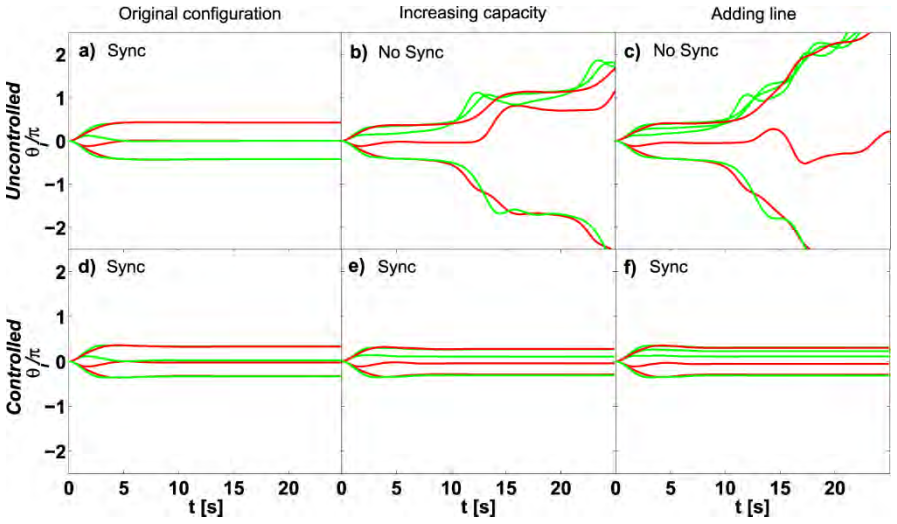


Fig. 1 Phase of the nodes of a network as function of time for the case without and with secondary control.

Immigrant community integration in world cities

Lamanna, Fabio; Lenormand, Maxime; Salas-Olmedo, María Henar; Romanillos, Gustavo; Gonçalves, Bruno; Ramasco, José Javier
PLoS ONE 13, e0191612

As a consequence of the accelerated globalization process, today major cities all over the world are characterized by an increasing multiculturalism. The integration of immigrant communities may be affected by social polarization and spatial segregation. How are these dynamics evolving over time? To what extent the different policies launched to tackle these problems are working? These are critical questions traditionally addressed by studies based on surveys and census data. Such sources are safe to avoid spurious biases, but the data collection becomes an intensive and rather expensive work. In this work, we conduct a comprehensive study on immigrant integration in 53 world cities by introducing an innovative approach: an analysis of users communication based on language detection in Twitter is performed to assign individuals to a local or immigrant community and to an (aggregated) residence areas in the city. The detected residence patterns have been validated with census data in three major cities: Barcelona, London and Madrid. Then we carry out a spatial distribution analysis through a modified entropy metric, as a quantitative measure of the spatial integration of each community in cities and the corresponding relevance within countries. The figure shows, for instance, the level of spatial integration of immigrant communities in the largest world cities. The lower the spatial entropy becomes (clearer colors in the figure), the more isolated the communities are. The cities can be classified in three major groups depending on the number of immigrant communities hosted and how well they spatially assimilate them. Along the same lines, one can also study which cultures integrate better in which hosting countries.

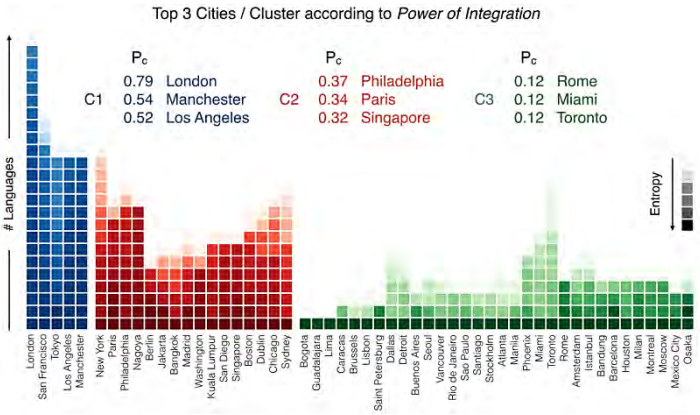


Figure.- Clusters of cities and Power of Integration. Three groups of cities show similar behavior in the number of communities detected and in their levels of integration. The length of the vectors represents the number of languages (communities) detected in each city; the color scale is representative of the decay of the entropy metric; the Power of Integration metric lead us to evaluate the potential of each city in uniformly integrating immigrant communities within its own urban area according to entropy values.

*National Geographic has highlighted our results in a recent online app. The link to the app is

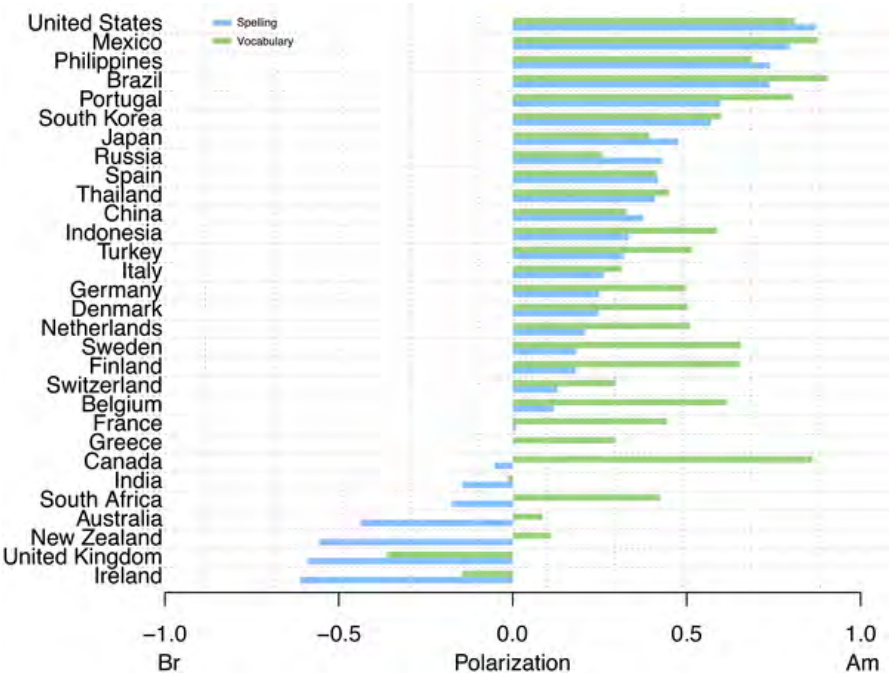
https://www.nationalgeographic.com/culture/2018/09/researchers-using-twitter-data-immigration-migration-graphic/

The new metric on integration for every immigrant community (language) in each of the cities considered in the paper can be explored in detail. The user can also select a community and observe the effect of changing countries (host culture) on the integration.

Mapping the Americanization of English in space and time

Gonçalves, B.; Loureiro-Porto, L.; Ramasco, J. J.; Sánchez, D.
PLoS ONE 13, e0197741 (1-15)

Languages show variations depending on a number of factors: social class, region, communication context, etc. These variations are reflected in all language levels, namely, phonetics, morphology, syntax, semantics and pragmatics. When the set of variants is constrained to a given spatial location, the resulting linguistic variety is known as dialect. The two global dialects of English are the British and the American varieties. In our work, we analyzed the progressive dominance of the American dialect over the British one, both in space and time. We employed methods that allow for an automatic assessment of the linguistic data: a Twitter corpus for the spatial analysis and a Google Books dataset for the study of the change of English in the last two centuries.



We consider two sources of variation. A given concept can be formalized using two spellings (ortographic variation) or two lexical items (vocabulary variation). Thus, a list of alternations is generated to distinguish between American and British varieties. Next, we create a corpus based on over 30 million geoleocalized tweets that match at least one of our keywords. We define a polarization metric that quantifies the degree of Americanization (Am) of Britishization (Br) for a specific geographical location. This metric ranges between -1 (a pure British dialect) and 1 (a pure American dialect). The results for the averaged polarization and different countries are shown in the Figure above. We find that both American orthography and vocabulary dominate except in UK and Ireland. Even in some ex-colonies there is a shift toward American vocabulary. Spelling is more conservative because this is studied in school.

The evolution in time (not shown here) also demonstrates the increasing usage of the American variety. Overall, our work contributes to the advancement of understanding variation and change in English using novel methods built on big data approaches.

2

PERSONNEL

2.1 PERMANENT SCIENTIFIC 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
SANDRO MELONI	CSIC Tenured Scientist
CLAUDIO MIRASSO	University Full Professor UIB
MAXI SAN MIGUEL	University Full Professor UIB, IFISC Director
JOSE J. RAMASCO	CSIC Tenured Scientist
DAVID SÁNCHEZ	University Professor UIB, IFISC Academic Secretary
LLORENÇ SERRA	University Full 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 2018.

Coherence and Integration / Interaction and Bridges	Pere Colet	Víctor M. Eguíluz	Ingo Fischer	Damia Gomila	Emilio Hernández-García	Cristóbal López	Rosa López	Manuel Matías	Sandro Meloni	Claudio Mirasso	José J. Ramasco	David Sánchez	Maxi San Miguel	LLorenç Serra	Tomàs 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	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					x	x	
6) *Collective phenomena in Social and Socio-technical Systems*	x	x							x		x	x	x			x	

IFISC people- Winter Solstice 2018

2.2 SCIENTIFIC ASSOCIATES

ALBERTO HERNANDO DE CASTRO
HORACIO WIO

2.3 POSTDOCTORAL RESEARCH ASSOCIATES

APOSTOLOS ARGYRIS	Marie Curie Contract
ANDRES A. CHACOMA	Postdoctoral Contract Project ESOTECOS
EDUARDO H. COLOMBO	Postdoctoral Contract Project ESOTECOS
MIGUEL C. SORIANO	Ramón y Cajal Fellow
GABOR DROTOS	Postdoctoral Contract Project LAOP
JUAN FERNANDEZ	Postdoctoral Contract Project SPASIMM
RICCARDO GALLOTTI	Postdoctoral Contract Project BigData4ATM
FERNANDO GALVE	Postdoctoral Contract Project EPheQuCS
GIANLUCA GIORGI	Balear Government Postdoctoral Contract
NAGI KHALIL	UIB Lecturer
KONSTANTIN KLEMM	Ramón y Cajal Fellow
GONZALO MANZANO	Postdoctoral Contract Project QUPROCS
BYUNGJOON MIN	Postdoctoral Contract Project ESOTECOS
SILVIA ORTÍN	Balear Government Postdoctoral Contract
JORGE P. RODRÍGUEZ	Postdoctoral Contract Project CAASE, since October
MEGHDAD SAEEDIAN	Postdoctoral Contract Project ESOTECOS
ALESSANDRO SOZZA	Postdoctoral Contract Project LAOP

2.4 PHD STUDENTS

ORIOL ARTIME	PhD student
JULIAN BUENO	PhD student
ALEIX BASSOLAS	Balear Government Fellowship
ALBERT CABOT	Balear Government Fellowship
VIOLETA CALLEJA	Contract Maria de Maeztu, since December
BRUNO CAMPANELLI	Balear Government Fellowship
LEONARDO DALLA PORTA	Fellow “Ciencia sin fronteras” sándwich CAPES, Brasil
REBECA DE LA FUENTE	FPI Contract Project LAOP
CRISTIAN ESTARELLAS	Balear Government Fellowship
ANTONIO FERNANDEZ	FPU Contract UIB
RODRIGO MARTÍNEZ	Contract Maria de Maeztu, since December
PEDRO MONROY	FPI Contract Project ESCOLA
JORGE P. RODRIGUEZ	FPU Contract, until September
DANIEL RUIZ REYNÉS	FPI Contract Project ESOTECOS
SOMAYE SHEYKHALI	Contract Project CAASE
MIGUEL A. SIERRA	Balear Government Fellowship
IRENE ESTÉBANEZ	Contract Maria de Maeztu, since December
MATTIA MAZZOLI	Contract Project ESOTECOS
AREF PARIZ	Collaboration Fellowship UIB
MORITZ PFLÜGER	Volkswagen Contract Project NeuroQNet
TOMASZ RADUCHA	Contract Project ESOTECOS
GUILLEM ROSSELLÓ	Contract Projects Set@QT and TQM@nano
PAOLA SOUTO	Contract Project CAASE
EDER B. TCHAWOU	Contract Project ESOTECOS

2.5 TECHNICAL AND ADMINISTRATIVE SUPPORT

INMA CARBONELL	Administration Unit Head
MARCOS GALLETERO	Lab Technician, until November
ADRIAN GARCÍA	Communication and Dissemination
PAU MASSUTI	Lab Technician
MARTA OZONAS	IFISC Secretary
ALBERTO PUEYO	Lab Technician, since November
EDUARD SOLIVELLAS	Computing Lab Technician
RUBEN TOLOSA	Computing Lab Technician
ANTONIA TUGORES	Data Engineer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2.6 VISITORS

LONG-TERM VISITORS (more than one month)

MEISAM AKBARZADEH	Isfahan Univ. of Technology, Iran. June-July
LUIZA ANGHELUTA	Univ. of Oslo, Norway. May - July
BENJAMÍN CARRERAS	Univ. Alaska, USA. March
MARIO COSENZA	Univ. Andes, Venezuela. May- June
FAKHTEH GHANBARNEJAD	TU, Berlin, Germany. Feb.-March
STEFANO LONGHI	Politecnico Milan, Italy. Sept.-Oct.
ANA M. MARTINS SEQUEIRA	Univ. of Western Australia, Perth, Australia. April
BYUNGJOON MIN	Chungbuk National Univ., Corea. July
ENRICO SER GIACOMI	Sorbonne Univ., Paris, France. April-May
FLORA SOUZA BACELAR	Univ. Federal de Bahia, Brasil. Feb.-March
ALIREZA VALIZADEH	Inst. Advanced Studies, Iran. June-August

New “María de Maeztu” PhD students

SHORT-TERM VISITORS (Less than one month)

FRANCISCO GONZALEZ	Univ. of Bristol, UK. January
HAYDEE LUGO	Univ. Complutense Madrid, Spain. January
SABRINA MANISCALCO	Turku C. Quantum Physics, Finland. January
TOBIAS GALLA	Univ. of Manchester, UK. January
HENK A. DIJKSTRA	Univ. of Utrech, Netherlands. February
MATEUSZ WILINSKI	Scuola Superiore Normale Piza. Italy. February
GIANLUCA SUSI	Centro Biotecnología, Madrid, Spain. March and Nov.
JORGE VIÑALS	University of Minnesotta, USA. March
FRANCESCO PLASTINA	Univ. della Callabria, Italy. March
ANXO SANCHEZ	Univ. Carlos III de Madrid, Spain. April
FRANCESCO D´OVIDIO	Univ. CNRS, France. April-May
CHRIS VAN DEN BROECK	Univ. Hasselt, Belgium. April-May
SANTIAGO CANALS	Inst. Neurociencias CSIC-UMH, Alicante, Spain. May
RAHUL PANDIT	Indian Institute of Science, Bangalore. May
DANIEL BRUNNER	FEMTO-ST, UMR CNRS, France. June
SERGEJ DEMOKRITOV	Muenster University, Germany. June
NATANIEL MARTINEZ	Univ. Nacional de Mar del Plata, Argentina. June
ERNESTO ESTRADA	Univ. of Strathclyde, UK. June
NATALYA ZIMBOVSKAYA	Univ. de Puerto Rico Humacao. July
JAN DANCKAERT	Vrije Universiteit, Brussel, Belgium. July
ROGER GUIMERÀ	SEESLab, Universitat Rovira i Virgili, Spain. July
MARIA MASOLIVER	Univ. Politécnica de Cataluña, Spain. July and October
MARCO CATTANEO	Univ. degli Studi di Milano, Italy. September
DAN CHICEA	Lucian Blaga Univ. of Sibiu, Romania. September
PASCAL SIMON	Univ. Paris SUD, France. October
JORDI NIN	BBVA Data & Analytics, Barcelona, Spain. October
GOURAB GOSHAL	Rochester Univ., NY, USA. October
HUI CAO	Yale Univ., USA. November

2.7 MASTER AND COLLABORATION STUDENTS

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

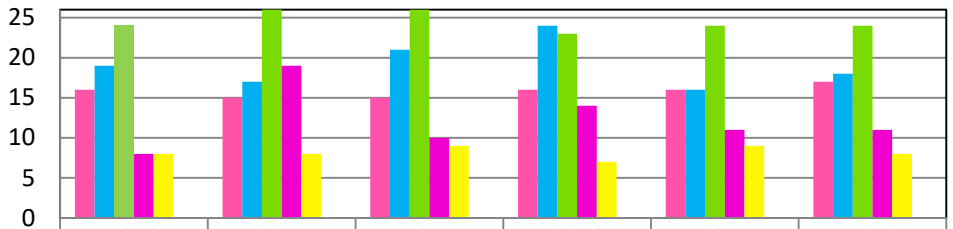
JAVIER AGUILAR	IFISC Master
ALEJANDRO ALMODÓVAR	IFISC Master
LORENA BALLESTEROS	IFISC Master
GUILLERMO BARRIOS	IFISC Master
ALEJANDRO CUNILLERA	IFISC Master
IRENE ESTÉBANEZ	IFISC Master
ALBERT FERRER	IFISC Master
HANI L. FRANCISCO	IFISC Master
ANTONIA FULLANA	IFISC Master
DAMIAN GIL	IFISC Master
OSCAR GOMEZ	IFISC Master
SAMUEL JAUME	IFISC Master
TOM JONGEMA	IFISC Master
SERGIO LACASTA	IFISC Master
GUILLEM LLODRA	IFISC Master
LUIS MARTÍN	IFISC Master
MARTÍN E. MAZA	IFISC Master
PABLO MORENO	IFISC Master
JUAN OZAITA	IFISC Master
JOAN PERELLÓ	IFISC Master
MARÍA MARTÍNEZ	IFISC Master
ANA PEREZ	IFISC Master
ADRIÀ PLAZAS	IFISC Master
BARTOLOMÉ PONS	IFISC Master
ALBERTO PUEYO	IFISC Master
RAMON SALETA-PIERSANTI	IFISC Master
SAMUEL SALINI	IFISC Master
GIACOMO SCETTRI	IFISC Master
FLORIAN SCHUSTEK	IFISC Master
ORESTIS VILCHEZ	IFISC Master
JESUS YELO	IFISC Master
JAVIER FERNÁNDEZ	SURF@IFISC Fellowship
GABRIEL GARAU	SURF@IFISC Fellowship
ALVARO MAS	SURF@IFISC Fellowship
ÁLVARO MORENO	SURF@IFISC Fellowship
DAVID PÉREZ	SURF@IFISC Fellowship
JAVIER RIVERA	SURF@IFISC Fellowship
JAVIER CANTERO	FUEIB Training contract. June
MERITXELL COLET	Undergraduate Research student. Carleton College, MN, USA. June
MARZIO DI VECE	ERASMUS student. Univ. Salerno, Italy. March - July
MINSEOK KANG	ERASMUS student. Univ. of Osnabrück, Germany. Sept. – March
MEDEA ZANOLI	ERASMUS student. Univ. Trento, Italy. April – Sept.
CLEMENT HAECK	ENS Paris-Saclay, France.
NATANIEL MARTÍNEZ	Univ. Nacional de Mar del Plata, Argentina
RODRIGO MARTÍNEZ	JAE Intro until November

2.8 HUMAN RESOURCES OVERVIEW

HUMAN RESOURCES IFISC 2018

	Total	Male	Female
Permanent staff	17	15	2
Postdoctoral fellows	16	15	1
PhD students	24	19	5
Long-term visitors	11	7	4
Support personnel	8	5	3
Total	76	61	15

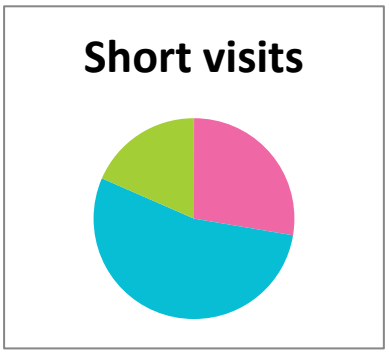
PERSONNEL IFISC 2013-2018

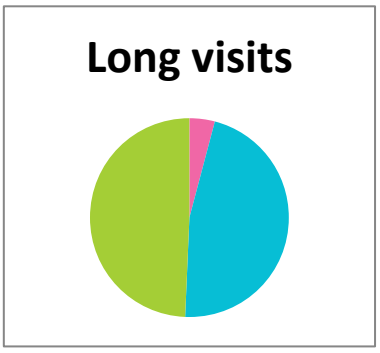


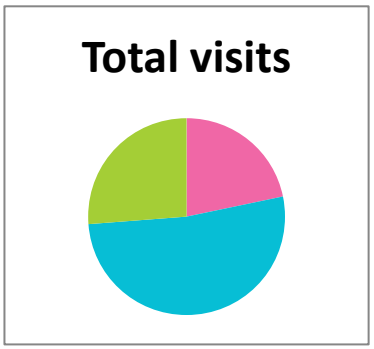
	2013	2014	2015	2016	2017	2018
PERMANENT STAFF	16	15	15	16	16	17
POSTDOCTORAL AND ASSOCIATED	19	17	21	24	16	18
PhD STUDENTS	24	27	26	23	24	24
LONG TERM VISITORS	8	19	10	14	11	11
SUPORT PERSONNEL	8	8	9	7	9	8
TOTAL	75	86	81	84	76	78

VISITING SCIENTISTS AT IFISC 2013-2018

		Short visits	Long visits	Total visits
	SPAIN	60	3	63
	EUROPE	117	34	151
	REST OF THE WORLD	40	36	76
	TOTAL	217	73	290







3

RESEARCH PROJECTS AND FUNDING

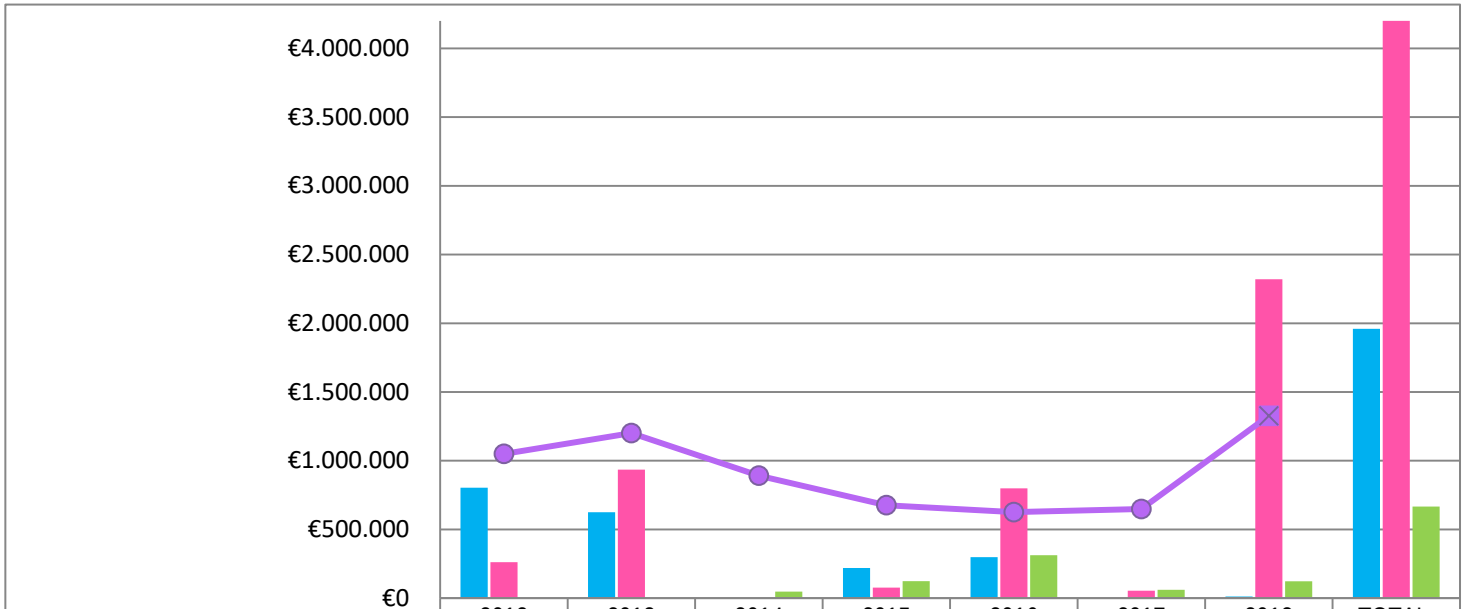
DURING 2018 IFISC HAS RECEIVED FUNDING VIA THE ACTIVE RESEARCH PROJECTS LISTED IN THE FOLLOWING PAGES. IN BRIEF:

- European Commission Framework Program projects: **4**
- Spanish National Plan: **9**
- Collaboration Networks: 4
- Research Contracts: 2

- Grand total budget of active projects in 2018: **2.131.944 €**
- Grand total budget of European Commission Framework Programs active projects in 2018: **529.997 €**
- Budget of EC-funded active projects in 2018: **24,85 %** of total
- Maria de Maeztu Unit of Excellence 2018: **2.000.000 €**

BUDGET FIGURES FOR THE PERIOD 2012-2018 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):

BUDGET IFISC´S RESEARCH PROJECTS 2012-2018 (IN €)



	2012	2013	2014	2015	2016	2017	2018	TOTAL
European Commission	€803.952	€625.349	€0	€219.875	€298.121	€0	€12.000	€1.959.297
Spanish National Plan for Science	€261.360	€934.830	€0	€77.000	€799.084	€54.450	€2.320.000	€4.446.724
Other Funding	€0	€0	€47.250	€123.813	€312.740	€60.500	€122.573	€666.876
Total	€1.065.312	€1.560.179	€47.250	€420.688	€1.409.945	€114.950	€2.454.573	€7.072.897
Anualized Total	€1.049.669	€1.201.140	€890.914	€676.039	€625.961	€648.528	€1.326.489	

3.1 RESEARCH PROJECTS FUNDED BY THE EUROPEAN COMMISSION

QuProCS

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

BigData4ATM

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

ESPON Housing

Espon EGTC "Big data for territorial analysis and housing dynamics". [2017/S 248-523261] Contract European Commission through the ESPON 2020 program devoted to study territorial uses in the EU. IFISC Principal Investigator: J. Ramasco.(2018-2019) Budget: 12.000€

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). Budget: 170.121,60 €

3.2 RESEARCH PROJECTS OF THE SPANISH NATIONAL PLAN FOR SCIENCE

MdM – IFISC

Accreditation of IFISC as "Maria de Maeztu, Unit of Excellence". Programa Estatal de Fomento de la Investigación Científica y Técnica de Excelencia. Principal Investigator: Claudio Mirasso. (2018-2022) Budget: 2.000.000 €

EPheQuCS

Emergent Phenomena and decoherence in quantum complex systems. [FIS2016-78010-P]. Spanish Government. Principal Investigator: Roberta Zambrini. (2017-2019). Budget: 102.850€

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, Claudio Mirasso and Miguel C. Soriano (2016-2019). CSIC Budget: 66.550€. UIB Budget: 46.585€

LAOP

Lagrangian studies of oceanic phenomena: connectivity patterns, transport barriers and marine populations. [CTM2015-66407-P]. Principal Investigator: Cristóbal Lopez (2016-2018). Budget: 171.941€

QuStruct

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

SPASIMM

Spatiotemporality in sociobiological interactions, models and methods. [FIS2016-80067-P]. Principal Investigators: Victor M. Eguíluz and Konstantin Klemm. (2017-2019). Budget: 54.450 €

TQM@Nano

Transport in Quantum Materials at the Nanoscale. [MAT2017-82639]. IFISC Principal Investigators: D. Sanchez and R. Lopez. (2018-2020) Budget: 70.000 €

CLUSTER

Computational Cluster for big data analysis and intensive numerical simulations. [EQC2018-004787-P] IFISC Principal Investigator: Maxi San Miguel (2018-2019) Budget: 250.000 €

3.3 OTHER IFISC RESEARCH PROJECTS

ND-PHOT

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

HOINK

Higher Order Interactions in Complex Networks. [2018501036] CSIC incorporation project. IFISC Principal Investigator: Sandro Meloni. Budget: 5.000 €

NeuroQNet

Neuromorphic Computing using Quantum Dot- Networks. Volkswagen Foundation (Germany). In collaboration with TU-Berlin and FEMTO-ST Besançon. IFISC Principal Investigator: Ingo Fischer (2016-2018). Budget: 115.000€

3.4 RESEARCH PROJECTS AND COLLABORATION NETWORKS WITH PARTICIPATION OF IFISC MEMBERS

COSTNET

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

RFE2017

Network of non-equilibrium statistical physics and its multidisciplinary applications. MINEICO [FIS2006-82028-REDT] IFISC Principal Investigator: David Sanchez. (2017-2019)

TNT

Thermoelectricity network: new theories. MINEICO [MAT2016-82015-REDT] Excellence Network. IFISC Principal Investigator: Rosa López. (2017-2019)

RICTE

Quantum Information and Technologies Network. [FIS2016-81891-REDT]. IFISC Principal Investigator: Roberta Zambrini. (2017-2019)

IN-TREE

INCT in Interdisciplinary and Transdisciplinary Studies in Ecology and Evolution. CNPq, CAPES, FAPESB Brazil. IFISC Principal Investigator: Emilio Hernández García. (2016-2022)

TEAMS

Towards an Ecological Approach of Information Systems. "Fondazione Cariparo" in Padua, Italy. IFISC Principal Investigator: Sandro Meloni. (2018-2019)

3.5 OTHER PUBLIC FUNDING

Research Institutes

Financial Support from the Government of the Balearic Islands for research Institutes. Ayuda Govern de les Illes Balears (2016-2018). Budget: 20.000 €

3.6 RESEARCH CONTRACTS

CAASE

Coupled Animal and Artificial Sensing for Sustainable Ecosystems: The Red Sea as a CAASE Study. Office of Sponsored Research. KAUST (Saudi Arabia). Principal Investigator: Victor M. Eguíluz. (2016-2020). Budget: 278.413 €

3 RESEARCH PROJECTS AND FUNDING

4

IFISC SEMINARS

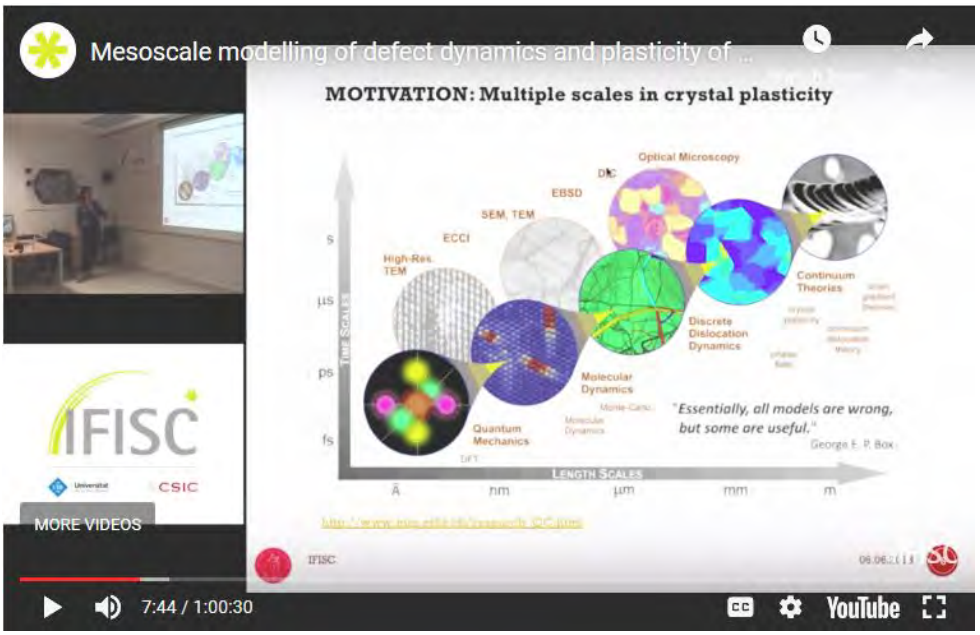
Coordinators:

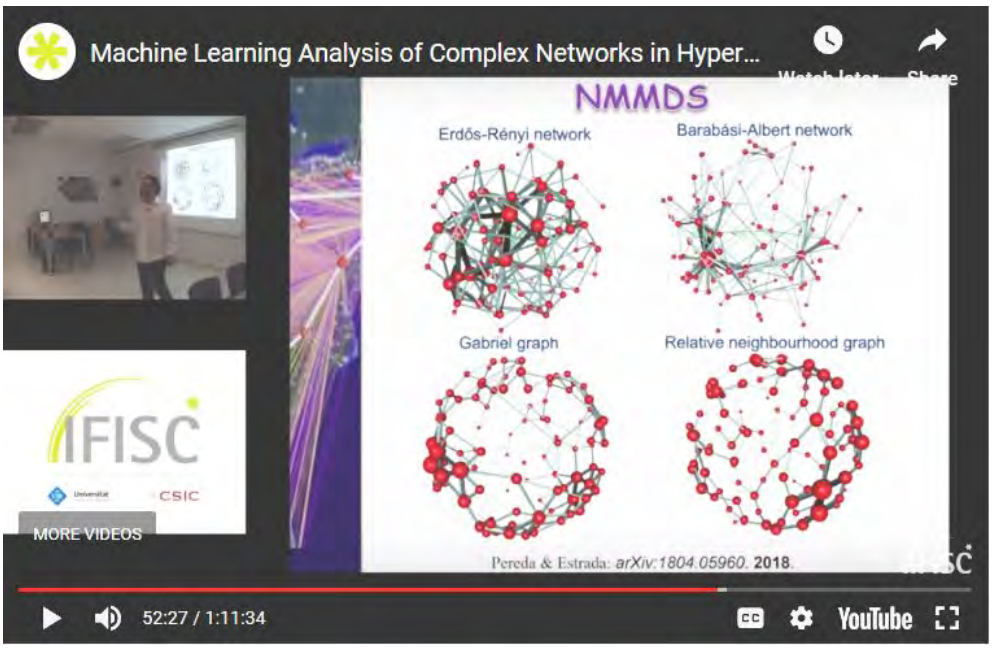
Llorenç Serra

Ingo Fischer

The full listing of the 52 seminars given at IFISC during 2018 can be found at **http://ifisc.uib-csic.es/en/events/seminars/** and in the Appendix of this Report.

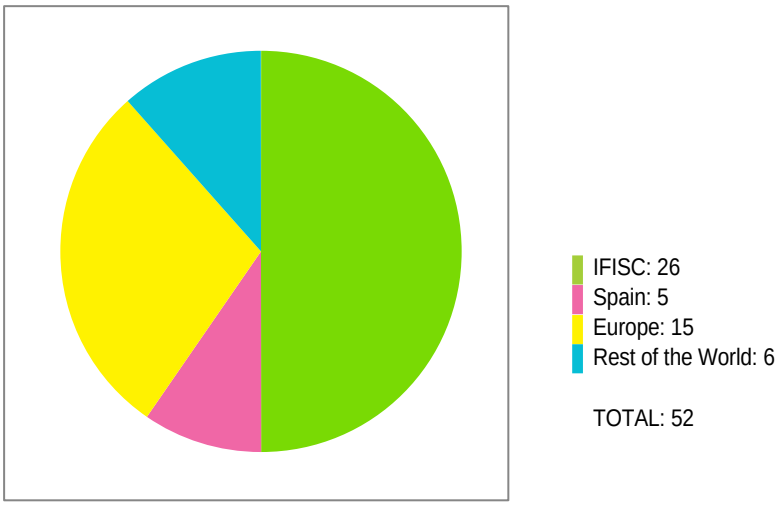
Seminars are broadcasted live and recorded. They are globally available at **http://ifisc.uib-csic.es/en/events/seminars/**, and also on our youtube channel **https://www.youtube.com/user/IFISCseminars/**



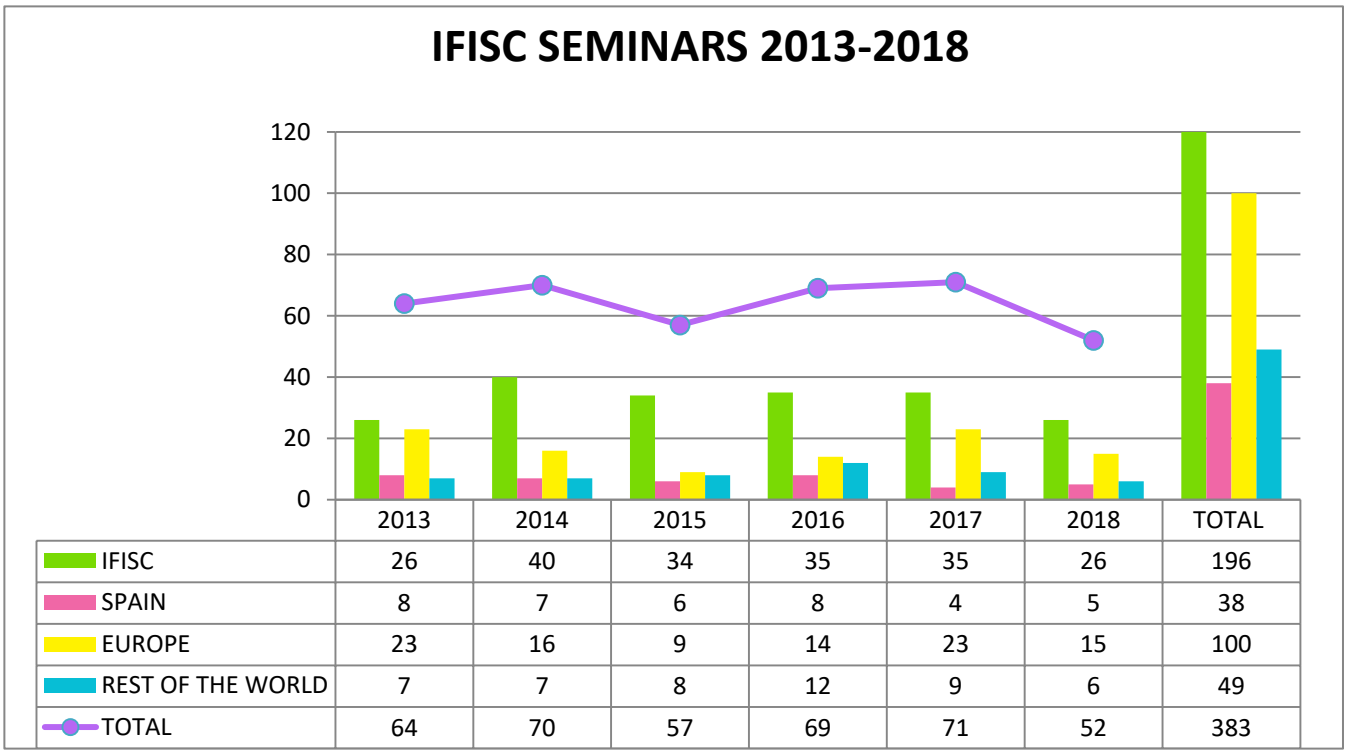


The following graphs show the distribution of seminars by geographical provenance of the speaker for 2018 and for the previous years:

PROVENANCE OF SPEAKERS AT IFISC SEMINARS 2018



IFISC SEMINARS 2013-2018



	2013	2014	2015	2016	2017	2018	TOTAL
IFISC	26	40	34	35	35	26	196
SPAIN	8	7	6	8	4	5	38
EUROPE	23	16	9	14	23	15	100
REST OF THE WORLD	7	7	8	12	9	6	49
TOTAL	64	70	57	69	71	52	383

4 IFISC SEMINARS

5

PUBLICATIONS

IFISC RESEARCH RESULTS HAVE BEEN REPORTED IN THE FOLLOWING PUBLICATIONS DURING 2018:

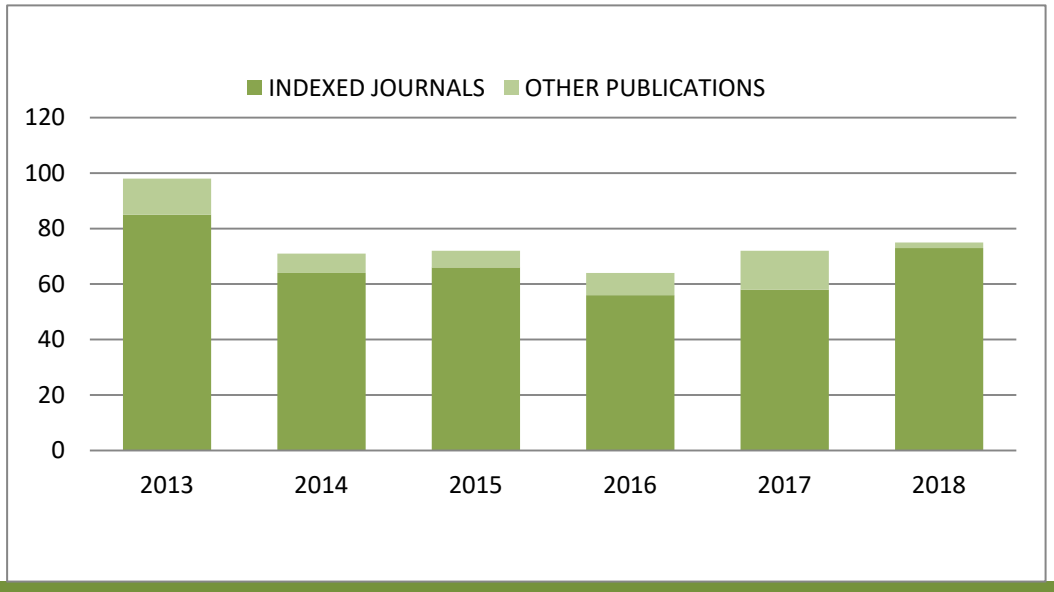
- Papers in indexed journals: **73**
- Other publications: **2**

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 2013-2018 IFISC has published 1 paper in Reviews of Modern Physics, 1 in Physics Reports, 3 papers in PNAS, 4 papers in Nature Communications, 2 in Science Advances, 1 paper in Nature Geophysics, 1 paper in Physical Review X, and 20 papers in Physical Review Letters.

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

IFISC PUBLICATIONS 2013-2018



	2013	2014	2015	2016	2017	2018	TOTAL
INDEXED JOURNALS	85	64	66	56	58	73	402
OTHER PUBLICATIONS	13	7	6	8	14	2	50
TOTAL	98	71	72	64	72	75	452

JOURNALS WITH THE LARGEST NUMBER OF PUBLICATIONS (2013-2018)

IFISC PUBLICATIONS	2013	2014	2015	2016	2017	2018	TOTAL
Physics journals							
Physical Review E	9	14	12	9	4	10	58
Physical Review B	8	7	7	5	4	5	36
Physical Review Letters	8	3	4	1	1	3	20
Physical Review A	5	5	2	3	3	1	19
New Journal of Physics	2	3	1	5	3	4	18
Chaos	1	0	3	2	5	4	15
European Physical Journal B	3	1	1	2	3	3	13
Multidisciplinary journals							
Scientific Reports	4	2	3	7	11	3	30
Plos One	0	5	6	2	1	4	18
Nature Communications	1	0	3	0	0	0	4
IEEE journals	4	0	3	2	1	0	10
Other non-physics journals	13	13	8	7	7	13	61

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

Biosciences:

Trends in Ecology and Evolution, Journal of Theoretical Biology, Bulletin of Mathematical Ecology, Journal of the Royal Society Interface, Neuroimage, PLoS Computational Biology, Ecological Complexity, Ecography, Macromolecules, Frontiers in Computational Neuroscience, Frontiers in Neuroscience, Frontiers in Neuroinformatics, Journal of Heredity, Physiological Reports, Journal of Applied Ecology, Theoretical Biology and Medical Modelling, ISME Journal, and Global Ecology and Biogeography.

Geosciences:

Nature Geoscience, Journal of Geophysical Research, Geophysical Research Letters, Deep-Sea Research I, Nonlinear Processes in Geophysics, Continental Shelf Research, ICES Journal of Marine Science, Earth Science Dynamics, Progress in Oceanography, Frontiers in Marine Science, and Journal of Climate

Social and sociotechnical systems:

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

Data science:

Computing and Informatics, EPJ Data Science, Journal of Machine Learning Research, Cognitive Computation, and Applied Network Science.

5 PUBLICATIONS

6

CONFERENCES AND WORKSHOPS

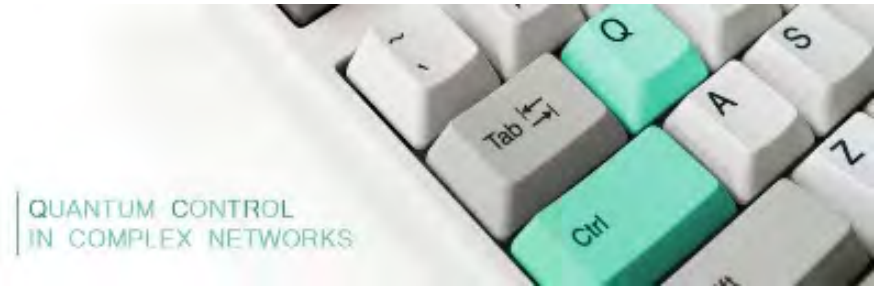
6.1 IFISC WORKSHOPS AND CONFERENCES

Quantum Control in Complex Networks

January 15
IFISC SCIENTIFIC ORGANIZER: Roberta Zambrini.
IFISC, UIB Campus, Palma de Mallorca, Spain

Exploratory international workshop to define common interests among invited scientists in view of a collaborative project for the first call of the "Quantum Technology" flagship.

https://ifisc.uib-csic.es/en/events/conferences/quantum-control-complex-networks/



CEWQO

25th Central European Workshop on Quantum Optics

May 21-25
IFISC Scientific Organizers: Roberta Zambrini, Gian Luca Giorgi, Fernando Galve and Albert Cabot.
UIB Campus, Palma de Mallorca, Spain

The 25th Central European Workshop on Quantum Optics (CEWQO 2018) was hosted by IFISC. The **conference series** started in early 1990s in Central Europe and transformed during more than 20 years into one of most popular annual meetings of European scientists interested in quantum optics and quantum information. Organized every year in a different location, the conference took place in different locations across the continent.

http://cewqo2018.ifisc.uib-csic.es

6.2 SCHOOLS

VIII GEFENOL Summer School on Statistical Physics of Complex Systems

July 2 - 13
IFISC Scientific Organizers: Pere Colet and Raul Toral
UIB Campus, Palma de Mallorca, Spain.

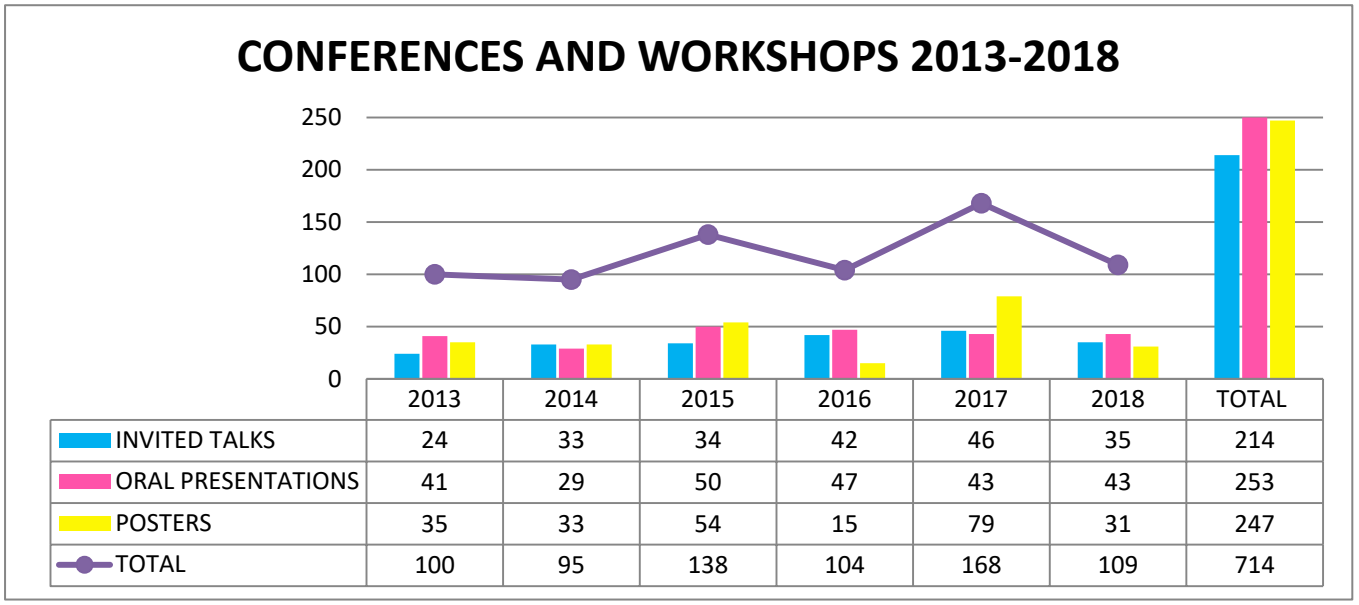
Statistical Physics, which was born as an attempt to explain thermodynamic properties of systems from its atomic and molecular components, has evolved into a solid body of knowledge that allows for the understanding of macroscopic collective phenomena. The tools developed by the Statistical Physics together with the Theory of Dynamical Systems are of key importance in the understanding of Complex Systems which are characterized by the emergent and collective phenomena of many interacting units. While the basic body of knowledge of Statistical Physics and Dynamical Systems is well described in textbooks at undergraduate or master level, the applications to open problems in the context of Complex Systems are well beyond the scope of those textbooks. Aiming at bridging this gap the Topical Group on Statistical and Non Linear Physics (**GEFENOL**) of the **Royal Spanish Physical Society** is promoting the Summer School on Statistical Physics of Complex Systems series, open to Master and PhD students and young postdocs world-wide.

Website**: https://school2018.gefenol.es/**

6.3 PRESENTATIONS AT SCIENTIFIC CONFERENCES 2018

- Invited talks: **35**
- Oral presentations: **43**
- Posters: **31**
- Total: **109**

Full listing in the Appendix of this Report.



	2013	2014	2015	2016	2017	2018	TOTAL
INVITED TALKS	24	33	34	42	46	35	214
ORAL PRESENTATIONS	41	29	50	47	43	43	253
POSTERS	35	33	54	15	79	31	247
TOTAL	100	95	138	104	168	109	714

6.4 SCIENTIFIC COMMITTEES AND ORGANIZATION OF CONFERENCES AND WORKSHOPS

Cabot, Albert; Giorgi, Gian Luca; Galve, Fernando; Zambrini, Roberta; Pueyo-Wagner, Alberto

- Collaboration members of the 25th Central European Workshop on Quantum Optics.

Colet, Pere

- Member of the Board and Treasurer of the Topical Group on Statistical and Nonlinear Physics (GEFENOL) of the Spanish Physical Society.

- Member of the Scientific Committee of the 6th International Conference on Photonics, Optics and Laser Technology, PHOTOPTICS 2018.

- Member of the Scientific Committee and School Coordinator of the VIII GEFENOL Summer School on Statistical Physics of Complex Systems.

Fischer, Ingo; Cornelles Soriano, Miguel

- Members of Conference Panel and Programme Committee of Conference on Nonlinear Dynamics of Electronic Systems: Nonlinear Technologies for Network and Distributed Systems Control in Acireal, NDES.

- Special Session Organizers on "Non-algorithmic computing by complex systems" of the 2018 International Symposium on Nonlinear Theory and Its Applications, NOLTA2018.

Fischer, Ingo

- Member of the Scientific Committee of the International Conference on Cognitive Computing 2018.

Gallotti, Riccardo

- Elected member of the council of the Complex Systems Society.

Klemm, Konstantin

- Member of the Program Committee of the Seventh Conference on Complex Networks and their Applications.

Meloni, Sandro

- Elected Member of the Steering Committee of the Conference on Complex Systems.

Sánchez, David

- Co-organizer of the Quantum Thermodynamics and Transport conference

Ramasco, Jose J.

- Elected member of the council of the Complex Systems Society.

- President of the Spanish Association for the Study of SocioTechnical Systems. COMSOTEC.

- Organizer of the " UrbanSys 2018" satellite of the conference CCS 2018.

San Miguel, Maxi

- Vice-chair of IUPAP C3Commission on Statistical Physics.

- Chair of the International Scientific Advisory Board of the Internet Interdisciplinary Institute (IN3) of the Open University of Catalunya (UOC).

Sintes, Tomas

- Member of the Scientific Committee of FisEs, Spanish Congress of Statistical Physics.

Toral, Raul

- President of the Board of the Group of Statistical and Nonlinear Physics (GEFENOL) of the Spanish Physical Society.

Zambrini, Roberta

- Member of the scientific committee of the conference XII Optics National Meeting, RNO2018.

- Member of the scientific committee of the conference " Quantum Technology International Conference" QTech2018

- CSIC Evaluation committee BBVA prizes. *BBVA Foundation Frontiers of Knowledge awards.*

7

OTHER ACTIVITIES

7.1 MASTER THESIS

Ozaita,Juan
Noisy voter model with partial aging and anti-aging
Supervisor: Raul Toral
December 11

Salini, Samuel
Inverse Problem in Legionella Outbreakes: From direct mobility to inference.
Thesis presented at Politecnico di Torino, Italy.
Supervisors: Ramasco, J.J.; Gallotti, R.
October 10

Gómez Fontana, Oscar
Application of a neural mass model to study phase-amplitude coupling
Supervisor: Mirasso, Claudio
September 28

Estébanez, Irene
Autonomous dynamical systems based on hardware implementations of delay-reservoir computers
Supervisors: Miguel C. Soriano, Ingo Fischer
September 27

Pueyo Wagner, Alberto
Collective motion of Brownian walkers in a birth-death gradient
Supervisors: E. Hernandez-Garcia and C. Lopez
September 27

Ferrer, Albert
Front motion in a non-local Fisher-Kolmogorov-Petrovskii- Piscunov (FKPP) equation
Supervisor: C. López
September 19

Aguilar-Sánchez, Javier
Active cluster crystals with Vicsek-like alignment interaction
Supervisor: Cristóbal López
September 10

Haeck, Clement
Lagrangian transport in the marine surface of the English Channel.
Thesis presented at ENS Paris- Saclay, France.
Supervisor: Cristóbal López
September 5

Martínez-Peña, Rodrigo
A Consumer-Resource Description of Public-Goods Production in Microbes
Supervisors: Manuel Matías and Ricardo Martínez-García
July 27

Maza-Cuello; Martin E.
Cluster Crystals under an external flow
Supervisors: Lopez, C. and Hernandez-Garcia, E.
July 26

Francisco, Hani Louie
Memory in Idiotypic Network Dynamics
Supervisor: Klemm, Konstantin
July 24

Losa Morlá, Joan
Complex photonic systems for post-processing communication signals
Supervisors: Argyris, Apostolos; Fischer, Ingo
June 20

Marconi, Luca
The noisy voter model with contrarian agents: a theoretical and computational study
Supervisors: Toral, R. and Khalil, N.
May 19

7.2 PHD THESIS

Tchawou Tchuisseu, Eder Batista
Complex dynamics in power grids
Supervisors: Damià Gomila and Pere Colet
December 13

Rodriguez, Jorge P.
The complexity of movement: Empirical data analysis and modelling of dynamical processes
Supervisor: Victor M. Eguíluz
September 21

7.3 AWARDS

Estébanez, Irene
"Autonomous dynamical system based on hardware implementations of delay-reservoir computers"

Awarded second prize in the competition for her Master thesis by the technology consultancy Informática El Corte Inglés (IECISA) and the Universitat de les Illes Balears (UIB) for the third edition of the **Premis IECI a la Innovació TIC (TalenTIC)** prizes for Degree theses (TFG) and Master theses (TFM) aimed at innovations in information and communications technologies (ICT).

7.4 MEMBERS OF EDITORIAL BOARD OF SCIENTIFIC JOURNALS

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

Member of the Editorial Board of the journal **Proceedings of the Royal Society A.**
Zambrini, Roberta

Member of the Editorial Board of the journal **Physics Communications.**
Zambrini, Roberta

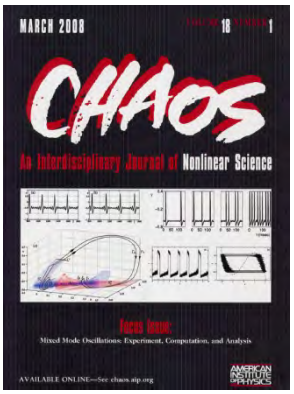
Member of the Editorial Board of the journal **European Physical Journal: Special Topics**
Colet, Pere

Members of the Editorial Board of **Frontiers in Physics** (Interdisciplinary Physics section):
Ramasco, J.J., Klemm, Konstatin, Wio, Horacio, Fernández-Gracia, Juan, and Eguiluz, Victor M.

Members of the Editorial Board of **PLoS ONE**
Ramasco, JJ; Meloni, Sandro

Member of the Editorial Board of **Scientific Reports.**
Ramasco, JJ

Members of the Editorial Board of the journal **Advances in Complex Systems**.
Klemm, Konstantin; Eguíluz, Victor M.



Member of the Editorial Advisory Board of **Chaos: An Interdisciplinary Journal of Nonlinear Science**.
Fischer, Ingo

Member of the Advisory Editorial Board of **European Physical Journal B.**
Wio, Horacio

Associate Editor of **Physica A.**
Wio, Horacio

Guest editors of the Special Issue on *Current perspectives in modelling, monitoring, and predicting geophysical fluid dynamics* of the journal **Nonlinear Processes in Geophysics**
Hernandez-Garcia, E.; Lopez, C.

7.5 RESEARCH STAYS IN OTHER CENTERS

Center for Data Science (New York University), USA.
Sánchez, David.
January 1st – Februrary 16

Instituto de Neurociencias de Alicante, Spain.
Estarellas. Cristian
November 11, 2017 – May 11

Max Planck Institute for Meteorology, Hamburg, Germany.
Drotos, Gabor
January 1 – 8

University of Nottingham, UK.
Zambrini, Roberta
January 21 – 24

Department of Physics, University of California, Berkeley, USA.
Ruiz-Reynés, Daniel
February 1 – May 1

Nanophysics group, ETH, Zurich, Switzerland.
Sánchez, David
February 1 – April 30

Technical University of Denmark (DTU-Nanotech), Germany.
Sierra, Miguel A.
February 1 – April 30

Department of Engineering Mathematics, University of Bristol, UK.
Rodríguez, Jorge P.
March 5 – April 6

University of Turku, Finland.
Zambrini, Roberta
April 17 – 22

Yukawa Institute for Theoretical Physics, Kyoto University, Japan.
Fischer, Ingo
October 1 – 31

Indian Ocean Marine Research Center, Crawley, Australia.
Rodríguez, Jorge P.
November 6 – 21

Università di Padova, Italy.
Meloni, Sandro
December 3 – 5

Institute for Theoretical Physics, Eotvos University, Budapest, Hungary.
Drotos, G.; Hernandez-Garcia, E.; Lopez, C.
December 12 – 13

7.6 SURF@IFISC

The Summer Undergraduate Research Fellowships (**SURF@IFISC**) program is part of one of the IFISC commitments: to offer training for the future generations of researchers in the field of complex systems.

Since 2013 we offer fellowships for introduction to academic research under the supervision of an IFISC researcher. Miguel C. Soriano, and Manuel A. Matías since 2018, have been the responsibles of the program. These fellowships are aimed at European undergraduate students of physics, mathematics, chemistry, biology and engineering.

2018 Selected students

- Fernández, Javier (Oviedo University), Data Science: prediction of air passenger´s flow. Advisors: J. Ramasco and Riccardo Gallotti.
- Garau, Gabriel (Autonoma Univ. Barcelona) Quantum machine learning with spins. Advisors: Roberta Zambrini and Gianluca Giorgi.
- Mas, Alvaro (Complutense Univ. Madrid) Nonlinear Thermoelectric transport in a selective spin environment. Advisor: Rosa Lopez.
- Moreno, Alvaro (Autonoma Univ. Barcelona) Autonomous operation of optoelectronic reservoir computing systems. Advisors: Ingo Fischer and Miguel C. Soriano
- Pérez, David. (La Laguna University) Modeling and dynamics of the power grid. Advisor: Damià Gomila
- Rivera, Javier (La Laguna University) Synchronization in a model of coupled neural oscillators. Advisor: Claudio Mirasso

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.

This is the 2018-2019 Master syllabus:

Structural module courses (39 credits):

Complex networks (3 credits)	Victor M. Eguiluz, Juan Fdez.-Gracia
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, Gianluca Giorgi
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)	Responsible: P. Colet

7. 8 OTHER POSTGRADUATE COURSES

Other Postgraduate Courses tought in 2018

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

- **Electronic nanostructures**
  David Sanchez, Llorenç Serra

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

- **Neural networks**
  Claudio Mirasso

7. 9 OTHER

Participation of IFISC in the International Day of Women and Girls in Science.

The United Nations General Assembly decided to proclaim February 11th as International Day of Women and Girls in Science with the aim of achieving full and equal access to science for girls and women. Within this framework, the platform 11FBalears (of which IFISC is part) organized a program of activities to make visible the role of women in R+D+I and promote scientific vocations (STEM) among girls.

All activities were free of charge and required prior registration.

Activities

FRIDAY, February 9th at 18:00 THEATER- ROUND TABLE (Salón de actos, CaixaForum Palma)

18:00 PERFORMANCE: "De ciencia, estereotipos y cifras"

18:20 ROUND TABLE: "La investigación en Baleares es también cosa de mujeres".

This round table addressed the issue of the visibility of women in science. In this event we compared the experiences of the invited researchers with the data provided by the main reports and studies. We got to know their opinions and encourage debate with those attending regarding the issues that are being addressed to make this day visible: the promotion of scientific vocations (STEM) in girls, the elimination of the "male brilliance" speech, the valorization of women in the History of Science, the glass ceiling, etc.... We also analyzed sexist and discriminatory behavior in the evaluating committees or in the publication system of specialized articles. In addition, we discussed the tools and actions that research institutions and R+D+I funding agencies have put in place to improve the implementation of gender equality. Some questions we tried to answer were: Why is it still so difficult to break the glass ceiling in science? How do institutions work to increase the presence of women in science and technology?

Moderator: **Patricia Fernández de Lis**, journalist and director of MATERIA (esmateria.com) and editor-in-chief of Science and Technology of the newspaper "El País".

Participants:

Dr. Beatriz Morales (IMEDEA, CSIC-UIB), Dr. Roberta Zambrini (IFISC, CSIC-UIB), Dr. Alicia Sintes (Department of Physics & IAC3, UIB), Dr. Mar Leza (Departments of Zoology and Biology, UIB), Dr. Dora Romaguera (IdISBa y CIBER-OBN), Dr. Salud Deudero (COB-IEO)

19:20 PUBLIC PARTICIPATION AND DEBATE

19:40 POETIC READING

19:50 CLOSING

SATURDAY, February 10th at 11:00 and 12:00 (Cafeteria, CaixaForum Palma). SPEED-DATING WITH SCIENTISTS

The bell's ringing! And you have 6 minutes to get to know in a relaxed, enjoyable and fun way one of the 21 female researchers who develop their careers in the Balearic Islands: what prompted them to dedicate themselves to science, their experiences in the scientific world, their current projects, etc.

Speed-Dating, emerged in recent years as an informal and dynamic outreach activity, which facilitates the interaction of groups of people to receive information from scientists and scientists in the first person, being able to ask questions and thus resolve doubts in a close and enjoyable way.

This activity was aimed at general and family audiences, with special interest for girls and students in Primary Education, Secondary Education and High School, students of Proffesional formative cycles and university cycles.

Participants:

Anna Traveset Vilaginés (IMEDEA, CSIC-UIB), Beatriz Morales Nin (IMEDEA, CSIC-UIB), Paula María Salgado Hernánz (IMEDEA, CSIC-UIB), Ananda Pascual Ascaso (IMEDEA, CSIC-UIB), Anna Díaz i Lorca (IMEDEA, CSIC-UIB), Inés Castejón Silvo (IMEDEA, CSIC-UIB), Ana Sanz-Aguilar (IMEDEA, CSIC-UIB), Ana Ruíz Frau (IMEDEA, CSIC-UIB), Amparo Lázaro Castillo (IMEDEA, CSIC-UIB), Francesca Iuculano (SOCIB), Emma Reyes (SOCIB), Inmaculada Ruíz (SOCIB), Eva Alou (SOCIB), Eva Aguiar (SOCIB), Paz Rotllán (SOCIB), Antonia Tugores (IFISC, CSIC-UIB), Rosa López (IFISC, CSIC-UIB), Rebeca de la Fuente (IFISC, CSIC-UIB), Maite Vázquez Luis (COB IEO), Patricia Reglero Barón (COB IEO), Gema Escribano Ávila (IMEDEA), Montse Compa (COB IEO), Maria Valls (COB IEO), Ana Morillas (COB IEO), Beatriz Guijarro (COB IEO), Ulla Fernández (COB IEO), Elvira Álvarez (COB IEO), Anabel Muñoz (COB IEO), Rocío Santiago (COB IEO), Pilar Córdoba (COB IEO), Cova Orejas (COB IEO), Rosa Balbín (COB IEO)

SATURDAY, February 17 from 09:00 to 18:00 (Ed. Jovellanos, aula AB02, Campus UIB). PROGRAMMING WORKSHOP Django Girls.

A workshop to learn the fundamentals of Python programming and web application development. Discover the world of information technology with the Django Girls Palma. No previous knowledge was necessary. Participation of Antonia Tugores (IFISC). More information: **https://djangogirls.org/palma/**

8

OUTREACH ACTIVITIES

8.1 CONFERENCE SERIES

Conference Series
"Sailing by the Complexity of the 21th Century: science, intelligence and creativity"

One of the objectives of IFISC (UIB-CSIC) has always been the organization of activities that promote the dissemination of complex systems and interdisciplinary science among citizens. For this reason, and taking over from "Explorando las Fronteras entre Saberes" (2007-2017), IFISC organizes since 2018 the series of talks "Navegando por la complejidad del siglo XXI".

PROGRAMME

APRIL 19

El arte de hacer matemáticas para dominar el mundo
The Art of making Math to domain the world

Dra. Clara Grima, Universidad de Sevilla, Spain

The work of a scientist in general and that of a mathematician in particular is similar to that of any artist: you have to know the techniques, find inspiration and, above all, dare to do something new, something that nobody has done before. And to seek beauty. Because as Hardy said, "There's no room in the world for ugly math." Can mathematical demonstrations be beautiful? Who decides which math is beautiful and how? We will try to answer these and other questions about creativity and beauty, although we warn that there are no theorems about mathematical beauty and creativity, as with colors. Well, there are theorems about colors, all right.

APRIL 26

Contra la estupidez, los propios dioses luchan en vano
Against stupidity, the gods themselves contend in vain

Anxo Sánchez, Universidad Carlos III de Madrid, Spain

While Economics bases much of its theory on the assumption that our decisions are rational, daily life shows us that we have little rationality, and experimental behavioral sciences rigorously prove it. In this talk I will show the results of an experiment with more than 500 people in which we ask them to make strategic decisions (i.e. to take into account that they are interacting with other people) in different situations. The fundamental conclusion of the experiment is that there is little rationality, and that most of us follow types of behavior that obey anything but intelligence.

MAY 3

Una perspectiva neuronal de la memoria
A neuronal perspective of memory

Santiago Canals, Instituto de Neurociencias de Alicante, Spain

Memory is a fundamental part of our life. It not only provides information about the past that helps us to live in the present, but also allows us to predict the future. Memory is a dynamic process, not a static repository of information, which evolves with us and whose fundamental feature is not to faithfully reflect the facts that have happened, but to facilitate our adaptation to a world in constant change. As important as remembering is the ability to forget and update what is memorized. We will deal with some of these topics and how the latest experimental developments in neuroscience allow us to erase or reactivate memories and even rewrite them. Knowing the mechanisms of memory helps us to create more efficient artificial systems and develop new approaches to increase our cognitive abilities.

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

8.2 OPEN DAYS @ IFISC

One more year the Institute of Interdisciplinary Physics and Complex Systems (IFISC-CSIC / UIB) organized its **Open Doors Day** targetting university students of the University of the Balearic Islands with the objective of communicating research work carried out in the center as well as its training offers. It is an open activity to students of any degree (being of special interest for the students of last courses) with intellectual and scientific restlessness. Throughout the activity it is explained what the IFISC is and which are the lines of research of the center, emphasizing the interdisciplinary spirit of the institute.

The event took place on Friday, February 9th at 3:00 p.m., IFISC seminar room Montserrat Casas. The activity began with a presentation of the center, how the IFISC works and the different research lines: transport and information in quantum systems, nonlinear photonics, nonlinear dynamics in fluids, biocomplexity and collective phenomena in social and socio-technical systems. The Master's Degree in Complex Systems Physics imparted by the IFISC was also presented to the students, as well as the itineraries to be followed by those students interested in studying a doctorate. The presentation included visits to the photonics laboratory and computer facilities.

Afterwards an appetizer was offered to the participants, after which the **IFISC Poster Party** began, where the master and doctoral students and the postdoctoral researchers of the center presented their research in poster format. In a relaxed atmosphere, the students were able to see first-hand what the young researchers of the Institute are working on.

It was a great opportunity for undergraduates to know what it means to dedicate themselves to research, as they had the opportunity to chat directly with the IFISC researchers themselves as well as with doctoral students who can tell their personal experience and solve doubts.

8.3 OTHER EVENTS

Participation in "Pint of Science"

IFISC has participated and organized "Pint of Science" which is a festival that aims to deliver interesting and relevant talks on the latest science research in an accessible format to the public – mainly across bars and pubs. The festival provides a platform which allows people to discuss research with the people who carry it out and no prior knowledge of the subject is required. It is run mainly by volunteers and was started by a community of British postgraduate and postdoctoral researchers in 2012. During two of the days of the event (May 14 and 15), four scientists from our Institute were in the iconic bar Palma 80's Café giving a dissemination talk about their work:

- "Nuestro cerebro no es tan diferente del de Terminator", by Cristian Estarellas.
- "Youtube solo me recomienda porquería, pero es mi culpa", by Adrian García.
- "Los estorninos no necesitan clases de baile", by Javier Aguilar.
- "¿Quo Vadis?: modelos de movilidad humana", by Juan Fernández Gracia.

.

Participation in the "III Fira de la Ciència I la Tecnologia d'Inca"

IFISC also participated in the Third "Fira de la Ciència i la Tecnologia d'Inca" (November 11-12). Members of IFISC (Irene Estébanez and Adrián García) participated in the III Fira de la Ciència i la Tecnologia d'Inca (October 28-30). Both seniors and children were able to visit the IFISC stand in order to learn more about our institute and the importance of complex systems in the study of nature. Among the experiments shown, the attendees highlighted the chaotic pendulum, the synchronization of metronomes, as well as the ferrofluid displays and an optical illusion with ambiguous cylinders.

Participation in the European Researchers' Night activities: Speed Dating with scientists

In the evening of Friday, September 28, there were several activities organized to raise awareness on the European Researchers´ Night. One of these activities, in which IFISC participated, was "Speed Dating with Scientists": during the short time of the "appointment" (five minutes), researchers explained their experiences in the scientific world and their current research to a small audience sitting next to them. When the bell rings, attendees change tables. IFISC participants: Rosa López and Adrián García.

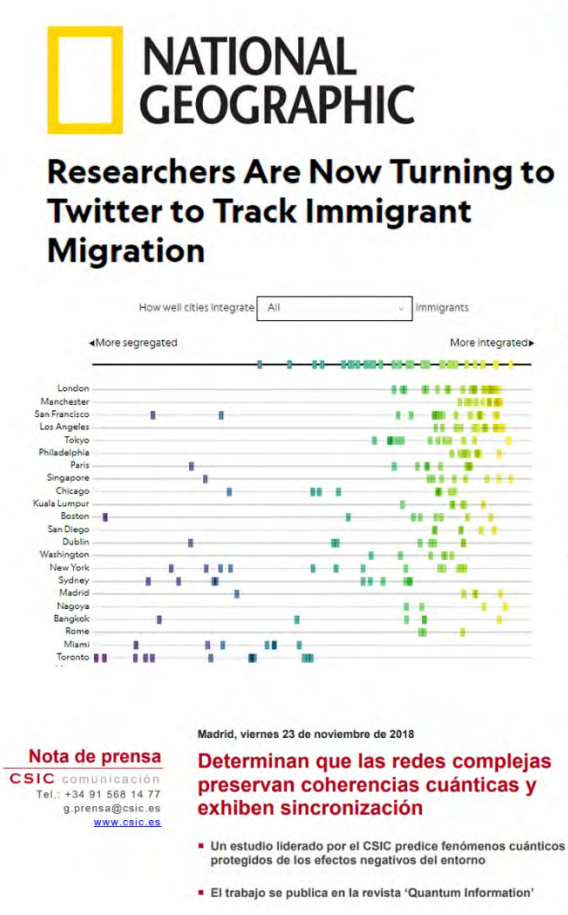
Laser graffiti at IES Joan Alcover

IFISC participated in the activity "Night at the Institute" organized by IES Joan Alcover with a laser graffiti, display organized by A. García. Students learned what a laser is and how an optical filter works while drawing with light on the walls of their classroom.

8.4 PRESS & MEDIA

IFISC research has also received attention from newspapers and other media.

During 2018, IFISC activities produced 155 press releases and appearances in written and digital press (national and international), and 12 clips on radio and TV. See the full lists in the Appendix.


NATIONAL GEOGRAPHIC

Researchers Are Now Turning to Twitter to Track Immigrant Migration

How well cities integrate All immigrants

◂More segregated More integrated▸

London
Manchester
San Francisco
Los Angeles
Tokyo
Philadelphia
Paris
Singapore
Chicago
Kuala Lumpur
Boston
San Diego
Dublin
Washington
New York
Sydney
Madrid
Nagoya
Bangkok
Rome
Miami
Toronto

Nota de prensa
CSIC comunicación
Tel.: +34 91 568 14 77
g.prensa@csic.es
www.csic.es

Madrid, viernes 23 de noviembre de 2018

Determinan que las redes complejas preservan coherencias cuánticas y exhiben sincronización

- Un estudio liderado por el CSIC predice fenómenos cuánticos protegidos de los efectos negativos del entorno
- El trabajo se publica en la revista 'Quantum Information'


BioTech

Neuronas de alta frecuencia determinan la conectividad efectiva en redes neuronales

Entender cómo se guía y procesa la información en el cerebro es clave a la hora de entender su funcionamiento. Esta no es, sin embargo, una tarea fácil: miles de millones de neuronas lo forman, cada una de ellas con sus propias conexiones, formando un entramado extremadamente complejo. Una dificultad añadida es el hecho de que los canales de información no son estáticos: las conexiones entre neuronas van cambiando, fortaleciéndose algunas mientras que otras se debilitan.

Un estudio internacional, en el cual ha participado un investigador del Instituto de Física Interdisciplinar y Sistemas Complejos (IFISC-UIB/CSIC) ha planteado un modelo de simulación neuronal en el que se analiza cómo estas conexiones dinámicas pueden ir variando dirigidas internamente por el propio comportamiento de las neuronas.

Para ello, simularon una red interconectada de 11 poblaciones neuronales, formadas por 100 neuronas cada una. El sistema inicialmente se plantea homogéneo, es decir, todas las neuronas pulsan (emiten impulsos eléctricos) con la misma frecuencia. De esta forma las conexiones entre nodos son simétricas y bidireccionales, por lo que la información puede transmitirse tanto de A a B como de B a A.

SINC
La ciencia es noticia

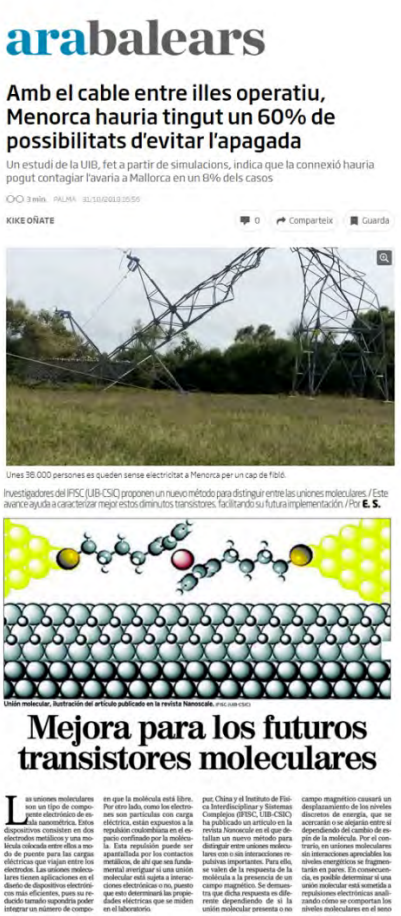
Focas, ballenas y aves marinas hacen los mismos viajes por el océano

Me gusta 0 Tweet

Los movimientos de los animales marinos por el océano abierto y la costa son una fuente de información crucial para su conservación. Un estudio liderado por centros de investigación australianos revela que a pesar de las diferencias en el tamaño corporal y la forma, todos los animales marinos se mueven a través del océano de manera parecida.

Más información sobre: océano animales movimiento

SINC | Seguir a @agencia_sinc | 26 febrero 2018 21:00


arabalears

Amb el cable entre illes operatiu, Menorca hauria tingut un 60% de possibilitats d'evitar l'apagada

Un estudi de la UIB, fet a partir de simulacions, indica que la connexió hauria pogut contagiar l'avaria a Mallorca en un 8% dels casos

3 min. PALMA 31/10/2018 05:55

KIKE OÑATE 0 Comparteix Guarda

Unes 38.000 persones es queden sense electricitat a Menorca per un cap de fibló.

Investigadores del IFISC (UIB-CSIC) proponen un nuevo método para distinguir entre las uniones moleculares. / Este avance ayuda a caracterizar mejor estos diminutos transistores, facilitando su futura implementación / Por E. S.

Unión molecular. Ilustración del artículo publicado en la revista Nanoscale.

Mejora para los futuros transistores moleculares

Las uniones moleculares son un tipo de componente electrónico de escala nanométrica. Estos dispositivos consisten en dos electrodos metálicos y una molécula colocada entre ellos a modo de puente para las cargas eléctricas que viajan entre los electrodos. Las uniones moleculares tienen aplicaciones en el diseño de dispositivos electrónicos más eficientes, pues su reducido tamaño supondría poder integrar un número de componentes que la molécula está libre. Por otro lado, como los electrones son partículas con carga eléctrica, están expuestos a la repulsión coulombiana en el espacio confinado por la molécula. Esta repulsión puede ser apantallada por los contactos metálicos, de ahí que sea fundamental averiguar si una unión molecular está sujeta a interacciones electrónicas o no, puesto que esto determinará las propiedades eléctricas que se miden en el laboratorio.

pur, China y el Instituto de Física Interdisciplinar y Sistemas Complejos (IFISC, UIB-CSIC) ha publicado un artículo en la revista Nanoscale en el que detallan un nuevo método para distinguir entre uniones moleculares con o sin interacciones repulsivas importantes. Para ello, se valen de la respuesta de la molécula a la presencia de un campo magnético. Se demuestra que dicha respuesta es diferente dependiendo de si la unión molecular presenta o no campo magnético causará un desplazamiento de los niveles discretos de energía, que se acercarán o se alejarán entre sí dependiendo del cambio de espín de la molécula. Por el contrario, en uniones moleculares con o sin interacciones apreciables los niveles energéticos se fragmentarán en pares. En consecuencia, es posible determinar si una unión molecular está sometida a repulsiones electrónicas analizando cómo se comportan los niveles moleculares en el seno

SOCIAL MEDIA IMPACT SUMMARY

TWITTER **@IFISC_mallorca**

Total tweets 3.052

Total Followers 1.528 (20% increase of number of followers in 2018)

60% men / 40% women interested in science news, technology, climate and astronomy

Languages most used by IFISC followers: Spanish (72%) and English (68%).

Mostly located in Spain, US, UK, Italy and Mexico.

FACEBOOK **http://www.facebook.com/ifisc**

Facebook fans: 960 (6% increase of fan number in 2018)

62% men / 38% women

Languages most used: Spanish (57%), English (15%), Portuguese (14%), Catalan (5%)

Mostly located in Spain, Mexico and Brazil

YOUTUBE **http://www.youtube.com/user/IFISCseminars**

Visualizations: 111.096 in 2018

YouTube subscribers: 656 in 2018

APPENDIX

a.4. IFISC seminars and talks 2018

In the electronic version of this report, titles are hyperlinked to the recording of the seminar, if available.

January 10
Atom-surface scattering at nonzero temperature: An example of chaotic scattering with three degrees of freedom
Francisco González Montoya, U. of Bristol, UK

January 24
Stochastic population dynamics in switching environments
Tobias Galla, The University of Manchester, UK

February 7
New perspectives on contagion processes: heterogeneous adoptability and compatibility
Byungjoon Min, IFISC

February 12
Coupled Lasers - concepts and realizations
Moritz Pflüger, IFISC

February 15
Inhomogeneities and caustics in the sedimentation process of marine biogenic particles in oceanic flows
Pedro Monroy, IFISC

February 21
Transport and diffusion in the turbulent ocean: Floaters on isopycnal surfaces.
Alessandro Sozza, IFISC

February 28
Cooperation vs. Competition in an Evolutionary Ecological Framework
Fakhteh Ghanbarnejad, Institute of Theoretical Physics, TU Berlin, Germany

March 7
Liquid crystal electrokinetics
Jorge Viñals, U. of Minnesota, USA

April 11
Opinion Formation by Social Influence: From Experiments to Modeling
Andrés Chacoma, IFISC

April 25
Consensus Building on a Scale-Free Network
Marzio di Vece, University of Salerno, Italy

April 26
Cognitive resource allocation determines the organization of personal networks
Anxo Sánchez, Universidad Carlos III de Madrid, Spain

May 2
Large deviation theory (1/3)
Christian Van den Broeck, Hasselt University, Belgium

May 3
Large deviation theory (2/3)
Christian Van den Broeck, Hasselt University, Belgium

May 3
Gamma frequencies coordinate theta oscillations in the hippocampus via cross-frequency coupling
Santiago Canals, Instituto de Neurociencias CSIC-UMH Alicante, Spain

May 4
Large deviation theory (3/3)
Christian Van den Broeck, Hasselt University, Belgium

May 14
The noisy voter model with contrarian agents: a theoretical and computational study
Luca Marconi, IFISC

May 21
Bitcoin is not (just) about money
Matteo Toto, CTO of Vulpern Ventures, Estonia

May 23
Superstatistical methods for complex systems: Application to frequency fluctuations in power grids
Christian Beck, School of Mathematical Sciences, Queen Mary U. of London, UK

May 30
Cardiac Arrhythmias: What can we learn from Mathematical Models for Cardiac Tissue?
Rahul Pandit, Indian Institute of Science, Bangalore

June 5
Bifurcation of periodic solutions of ODEs with finite symmetry group
Adrian Murza, University of Texas at Dallas, USA

June 6
Mesoscale modelling of defect dynamics and plasticity of defects crystals
Luiza Angheluta, Univ. of Oslo, Norway

June 13
When seeing things in a different light: A new scaling rule for context dependent moral decisions
Luis Martinez, Instituto de Neurociencias de Alicante, Spain.

June 20
Complex photonic systems for post-processing communication signals
Joan Losa Morlá, IFISC

June 20
Spin-current induced magnetic dynamics
Sergej Demokritov, Muenster University, Germany

June 27
Machine Learning Analysis of Complex Networks in Hyperspherical Space
Ernesto Estrada, U. of Strathclyde, UK

July 4
Statistical Physics of a Rational Machine Scientist
Roger Guimerà, SEESLab, Universitat Rovira i Virgili, Spain

July 5
Some Applications of Complex Network Methods in Urban Transportation Networks
Meisam Akbarzadeh, Dept. of Transportation Engineering, Isfahan Univ. of Technology, Iran

July 9
Reduction of Power Grid Fluctuations by Using Smart Devices
Damià Gomila, IFISC

July 10
Chaotic time-series prediction and attractor reconstruction using machine learning
Miguel Cornelles, IFISC

July 11
Noise-induced transitions vs. Noise-induced phase transitions
Raúl Toral, IFISC

July 12
Heat Transfer in Interacting Quantum Dot Systems
Rosa López, IFISC

July 18
Population survival in spatiotemporal environments
Eduardo H, Colombo, IFISC

September 6
System-size expansion of the moments of a master equation
Antonio Fernández Peralta, IFISC

September 14
Searching on noisy graphs via continuous-time quantum walks
Marco Cattaneo, Univ. degli Studi di Milano, Italy

September 14
Noiseless clusters in complex quantum networks
Albert Cabot, IFISC

September 19
Dynamic Light Scattering Revisited - An Artificial Neural Network Approach for Time Series Processing
Dan Chicea, Lucian Blaga University of Sibiu, Romania

September 26
Parity-Time and Topological Photonics
Stefano Longhi, Dipartimento di Fisica, Politecnico di Milano, Milan, Italy

October 5
Characterization of chaotic advection in three dimensional fluid flows
Rebeca de la Fuente, IFISC

October 10
Random walks, flocking, large deviations and Bose-Einstein transitions
Raúl Toral, IFISC

October 16
Assessing the risk of default propagation in interconnected sectorial financial networks
Jordi Nin, BBVA Data & Analytics, Barcelona, Spain

October 23
Vegetation fronts in clonal growth models
Daniel Ruiz-Reynés, IFISC

October 24
Thermal interplay between magnetic Kondo impurities
Miguel Sierra, IFISC

October 31
Immigrant community integration in world cities
José J. Ramasco, IFISC

November 7
Presentation of new IFISC projects
Researchers, IFISC

November 9
Structural invariants in street networks
Gourab Goshal, Rochester University, Rochester NY, USA

November 11
III Fira de la Ciència i la Tecnologia d'Inca
Marcos Galletero, Irene Estébanez, Adrián García, IFISC

November 14
Inhibitory gating in the Dentate Gyrus
Cristian Estarellas, IFISC

November 23
Complex Lasers
Hui Cao, Yale University, USA

November 28
Valley splitting in bilayer graphene quantum point contacts
David Sánchez, IFISC

November 29
From human mobility to intra-urban hierarchy: the linkage between city structure, transport, emissions and health
Aleix Bassolas, IFISC

December 3
Recent advances in Photonic Neural Networks
Julián Bueno, IFISC

December 13
Complex dynamics in power grids
Eder Batista Tchawou, IFISC

December 19
IFISC winter solstice
Researchers, IFISC

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 Indexed Publications

Convergence of marine megafauna movement patterns in coastal and open oceans
Sequeira,A. M. M.;Rodríguez,J. P.;Eguíluz,V. M.;Harcourt,R.;Hindell,M.;Sims,D. W.;Duarte,C. M.;Costa,D. P.;Fernández-Gracia,J.;Ferreira,L. C.;Hays,G.C.;Heupel,M. R.;Meekan,M. G.;et al.
Proceedings of the National Academy of Sciences, 115, 3072-3077

Deciphering the interdependence between ecological and evolutionary networks
Melián,Carlos J.;Matthews,Blake;de Andreazzi,Cecilia S.;Rodríguez,Jorge P.;Harmon,Luke J.;Fortuna,Miguel A.
Trends in Ecology & Evolution, 33, 504-512

Human mobility: Models and applications
Barbosa-Filho, H; Barthelemy, M; Ghoshal, G; James, CR; Lenormand, M; Louail, T; Menezes, R; Ramasco, JJ; Simini, F; Tomasini, M
Physics Reports, 734, 1-74

Quantum Fluctuation Theorems for Arbitrary Environments: Adiabatic and Nonadiabatic Entropy Production
Manzano, G.;Horowitz, J.M.; Parrondo, J.M.R.
Physical Review X, 8, 031037

Topologically Nontrivial Valley States in Bilayer Graphene Quantum Point Contacts
Overweg, H.; Knothe, A.; Fabian, T.; Linhart, L.; Rickhaus, P; Wernli, L; Watanabe, K.; Taniguchi, T.; Sánchez, D.; Burgdörfer, J.; Libisch, F.; Fal'ko, V. I.; Ensslin, K.; Ihn, T.
Physical Review Letters, 121, 257702 (1-6)

Thermally Driven Out-of-Equilibrium Two-Impurity Kondo System
Sierra, M A.;López, R; Lim, J S
Physical Review Letters, 121, 096801 (1-6)

Optimal work extraction and thermodynamics of quantum measurements and correlations
Manzano, Gonzalo; Plastina, Francesco; Zambrini; Roberta
Physical Review Letters, 121, 120602

Competition and dual users in complex contagion processes
Min, Byungjoon; San Miguel, Maxi
Scientific Reports, 8, 14580

Competing contagion processes: Complex contagion triggered by simple contagion
Min, Byungjoon; San Miguel, Maxi
Scientific Reports, 8, 10422

Photonic machine learning implementation for signal recovery in optical communications
Argyris, Apostolos; Bueno, Julián; Fischer, Ingo
Scientific Reports, 8, 8487

Reinforcement learning in a large-scale photonic recurrent neural network
Bueno, Julian; Maktoobi, Sheler; Froehly, Luc; Fischer, Ingo; Jacquot, Maxime; Larger, Laurent; Brunner, Daniel
Optica, 5, 756-760

Unveiling noiseless clusters in complex quantum networks
Cabot, Albert; Galve, Fernando; Eguíluz, Victor; Klemm, Konstantin; Maniscalco, Sabrina; Zambrini, Roberta
npj Quantum Information, 57, 4

Rare symbionts may contribute to the resilience of coral–algal assemblages
Ziegler, Maren; Eguíluz, Víctor M; Duarte, Carlos M; Voolstra, Christian R
The ISME Journal, 12, 161–172

Circular dichroism of chiral Majorana states
Osca, Javier; Serra, Llorenç
Beilstein Journal of Nanotechnology, 9, 1194-1199

How to distinguish between interacting and noninteracting molecules in tunnel junctions
Sierra, M. A.; Sánchez, D.; Garrigues, A. R.; del Barco, E.; Wang, L.; Nijhuis, C. A.
Nanoscale, 10, 3904–3910

Improving the quality of a collective signal in a consumer EEG headset
Morán, Alejandro; Soriano, Miguel C.
PLoS ONE, 13, e0197597

Mapping the Americanization of English in space and time
Gonçalves, B.; Loureiro-Porto, L.; Ramasco, J. J.; Sánchez, D.
PLoS ONE, 13, e0197741 (1-15)

Immigrant community integration in world cities
Lamanna, Fabio; Lenormand, Maxime; Salas-Olmedo, María Henar; Romanillos, Gustavo; Gonçalves, Bruno; Ramasco, José Javier
PLoS ONE, 13, e0191612

Predicting language diversity with complex networks
Raducha, Tomasz; Gubiec, Tomasz
PLoS ONE, 13, e0196593

Stochastic pair approximation treatment of the noisy voter model
Peralta, A. F. ; Carro, A. ; San Miguel, M. ; Toral, R.
New Journal of Physics, 20, 103045

Curing Braess' Paradox by Secondary Control in Power Grids
Tchawou Tchuisseu, Eder Batista; Gomila, Damia; Colet, Pere; Witthaut, Dirk; Timme, Marc; Schäfer, Benjamin
New Journal of Physics, 20, 083005

Reconfigurable optical implementation of quantum complex networks
Nokkala, Johannes; Arzani, Francesco; Galve, Fernando; Zambrini, Roberta; Maniscalco, Sabrina; Piilo, Jyrki; Treps, Nicolas; Parigi, Valentina
New Journal of Physics , 20, 053024

Engineering drag currents in Coulomb coupled quantum dots
Lim, J. S.; Sánchez, D.; López, R.
New Journal of Physics, 20, 023038 (1-12)

Coherent and radiative couplings through 2D structured environments
Galve, Fernando; Zambrini, Roberta
Physical Review A, 97, 033846 (1-10)

Aharonov-Bohm and Aharonov-Casher effects in a double quantum dot Josephson junction
Tomaszewski, D.; Busz, P.; López, R.; Lee, M.; Martinek, J.
Physical Review B, 98 , 174504

Conductance oscillations and speed of chiral Majorana mode in a quantum anomalous Hall two-dimensional strip
Osca, Javier; Serra, Llorenç
Physical Review B, 98, 121407(R)(1-4)

Anomalous Joule law in the adiabatic dynamics of a quantum dot in contact with normal-metal and superconducting reservoirs
Arrachea, Liliana; Lopez, Rosa
Physical Review B, 98, 045404

Aharonov-Bohm and Aharonov-Casher effects for local and nonlocal Cooper pairs
Domaszewski, Damian; Busz, Piotr; López, Rosa; Žitko, Rok; Lee, Minchul; Martinek, Jan
Physical Review B, 97, 214506

Probing the energy reactance with adiabatically driven quantum dots
Ludovico, M. F.; Arrachea, L.; Moskalets, M.; Sánchez, D.
Physical Review B, 97, 041416(R) (1-6)

First-passage distributions for the one-dimensional Fokker-Planck equation
Oriol Artime, Nagi Khalil, Raul Toral, and Maxi San Miguel
Physical Review E, 98(4), 042143

Cluster crystals with combined soft- and hard-core repulsive interactions
Caprini, Lorenzo; Hernández-García, Emilio; López, Cristóbal
Physical Review E, 98, 052607 (1-10)

Bifurcation structure of periodic patterns in the Lugiato-Lefever equation with anomalous dispersion
Parra-Rivas,P.;Gomila,D.;Gelens,L.;Knobloch,E.
Physical Review E, 98, 042212 (1-13)

Statistical mechanics of coevolving spin system
Raducha,Tomasz; Wiliński, Mateusz; Gubiec,Tomasz; Stanley, H. Eugene
Physical Review E, 98, 030301 (R)(1-5)

Aging-induced continuous phase transition
Artime, Oriol; Peralta, Antonio F.; Toral, Raúl; Ramasco, José J.; San Miguel, Maxi
Physical Review E, 98, 032104

Consistency properties of chaotic systems driven by time-delayed feedback
Jüngling, Thomas; Soriano, Miguel C.; Oliver, Neus; Porte, Xavier; Fischer, Ingo.
Physical Review E, 97, 042202 (1-13)

Bifurcation structure of localized states in the Lugiato-Lefever equation with anomalous dispersion
Parra-Rivas, P.; Gomila, D.; Gelens, L.; Knobloch, E.
Physical Review E, 97, 042204 (1-20)

Heat flux of driven granular mixtures at low density. Stability analysis of the homogeneous steady state
Khalil, Nagi; Garzo, Vicente
Physical Review E, 97, 022902

Point-particle method to compute diffusion-limited cellular uptake
Sozza, A.; Piazza, F.; Cencini, M.; De Lillo, F.; Boffetta, G.
Physical Review E, 97, 023301

Zealots in the mean-field noisy voter model
Khalil, Nagi; San Miguel, Maxi; Toral, Raul
Physical Review E, 97, 012310

System-size expansion of the moments of a master equation
Peralta, Antonio F.; Toral, Raúl
Chaos, 28, 106303

Analytical and numerical study of the non-linear noisy voter model on complex networks
Peralta, A. F. ; Carro, A. ; San Miguel, M. ; Toral, R.
Chaos, 28, 075516

A continuous-time persistent random walk model for flocking
Escaff,Daniel; Toral,Raul; Van den Broeck,Christian; Lindenberg,Katja
Chaos, 28, 075507 (1-10)

Diversity of hysteresis in a fully cooperative coinfection model
Rodríguez,Jorge P.;Liang,Yu-Hao;Huang,Yu-Jhe;Juang,Jonq
Chaos, 28, 023107

How ants move: individual and collective scaling properties
Gallotti,Riccardo; Chialvo,Dante R.
Journal of the Royal Society Interface, 15, 20180223

Tracking random walks
Gallotti,Riccardo; Louf,Remi; Luck,Jean-Marc; Barthelemy,Marc
Journal of the Royal Society Interface, 15, 20170776

Generalized time evolution of the homogeneous cooling state of a granular gas with positive and negative coefficient of normal restitution
Khalil, Nagi
Journal of Statistical Mechanics: Theory and Experiment, 2018, 043210

Phase structure of XX0 spin chain and nonintersecting Brownian motion
Saeedian, M.; Zahabi, A.
Journal of Statistical Mechanics: Theory and Experiment, 2018, 013104

Patterning the insect eye: from stochastic to deterministic mechanisms
Ebadi, Haleh; Perry, Michael; Short, Keith; Klemm, Konstantin; Desplan, Claude; Stadler, Peter F.; Mehta, Anita
PLoS Computational Biology, 14, e1006363

Waves of seed propagation induced by delayed animal dispersion
Kazimierski, L.D.; Kuperman, M. N; Wio, H. S.; Abramson, G.
Journal of Theoretical Biology, 436, 1-7

Cover-Encodings of Fitness Landscapes
Klemm, Konstantin; Mehta, Anita; Stadler, Peter F.
Bulletin of Mathematical Biology, 80, 2154–2176

Self-assembly of polymer-like structures of magnetic colloids: Langevin dynamics study of basic topologies.
Rozhkov, D. A.; Pyanzina, E. S.; Novak, E.V.; Cerdà, J.J.; Sintes, Tomas; Ronti, M. ; Sciortino, F. ; Sanchez, P.A.; Kantorovich, S. S.
Molecular Simulation, 44, 507-515

Completely subradiant multi-atom architectures through 2D photonic crystals
Galve, Fernando; Zambrini, Roberta
Annalen der Physik, 530, 1800017(1-6)

Bipartisanship Breakdown, Functional Networks, and Forensic Analysis in Spanish 2015 and 2016 National Elections
Fernández-Gracia, Juan; Lacasa, Lucas
Complexity, 2018, 9684749 (1-23)

Nano-patterning of surfaces by ion sputtering: Numerical study of the anisotropic damped Kuramoto-Sivashinsky equation
Vitral, E.; Walgraef, D.; Pontes, J.; Anjos, G.R.; Mangiavacchi, N
Computational Materials Science, 146, 193-203

Using Network Theory and Machine Learning to predict El Niño
Nooteboom, P.D.; Feng, Q.Y.; Lopez, C.;Hernandez-Garcia, E.; Dijkstra, H.A.
Earth System Dynamics, 9, 969-983

Preface: Current perspectives in modelling, monitoring, and predicting geophysical fluid dynamics
Mancho, A.M.; Hernandez-Garcia, E.; Lopez, C.; Turiel, A.; Wiggins, S.; Perez-Muñuzuri, V.
Nonlinear Processes in Geophysics, 25, 125-127

Regionalisation of the Mediterranean basin, a MERMEX synthesis
Ayata, S-D.; Irisson, J-O; Aubert, A.; Berline, L.; Dutay, J-C.; Mayot, N.; Nieblas, A-E.; D'Ortenzio, F.; Palmiéri, J.; Reygondeau, G.; Rossi, V.; Guieu, C.
Progress in Oceanography, 163, 7-20

Coevolving nonlinear voter model with triadic closure
Raducha,Tomasz;Min,Byungjoon;San Miguel,Maxi
Europhysics Letters, 124, 3001

Inertial floaters in stratified turbulence
Sozza, A.; De Lillo, F.; Boffetta, G.
Europhysics Letters, 121, 14002

How Big Data Fast Tracked Human Mobility Research and the Lessons for Animal Movement Ecology
Thums,Michele;Fernández-Gracia,Juan;Sequeira,Ana M. M.;Eguíluz,Víctor M.;Duarte,Carlos M.;Meekan,Mark G.
Frontiers in Marine Science, 5, 21

A Neuro-Inspired System for Online Learning and Recognition of Parallel Spike Trains, Based on Spike Latency, and Heterosynaptic STDP
Susi, G.; Tioro, L.; Canuet, L., López, M. A., Maestú, F.; Mirasso, C. R. and Pereda, E.
Frontiers in Neuroscience, 12, 780

From Continuous to Discontinuous Transitions in Social Diffusion
Tuzón,Paula;Fernández-Gracia,Juan;Eguíluz,Víctor M.
Frontiers in Physics, 6, 21

Tutorial: Photonic neural networks in delay systems
Brunner, D.; Penkovsky, B.; Marquez, A.; Jacquot, M.; Fischer, I.; Larger, L.
Journal of Applied Physics, 124, 152004 (1-14)

Suspensions of supracolloidal magnetic polymers: self-assembly properties from computer simulations.
Pyanzina, E. S.; Novak, E. V.; Rozhkov, D. A.; Ronti, M.; Cerdà, J. J.; Sintes, T.; Sánchez, P. A.; Kantorovich, S. S.
Journal of Molecular Liquids, 271, 631-638

Hierarchical invasion of cooperation in complex networks
Vilone, Daniele; Capraro, Valerio; Ramasco, Jose J.
Journal of Physics Communications, 2, 025019

Heat current through an artificial Kondo impurity beyond linear response
Sierra, M. A.; Sánchez, D.
Journal of Physics: Conference Series, 969, 012144 (1-6)

Nonlinear heat transport in ferromagnetic-quantum dot-superconducting systems
Hwang, S.-Y.; Sánchez, D.
Journal of Physics: Conference Series, 969, 012139 (1-6)

High frequency neurons determine effective connectivity in neuronal networks
Pariz, A.; Esfahani Z. G.; Parsi, S. S.; Valizadeh, A.; Canals, S.; Mirasso, C. R.
Neuroimage, 166, 349-359

Coupled Brownian motors
J.I.Peña Roselló, R.R.Deza, H.S.Wio
European Physical Journal B, 91, 103 (1-5)

Modulated class A laser: Stochastic resonance in a limit-cycle potential system
Mayol, Catalina; Toral, Raul; Wio, Horacio S
European Physical Journal B, 91, 114 (1-8)

Identifying an influential spreader from a single seed in complex networks via a message-passing approach
Min, Byungjoon
European Physical Journal B, 91, 18 (1-6)

Entropy production and fluctuations in a Maxwell's refrigerator with squeezing
Manzano, Gonzalo
European Physical Journal - Special Topics, 227, 285-300

Hallmarking quantum states: unified framework for coherence and correlations
Giorgi, Gian Luca; Zambrini, Roberta
Quantum, 2, 109 (1-8)

a.5.2 Other publications

Post-processing of Long-haul and Ethernet Optical Transmission Signals Using Photonic Reservoir Computing
Argyris, Apostolos; Bueno, Julián; Fischer, Ingo
2017 European Conference on Optical Communication (ECOC)

a.5.3 Book

La Emulación del Cerebro
Mirasso, C; Pereda, E.; Maestu, F.; Vicente, R.
Colección National Geographic - Desafíos de la Ciencia #22

a.6. Presentations at conferences and academic centers

a.6.1 Invited talks at conferences and workshops

Zambrini, Roberta
Spin synchronization: sub-radiance, probing and simulation.
Quantum Machine Learning and Biomimetic Quantum Technologies. Bilbao, Spain.
March, 19

Gomila, Damià
Fairy circles under the sea.
Perspectives in nonlinear science Cargese, France.
March, 26

Toral, Raúl
Anticipated synchronization in extended systems.
International Workshop Predicting Transitions in Complex Systems, Max Planck Institute for the Physics of Complex Systems, Dresden, Germany.
April, 23

Hernandez-Garcia, E.
Percolation and network indicators of network transitions.
International Workshop Predicting Transitions in Complex Systems, Max Planck Institute for the Physics of Complex Systems, Dresden, Germany.
April, 26

Fischer, Ingo
Neuro-inspired information processing: The return of optics in computing.
"Physikalisches Kolloquium", TU Berlin, Gemany.
May, 24

San Miguel, Maxi
Complexity: Science, Engineering or a State of Mind?Towards a Scientific Renaissance.
Complexity-Where do we go from here?, CSH Vienna Conference, Vienna, Austria..
May, 24

Fischer, Ingo
Spatio-temporal chaos in semiconductor lasers with delayed feedback.
15th Experimental Chaos and Complexity Conference, Madrid, Spain.
June, 04

San Miguel, Maxi
The Voter Model: A paradigm of stochasticity in models of social behavior.
Workshop Trends in Non-equilibrium Physics, Universidad de Barcelona, Spain.
June, 22

Toral, Raúl
Extremely high precision simulations of Langevin and master equations using weighted-ensemble algorithms.
Workshop Trends in Non-equilibrium Physics, Universidad de Barcelona, Spain.
June, 22

Zambrini, Roberta
Collective dissipation: Dynamic and thermodynamic effects.
Quantum Thermodynamics, KITP Santa Barbara, USA.
June, 25

Mirasso, Claudio
Delayed but not much: the role of inhibition in neuronal synchronization.
14th IFAC Workshop On Time Delay Systems. Budapest, Hungary.
June, 27

Hernandez-Garcia, Emilio
Ocean transport, coherent structures and their impact on chemical and ecological marine processes.
Three invited lectures at the CNRS Summer School on "Active transport in the Ocean: Turbulence, Chemistry and Biology", Wimereux, France.
July, 02

Fischer, Ingo
Employing Delay Systems for Fast Neuro-Inspired Information Processing.
675. WE-Heraeus Seminar: Delayed Complex Systems 2018. Bad Honnef, Germany.
July, 02

Sánchez, David
Transport in Nanosystems.
VIII GEFENOL Summer School on Statistical Physics of Complex Systems, IFISC, Palma de Mallorca, Spain.
July, 02

Toral, Raúl
Noise-induced transitions versus noise-induced phase transitions.
VIII GEFENOL Summer School on Statistical Physics of Complex Systems, IFISC, Palma de Mallorca, Spain.
July, 09

San Miguel, Maxi
Complex Contagion: Competition, Dual Users and Heterogeneous Adoptability.
Workshop on Network Cascades, International Conference on Complex Systems 2018, Cambridge, MA, USA.
July, 22

Gomila, Damià
Cracking patterns in optical microresonators.
Conference on Mathematics of Wave Phenomena Karlsruhe, Germany.
July, 23

Fischer, Ingo
State-Dependent Delay Dynamics in Semiconductor Lasers.
2018 International Symposium on Nonlinear Theory and Its Applications, NOLTA2018, Tarragona, Spain.
September, 02

Soriano, Miguel Cornelles
Autonomous operation of echo state networks.
2018 International Symposium on Nonlinear Theory and Its Applications, NOLTA2018, Tarragona, Spain.
September, 02

Hernandez-Garcia, Emilio
Vegetation patterns under the sea.
Minisymposium on "Pattern Formation" in the conference Dynamics Days Europe 2018. Loughborough, UK.
September, 07

Meloni, Sandro
Epidemic Spreading On Networks.
Conference on Complex Systems CCS2018 Warm Up, Thessaloniki, Greece.
September, 21

Meloni, Sandro
Family Business: quantifying nepotism in academia.
Conference on Complex Systems CCS2018. Thessaloniki, Greece.
September, 27

Ramasco, Jose J.
Immigrant community integration in world cities.
"Complex Systems for the Most Vulnerable" a satellite of the Complex Systems Conference CCS organized by UNICEF, in Thessaloniki, Greece.
September, 27

Sánchez, David
Thermoelectric transport in a ferromagnet-superconductor quantum dot device.
2nd Workshop of the Thematic Network on Thermoelectricity: New Theories. Valencia, Spain.
September, 27

Toral, Raúl
Random walks, flocking, large deviations and Bose-Einstein transitions.
Reunión de Física Estadística, FISES 2018, Madrid, Spain.
October, 18

Fischer, Ingo
Neuro-inspired Optical Information Processing: Concept and Applications.
Kyoto University International Forum on Advanced Future Studies, Narita, Japan.
October, 22

Ramasco, Jose J.
Big Data applied to tourism mobility.
UNWTO Network of Observatories (INSTO) in Madrid, Spain.
October, 22

Sánchez, David
Thermoelectrics and heat in hybrid superconductor-quantum dot junctions.
Open Questions on Energy Transport and Conversion in Nanoscale Quantum Systems. Marseille, France.
November, 15

Sánchez, D.
Valley splitting in bilayer graphene quantum point contacts.
First Meeting of the Thematic Network 'Fisica estadística de no equilibrio y sus aplicaciones multidisciplinares'. Barcelona, Spain.
November, 21

Zambrini, Roberta
Collective dissipation in complex networks, optomechanical systems and autonomous refrigerators.
International Symposium on Quantum Technologies, Fundación Ramón Areces, Madrid, Spain.
November, 21

Zambrini, Roberta
Non-classical and synchronization in extended open quantum systems.
684. WE-Heraeus-Seminar Advances in open systems and fundamental tests of quantum mechanics, Physikzentrum Bad Honnef, Germany.
December, 02

Toral, Raúl
The aging and nonlinear noisy voter model.
XX MEDYFINOL, Conference on Nonequilibrium Statistical Mechanics and Nonlinear Physics, Santiago de Chile.
December, 03

Mirasso, Claudio
High frequency neurons contribute to define effective connectivity in brain networks.
XX MEDYFINOL, Conference on Nonequilibrium Statistical Mechanics and Nonlinear Physics, Santiago de Chile.
December, 03

Cornelles Soriano, Miguel
Recent advances in photonic reservoir computers.
International Symposium on Physics and Applications of Laser Dynamics, IS-PALD 2018, Hong Kong.
December, 04

Fischer, Ingo
Photonic Reservoir Computers as Decoders for Optical Communication Systems.
International Conference on Cognitive Computing, Hannover, Germany.
December, 18

a.6.2 Other talks at conferences and workshops

Sánchez, D.
Periodic energy transport and entropy in quantum electronics.
X GEFES meeting. Valencia, Spain.
January, 24

San Miguel, Maxi
The effect of compatibility and heterogeneous adoptability in contagion processes.
Joint Meeting of the DPG and EPS Condensed Matter Divisions, Berlin, Germany.
March, 11

Toral, Raúl
The biased-voter model.
2018 Joint meeting of the DPG and EPS Condensed Matter Divisions, Berlin, Germany.
March, 11

Khalil, Nagi
The influence of zealots on the noisy voter model.
IV Workshop on Complex Sociotechnical Systems, COMSOTEC, Zaragoza, Spain.
March, 21

Mazzoli, Mattia
Equilibria, information and frustration in heterogeneous network games with conflicting preferences.
IV Workshop on Complex Sociotechnical Systems, COMSOTEC, Zaragoza, Spain.
March, 21

Ramasco, J.J.
Field Theory for recurrent mobility.
IV Workshop on Complex Sociotechnical Systems, COMSOTEC, Zaragoza, Spain.
March, 21

Giorgi, Gian Luca
Hallmarking quantum states: unified framework for coherence and correlations.
25th Central European Workshop on Quantum Optics, CEWQO, UIB, Palma de Mallorca, Spain.
May, 21

Mirasso, Claudio
High frequency neurons contribute to define eff ective connectivity in brain networks.
Barcelona Computational, Cognitive and Systems Neuroscience (BARCCSYN) 2018, Barcelona, Spain.
May, 24

Cornelles Soriano, Miguel
Information processing by complex systems: the case of a single nonlinear node with delay.
15th Experimental Chaos and Complexity Conference, Madrid, Spain.
June, 04

Mazzoli, Mattia
A network approach to airports mobility.
Conference NetSci 2018 in Paris, France.
June, 11

Ramasco, Jose J.
Field Theory for recurrent mobility.
Conference NetSci 2018 in Paris, France.
June, 11

Mazzoli, Mattia
Equilibria, information and frustration in heterogeneous network games with conflicting preferences.
Conference NetSci 2018 in Paris, France.
June, 12

Klemm, Konstantin
Branch decompositions in network analysis.
1st ODYCCEUS conference on Opinion DYnamics and Cultural Conflict in EUropean Space. Leipzig, Germany.
June, 19

Hernandez-Garcia, E.
Stretching fields in ocean transport.
Mixing Day. Barcelona, Spain.
June, 28

Sozza, Alessandro
Lagrangian models for the transport of phytoplankton in turbulence.
CNRS Summer School on "Active transport in the Ocean: Turbulence, Chemistry and Biology", Wimereux, France.
July, 02

Fernández Peralta, Antonio
Analytical and numerical study of the non-linear noisy voter model on complex networks.
Computational Social Science and Complex Systems. Enrico Fermi School. Varenna, Italy.
July, 15

Sierra, Miguel A.
Thermal effects in a Kondo-correlated double quantum dot.
34th International Conference on the Physics of Semiconductors (ICPS) in Montpellier, France.
July, 29

Drotos, Gabor
Inhomogeneities and caustics in the sedimentation of noninertial particles in incompressible flows.
Dynamics Days Europe 2018. Loughborough, UK.
September, 03

Giorgi, Gian Luca
Unified framework for coherence and correlations.
11th Italian Quantum Information Science Conference, Catania, Italy.
September, 17

Drotos, Gabor
Reconsidering the relationship of the El Niño-Southern Oscillation and the Indian monsoon using ensembles in Earth system models.
CliMathNet Conference 2018 (Reading), UK.
September, 19

Raducha, Tomasz
Coevolving networks in social simulations.
Conference on Complex Systems 2018 Warm-up, Greece.
September, 21

Rodríguez, Jorge P.; Ghanbarnejad, Fakhteh; Eguíluz, Víctor M.
Cooperative diseases spreading in networks of mobile particles: how mobility can speed up, slow down and change the nature of the epidemic phase transition.
Conference on Complex Systems CCS2018, Thessaloniki, Greece.
September, 23

Fernández-Gracia, Juan; Rodríguez, Jorge P.; Peel, Lauren; Klemm, Konstantin; Meekan, Mark; Eguíluz, Víctor M.
Inferring intraspecific tracing behaviour in animal movement.
Conference on Complex Systems CCS2018, Thessaloniki, Greece.
September, 23

San Miguel, Maxi
Complex Contagion: Competition, dual users and heterogeneous adoptability.
Conference on Complex Systems CCS2018, Thessaloniki, Greece.
September, 23

Ramasco, Jose J.
Field Theory for recurrent mobility.
Conference on Complex Systems CCS2018, Thessaloniki, Greece.
September, 23

Raducha, Tomasz
Predicting language diversity with complex networks.
Conference on Complex Systems CCS2018, Thessaloniki, Greece.
September, 23

Artime, Oriol
Aging-induced continuous phase transition.
Conference on Complex Systems CCS2018, Thessaloniki, Greece.
September, 24

Mazzoli, Mattia
Field theory for recurrent mobility.
Labex Summer School 2018. Firenze, Italy.
September, 25

Klemm, Konstantin
Branch decompositions for analyzing stochastic processes on networks.
COSTNET18 conference. Warsaw, Poland.
September, 26

Sierra, Miguel A.
Thermoelectric properties of artificial Kondo impurities.
1st Thermoelectric workshop of the Excelence Network MAT2016-82015-REDT, Valencia, Spain.
September, 27

Hernandez-Garcia, Emilio
Modeling the connectivity of marine populations by Lagrangian flow networks.
Physics and ecology: Challenges at the frontier. Maó, Menorca, Spain.
October, 09

Colombo, Eduardo H.
Species mixing determines predators' optimal perception range and coexistence times in predator-prey dynamics.
Physics and ecology: Challenges at the frontier. Maó, Menorca, Spain.
October, 09

Gomila, Damià
Pattern formation in Posidonia oceanica meadows.
Physics and ecology: Challenges at the frontier. Maó, Menorca, Spain.
October, 09

Fernández-Gracia, Juan
Inferring social relations from presence data. Manta Rays case study.
Physics and ecology: Challenges at the frontier. Maó, Menorca, Spain.
October, 09

Colet, Pere
Secondary control may prevent Braess' paradox in AC power grids.
2018 Workshop on Complexity in Engineering, (COMPENG 2018), Florence, Italy.
October, 10

Klemm, Konstantin
Bond percolation: threshold estimates and an exact method.
1st Workshop "Networks and Dynamics of Social Systems". Berlin, Germany.
October, 11

Artime, Oriol
Aging-induced continuous phase transition.
XXII Congreso de Física Estadística (FisEs'18), Madrid, Spain.
October, 18

Ramasco, José J.
Field theory for recurrent mobility.
XXII Congreso de Física Estadística (FisEs'18), Madrid, Spain.
October, 18

Colet, Pere
Power grid frequency fluctuations and smart devices with dynamic demand control.
Física Estadística de No Equilibrio y sus aplicaciones multidisciplinares. Barcelona, Spain.
November, 21

López, Cristóbal
Active cluster crystals.
Física Estadística de No Equilibrio y sus aplicaciones multidisciplinares. Barcelona, Spain.
November, 23

Soriano, Miguel C.
Photonic reservoir computing post-processing for optical communication signals with multilevel encoding.
International Symposium on Physics and Applications of Laser Dynamics, IS-PALD 2018. Hong Kong.
December, 04

Fernández-Gracia, Juan
Inferring social relations from presence data. Manta Rays case study.
COMPLEX NETWORKS 2018 The 7th International Conference on Complex Networks and Their Applications. Cambridge, UK.
December, 11

Sheykhali, Somaye; Fernández-Gracia, Juan; Eguíluz, Víctor M.
Cooccurrence plasticity increases modularity and stability in bipartite networks.
COMPLEX NETWORKS 2018 The 7th International Conference on Complex Networks and Their Applications. Cambridge, UK.
December, 11

a.6.3 Poster presentations

Rosselló, Guillem
Chiral Maxwell demon in a quantum Hall setup.
GEFES X conference, Valencia, Spain.
January, 24

Bettencourt, J.; Rossi, V.; Hernandez-Garcia, E.; Marta-Almeida, M.; Lopez, C.
Characterization of the structure and cross-shore transport properties of a coastal upwelling filament using three-dimensional finite-size Lyapunov exponents.
European Geosciences Union General Assembly 2018. Vienna, Austria.
April, 08

Drotos, G.; Monroy, P.; Hernandez-Garcia, E.; Lopez, C.
Inhomogeneities and caustics in the sedimentation of marine biogenic particles as passive tracers in incompressible flows.
European Geosciences Union General Assembly 2018. Vienna, Austria.
April, 08

Drotos, Gabor; Bodai, Tamas; Tel, Tamas
Why and when ensembles are relevant in climate projections.
European Geosciences Union General Assembly 2018. Vienna, Austria.
April, 08

Cabot, Albert
Dynamical and quantum effects of collective dissipation in optomechanical systems.
25th Central European Workshop on Quantum Optics (CEWQO 2018) IFISC, Palma de Mallorca, Spain.
May, 21

Cristian Estarellas; José María Caramés; Víctor A. López-Madrona; Claudio Mirasso; Santiago Canals
Inhibitory Gating in the Dentate Gyrus.
BARCCSYN 2018. Barcelona, Spain.
May, 24

Masoliver, María; Estarellas, Cristian; Mirasso, Claudio; Masoller, Cristina
Characterizing spike sequences generated by differente neuronal models via ordinal time-series analysis.
International Conference on Mathematical NeuroScience. Juan les Pins, France.
June, 10

Mazzoli, Mattia; Sanchez, Angel
Equilibria, information and frustration in heterogeneous network games with conflicting preferences.
NETSCI 2018 International School and Conference on Network Science. Paris, France.
June, 11

Tuzón, Paula; Fernández-Gracia, Juan, Eguíluz, Víctor M.
From continuous to discontinuous transitions in social diffusion.
NETSCI 2018 International School and Conference on Network Science. Paris, France.
June, 11

Pariz, Aref; G. Esfahani, Zahra; S. Parsi, Shervin; Valizadeh, Alireza; Canals, Santiago; Mirasso, Claudio R.
High frequency neurons determine effective connectivity in neuronal networks.
The third Workshop on Advanced Methods in Theoretical Neuroscience. Max Plank Institute for Dynamics and Self-Organization (MPI-DS), Gottingen, Germany.
June, 27

De la Fuente, Rebeca; Lopez, Cristobal; Hernandez-Garcia, Emilio
Flow Network characterization of bilayers.
CNRS Summer School on "Active transport in the Ocean: Turbulence, Chemistry and Biology" Wimereux, France.
July, 02

Estarellas, C.; Caramés, J.M.; López-Madrona, V.A.; Mirasso, C.; Canals, S.
Inhibitory Gating in the Dentate Gyrus.
11th FDENS Forum of Neuroscience, Berlin, Germany.
July, 07

Serra, Llorenç; Osca, Javier
Circular dichroism of chiral Majoranas.
20th International conference on Superlattices, Nanostructures and Nanodevices (ICSNN), Madrid, Spain.
July, 23

Sierra, Miguel A.
Interacting and noninteracting molecular tunnel junctions: Temperature and magnetic effects.
20th International Conference on Superlattices, Nanostructures and Nanodevices (ICSNN), Madrid, Spain.
July, 23

Tugores, Antònia
Human mobility patterns.
EuroPython 2018, Edinburgh, UK.
July, 25

Sierra, Miguel A.
Interacting and noninteracting molecular tunnel junctions: Temperature and magnetic effects.
34th International Conference on the Physics of Semiconductors (ICPS). Montpellier, France.
July, 29

Raducha, Tomasz
Predicting language diversity with complex networks.
Econophysics Colloquium 2018, Italy.
September, 12

Drotos, Gabor; Bodai, Tamas; Tel, Tamas
Why and when ensembles are relevant in climate projections.
CliMathNet Conference 2018 (Reading), UK.
September, 19

Lüsebrink, Daniel; Cerdà, Joan J.; Sánchez, Pedro A.; Kantorovich, Sofia S.; Sintes, Tomàs
Tunable dynamics of flexible magnetic filaments in flow
XXII Congreso de Física Estadística (FisEs18), Madrid, Spain.
October, 18

Ruiz-Reynés, Daniel; Schönsberg, Francesca; Hernández-García, Emilio; Gomila, Damià;
A simple model for clonal-growth plants.
XXII Congreso de Física Estadística (FisEs18), Madrid, Spain.
October, 18

De la Fuente, Rebeca; Lopez, Cristobal; Hernandez-Garcia, Emilio
Bipartite network characterization of fluid flows and its relation with the classical Lyapunov exponent.
XXII Congreso de Física Estadística (FisEs18), Madrid, Spain.
October, 18

Lopez, Cristobal; Drotos, Gabor; Monroy, Pedro; Hernandez-Garcia, Emilio
Inhomogeneities and caustics in the sedimentation of marine biogenic particles as passive tracers in incompressible flows.
XXII Congreso de Física Estadística (FisEs18), Madrid, Spain.
October, 18

De la Fuente, Rebeca; Skaugen, Audun; Angheluta, Luiza; Hernandez-Garcia, Emilio; Lopez, Cristobal
Lagrangian structures in two-dimensional quantum turbulence.
XXII Congreso de Física Estadística (FisEs18), Madrid.
October, 18

Colombo, E.H.; Anteneodo, C.
Nonlinear population dynamics in a bounded habitat.
XXII Congreso de Física Estadística (FisEs18), Madrid, Spain.
October, 18

Mazzoli, Mattia; Gallotti, Riccardo; Privitera, Filippo; Colet, Pere; Ramasco, Jose J.
A network approach to airports mobility.
XXII Congreso de Física Estadística (FisEs18), Madrid, Spain.
October, 18

Tchawou Tchuisseu, Eder Batista; Gomila, Damià; Colet, Pere; Witthaut, Dirk; Timme, Marc; Schäfer, Benjamin
Secondary control may prevent Braess' paradox in AC power grids.
XXII Congreso de Física Estadística (FisEs18), Madrid, Spain.
October, 18

Artime, Oriol; Khalil, Nagi; Toral, Raúl; San Miguel, Maxi
First-passage distributions for the one-dimensional Fokker-Planck equation
XXII Congreso de Física Estadística (FisEs18), Madrid, Spain.
October, 18

Chacoma, Andrés; Gomila,Damià; Colet, Pere
The effect of network topology in electrical power grids.
XXII Congreso de Física Estadística (FisEs18), Madrid, Spain.
October, 18

Chacoma, Andrés; Tugores, Antonia; Ramasco, Jose; Colet, Pere
Gathering tourist indicators by ussing twitter data analysis.
XXII Congreso de Física Estadística (FisEs18), Madrid, Spain.
October, 19

Mirasso, Claudio R.; Cantero, Javier; Argyris, Apostolos; Galletero, Marcos; Fischer, Ingo; Soriano, Miguel Cornelles
Comparison of minimal machine learning models for the recovery of optical communication signals.
XX Conference on Nonequilibrium Statistical Mechanics and Nonlinear Physics, Medyfinol 2018. Santiago de Chile.
December, 03

Estébanez, Irene; Soriano, Miguel Cornelles; Fischer, Ingo
Delay-based reservoir computers for autonomous operation as nonlinear oscillators.
Cognitive Computing Conference 2018. Hannover, Germany.
December, 18

a.6.4 Seminars and talks in other research centers

San Miguel, Maxi
¿Qué podemos aprender de modelos físicos sencillos de comportamiento social?.
Coloquio Departamento de Fisica, Universidad de Buenos Aires, Argentina.
April 12

Drotos, Gabor
A coarse-grained finite-time description of open flows, with an introduction to the concept of Lagrangian flow networks.
Seminars in Statistical Physics. Visit to the Institute for Theoretical Physics, Eotvos University, Budapest, Hungary.
April 14 - 24

Fernández-Gracia, Juan
Electoral data analysis and modeling.
CoSy Seminars Spring 2018, Uppsala University. Uppsala, Sweden.
May 22

Drotos, Gabor
Climate is described after forgetting the initial conditions.
MPI Grand Ensemble Workshop. Visit to the Max Planck Institute for Meteorology, Hamburg, Gemany.
June 14 - 21

Tugores, Antonia
Dyango Girls Málaga
PyConEs, Málaga, Spain.
October 5

Tugores, Antonia
Introducción a Data Science en Python
PyConEs, Málaga, Spain.
October 5

Fischer, Ingo
A Computer working with Light.
Public Outreach Talk at Kyoto University, Japan.
October 27

Drotos, Gabor
Reconsidering the relationship of the El Niño–Southern Oscillation and the Indian monsoon.
MPI Grand Ensemble Workshop 2. Visit to the Max Planck Institute for Meteorology, Hamburg, Germany.
November 10 - 26

Rodríguez, Jorge P.
Animal movement in the Big Data era: from data analysis to forecast and control.
Indian Ocean Marine Research Center, Crawley, Australia.
November 19

Hernandez-Garcia, E.
Network-theory approach to geophysical fluid transport.
Seminar given in the Institute of Theoretical Physics, Eotvos University, Budapest, Hungary.
December 12

López, Cristóbal
Active cluster crystals.
Seminar given in the Institute of Theoretical Physics, Eotvos University, Budapest, Hungary.
December 12

Drotos, Gabor
Coarse-grained finite-time quantifiers of chaos in open flows.
Seminar given in the Institute of Theoretical Physics, Eotvos University, Budapest, Hungary
December 12

a.8. Press and Media

The titles are linked to the document or media clip

a.8.1 Press and digital Media

Intelligenz aus dem Mallorca-Labor
Mallorca Zeitung
January 4

Les neurones d'alta freqüència determinen la connectivitat efectiva en xarxes neuronals
El diari de la UIB
January 8

Las neuronas de alta frecuencia determinan la conectividad efectiva en redes neuronales, según un estudio internacional con participación del IFISC (CSIC-UIB)
Salud Ediciones
January 8

Neuronas de alta frecuencia determinan la conectividad efectiva en redes neuronales
BioTech
January 10

Nace una plataforma para aumentar las vocaciones científico-técnicas entre las jóvenes
Diario de Mallorca
January 23

How to Untangle Cascade Effects in Complex Systems
BBVA Data & Analytics
January 24

Las mujeres denuncian el techo de cristal en la ciencia y la tecnología
Diario de Mallorca
January 25

Las mujeres toman el ParcBit para reivindicar su papel en la ciencia y la tecnología
Ibeconomía
January 25

«FOTCIENCIA14»: la fotografia científica es mostra a la UIB
El diari de la UIB
January 26

Predicting influencers has just been made simpler
EurekAlert!
Phys
Long Room
Mr Loyacano
January 29

El demonio cuántico de Maxwell
El Mundo, Baleópolis
January 30

Influencer di successo 'virali' come le epidemie
Ansa
January 30

Prueban en el Oceanogràfic sensores en animales para conocer la salud del océano
Levante, El Mercantil Valenciano
January 30

Sensores instalados en peces permitirán explorar los océanos a un nivel desconocido
RTVE
January 30

"Sensores-tirita" para explorar los océanos y su biodiversidad
Diario Información
January 30

Ojos para ver el 'lado oscuro' del océano
El Mundo
January 31

El Oceanográfico presenta un “revolucionario” sistema de control oceánico
7televalencia
February 1

La investigació a Balears també és cosa de dones
Ara Balears
February 3

FOTCIENCIA14, la fotografia científica es mostra a la UIB
Ara Balears
February 5

La investigación en Baleares también es cosa de mujeres
El Mundo, Baleópolis
February 6

Jornada de Puertas Abiertas y Poster Party @IFISC 2018
El diari de la UIB
February 6

El Oceanogràfic prueba nuevos sensores para poder conocer en profundidad la vida marina
La Verdad
February 6

Antònia Tugores: “Ser un bon programador no està vinculat al sexe de la persona”
Ara Balears
February 10

Donar visibilitat a la dona i crear referents femenins en la ciència
Ara Balears
February 10

Más de 40 científicas visitan centros educativos de Baleares para dar a conocer la labor investigadora de las mujeres
Noticias Mallorca
Mallorca Diario
Europa Press
EcoDiario, El Economista
February 10

Unas 40 científicas visitarán colegios para explicar su labor
Diario de Mallorca
February 11

Científicas se hacen un hueco en un mundo tradicionalmente masculino
Mallorca Confidencial
February 11

Zambrini: "El sostre de vidre no es pot superar"
Ara Balears
February 11

Pulso a la brecha de género tecnológica
Diario de Mallorca
February 12

Derribando estereotipos de género en la ciencia
Baleópolis, El Mundo
February 13

Marcos Galletero: «Aquesta feina és “l’oportunitat”!»
Divulga UIB
February 15

Nosotras también podemos programar
Diario de Mallorca
February 20

Django Girls, la programación también es cosa de mujeres
Baleópolis, El Mundo
February 20

L'IFISC (CSIC-UIB) convoca les beques SURF per a estudiants de grau
El diari de la UIB
February 26

Tracking data reveal the secret lives of marine animals
Science Daily
University of California, Santa Cruz
Courthouse News
February 26

From Turtles to Whales, Marine Animals Have the Same Moves
Atlas Obscura
February 26

Marine animals explore the ocean in similar ways
Phys
Australian Government
February 26

Registran los patrones de movimiento de la fauna marina para su conservación
El diario
El Universal
February 26

Focas, ballenas y aves marinas hacen los mismos viajes por el océano
Agencia SINC
February 26

El 'big data' de la fauna marina
Baleópolis, El Mundo
February 27

SURF 2017
Baleópolis, El Mundo
February 27

¿A qué velocidad y con qué frecuencia se desplazan los animales marinos?
Ambientum
March 2

Nueva mejora para los futuros transistores moleculares
Agencia SINC
March 6

Hacia una mejor caracterización de los transistores moleculares
El diari de la UIB
March 7

Nueva mejora para los transistores moleculares
Baleópolis, El Mundo
March 13

Un nuevo método matemático mide la integración o segregación de los inmigrantes a partir de sus tuits
CSIC
March 15

Nous Conceptes
IB3
March 15

Dades massives per caracteritzar la integració o segregació de les comunitats immigrants
El Diari de la UIB
March 15

Investigadores de CSIC-UIB analizan mediante Twitter la segregación de comunidades inmigrantes en las ciudades
Europa Press
La Vanguardia
El Economista
20minutos
March 15

Londres integra mejor a los inmigrantes que Ámsterdam, según un método que analiza la segregación a partir de tuits
Diario Siglo XXI
Telecinco
March 15

A new method measures the integration or segregation of immigrants based on their tweets
Phys
EurekAlert!
Science Newsline
Bright Surf
March 15

El Ártico, más caliente que nunca
La Vanguardia
March 18

Un método matemático mide la integración o segregación de los inmigrantes por sus tuits
CIO
March 19

La integración de los inmigrantes también se mide con matemáticas
Innova Spain
March 27

Navegant per la complexitat del segle XXI
El diari de la UIB
April 12

Un ciclo para navegar por la complejidad del siglo XXI
El Mundo, Baleópolis
April 14

Simulador de fenómenos sociales
El Mundo, Baleópolis
April 24

La memoria no es un banco de datos
El Mundo, Baleópolis
May 1

Palma acogerá del 14 al 16 de mayo el festival 'Pint of Science'
Europa Press
20minutos
Gente Digital
May 11

Llega 'Pint of Science', un encuentro entre científicos y público en bares
Mallorcadiario
May 13

Pint of Science 2018
El Mundo
May 15

Mallorca s'acosta a la segona revolució quàntica de la mà del CEWQO
El diari de la UIB
May 17

Els estornells no necessiten classes de ball
Ara Balears
May 19

UIB acoge encuentro de 200 especialistas internacionales en óptica cuántica
ABC
May 20

200 investigadores debatirán sobre la interacción entre y luz y la materia en la UIB
Mallorcadiario
May 20

Encuentro en la UIB de especialistas en óptica
Diario de Mallorca
May 20

Blockchain: potencial i incerteses
Dr. TIC
May 23

El futuro es cuántico
El Mundo, Baleópolis
May 29

La ciència aterra de l'espai al Consell de Ministres
Ara Balears
June 09

Com es mouen les formigues?
El diari de la UIB
June 28

Un modelo matemático inspirado en el movimiento de las hormigas
Agencia SINC
July 02

L'IFISC (UIB-CSIC) rep l'acreditació com a Unitat d'Excel·lència María de Maeztu
El diari de la UIB
July 13

El IFISC recibe la acreditación de Excelencia María de Maeztu
Última Hora
July 15

El IFISC sube a la primera división de la investigación
Diario de Mallorca
July 20

Datos en las redes confirman la americanización del inglés británico
Periodistas en español
July 22

L'I.A. met le chaos K.O.
Science & Vie
August 1

Datos en las redes confirman la americanización del inglés británico
La Mar de Onuba
August 15

Un complex científic per acostar la ciència al món empresarial
Ara Balears
August 31

¿Están segregados los migrantes del mundo? Un análisis de sus tuits tiene la respuesta
El Espectador
August 31

Researchers Are Now Turning to Twitter to Track Immigrant Migration
National Geographic
September 11

Organizan actividades en todas las islas para 'La noche de la investigación'
Mallorca Diario
ABC.es
Diari de Balears
Mallorca Confidencial
Gente Digital
Europa Press
Ara Balears
September 15

Ocellaires del GOB, tocats de l'ala de la ciència
Ara Balears
September 15

Mallorca prepara la Nit de la Investigació
Ara Balears
September 22
Una noche para acercar la cienca a la sociedad
Baleópolis, El Mundo
September 25

Teoremes de fluctuació quàntica per a entorns arbitraris
El diari de la UIB
September 25

La Nit de la Investigació de les Illes Balears, una oportunitat per mostrar la recerca a la societat, amb la participació de la UIB
El diari de la UIB
September 26

Éxito de la «Nit de la Investigació 2018»: Más de un millar de personas participaron en las actividades organizadas por el Govern y los principales centros de investigación
Salud Ediciones
October 2

El Nobel se ilumina
Baleópolis, El Mundo
October 9

El apagón sólo habría afectado al 40% de Menorca con el cable conectado con Mallorca, según el IFISC
Cadena SER
October 31

Amb el cable entre illes operatiu, Menorca hauria tingut un 60% de possibilitats d'evitar l'apagada
Ara Balears
October 31

¿Qué hubiera pasado si el cable entre Mallorca y Menorca no estuviera roto?
Diario de Mallorca
October 31

El cable submarino podría haber implicado propagar el apagón de Menorca a parte de Mallorca, según científicos
Europa Press
20minutos
October 31

El cable submarino habría reducido a la mitad los efectos del corte eléctrico
Menorca Info
October 31

El cable submarino podría haber implicado propagar el apagón de Menorca a parte de Mallorca
COPE
Última Hora
October 31

Què hauria passat a Menorca si hi hagués connexió elèctrica submarina?
El diari de la UIB
October 31

L'IFISC (CSIC-UIB) es reforça de la mà de la Unitat d'Excel·lència María de Maeztu
El diari de la UIB
November 20

Dades massives o Big Data per estudiar la mobilitat d'animals marins i les malalties
El diari de la UIB
November 14

Armengol considera que el reconocimiento de excelencia del IFISC refuerza la "apuesta por la investigación" de las Islas
Europa Press
La Vanguardia
November 21

El Govern felicita al IFISC por su reconocimiento nacional como centro investigador de referencia
Diario de Mallorca
November 21

PRESIDENTA Armengol: el IFISC refuerza la apuesta por el conocimiento y la excelencia investigadora que estamos impulsando en las Illes
Noticias Mallorca
November 21

Acreditación del IFISC
Última Hora
November 22

Tres unidades vinculadas al CSIC reciben la María de Maeztu: el Instituto de Física de Cantabria, el Centro de Astrobiología y el Instituto de Física Interdisciplinar y Sistema Complejos
CSIC
November 21

Armengol: «l'IFISC reforça l'aposta pel coneixement i l'excel·lència investigadora que estam impulsant a les Illes Balears»
Govern de les Illes Balears
November 22

Entrega de los premios TalenTIC
El diari de la UIB
November 22

IECISA y la UIB premian el talent y la innovación de los estudiantes
Diario de Mallorca
November 23

Premios TalenTIC
Última Hora
November 23

Determinan que las redes complejas preservan coherencias cuánticas y exhiben sincronización
CSIC
November 23

L'IFISC, física d'excel·lència i cosmopolita
Ara Balears
November 24

TalenTIC 2018 premia dos proyectos de realidad virtual y de inteligencia artificial
Economía de Mallorca
November 26

IFISC, centro de investigación en las fronteras de la Física
El Mundo, Baleópolis
November 27

Una forma de reducir el 'ruido' en redes cuánticas
Agencia SINC
December 18

a.8.2 Radio and TV

Interveiw to Roberta Zambrini
Informativo Balear
TVE
January 24

Interview to Antonia Tugores
Informatiu Migdia
Notícies, IB3 TV
January 24

Tertúlia Plataforma 11F
Balears fa Ciència, IB3 Ràdio
January 27

Tertúlia Django Girls
Balears fa Ciència, IB3 Ràdio
February 3

L'evolució de la dona a la ciència
Météo temps i natura, IB3 TV
February 9

L`evolució de la dona a la ciència
Notícies, IB3 TV
February 9

Tertúlia Django Girls
Balears fa Ciència, IB3 Ràdio
February 17

Tertúlia FOTCIENCIA
Balears fa Ciència, IB3 Ràdio
February 17

FOTCIENCIA
Météo, temps i natura, IB3 TV
February 19

L'efecte Robin Hood
Balears Fa Ciència, IB3 TV
March 18

Redes sociales
La Ciencia de Clara, RNE
April 21

Anxo Sánchez: "Nadie hace lo que se esperaría de una persona absolutamente racional"
A vivir que son dos días, Cadena SER
April 29

Interview to Santiago Canals
Balears Fa Ciència, IB3 Ràdio
May 5

Pint of Science llega a Palma de la mano del IFISC
Balears Fa Ciència, IB3 Ràdio
May 12

Mallorca acull la segona edició del 'Pint of Science'
Notícies, IB3 TV
May 14

Pint of Science PMI
Balears Fa Ciència, IB3 Ràdio
May 19

Com es mouen les formigues?
Notícies IB3 TV
July 18

Interview to Claudio Mirasso
Balears Fa Ciència, IB3 Ràdio
July 21

Interview to Ricardo Martínez
Balears Fa Ciència, IB3 Ràdio
July 21

El IFISC ha sido acreditado como 'Unidad de Excelencia María de Metzu'
Canal 4
November 20

L'IFISC ha rebut el reconeixement d'Unitat d'Excel·lència María de Maeztu
RTVE, Informatiu Balear
November 21

L'IFISC s'acredita com a Unitat d'Excel·lència María de Maeztu
Al día, IB3 Ràdio
November 22

Interview to Antònia Tugores
Balears Fa Ciència, IB3 Ràdio
November 23