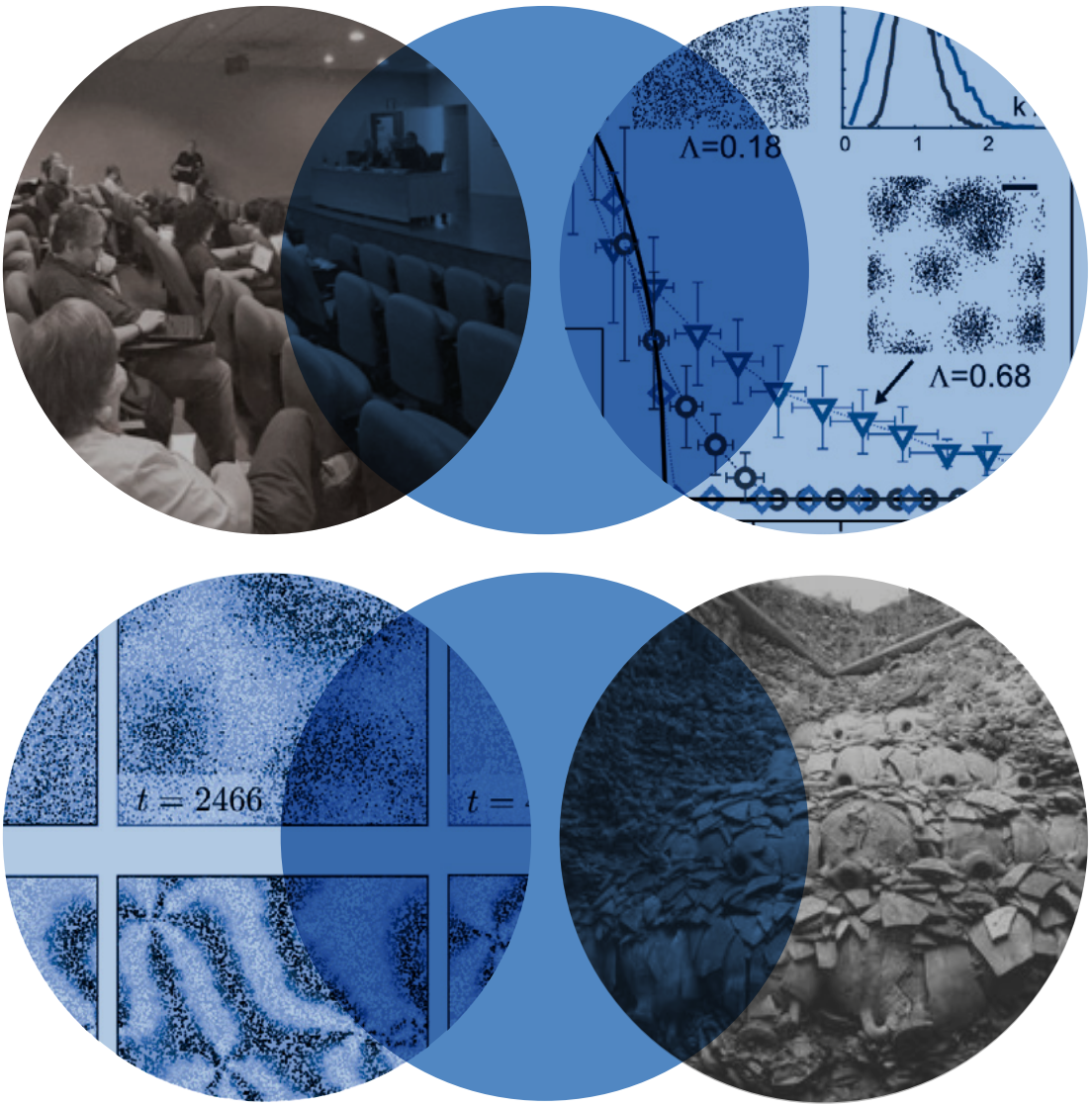
Universitat de Barcelona

UBICS Institute of Complex Systems

Annual Report

2017



UBICS

Institute of Complex Systems

Universitat de Barcelona

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UBICS Institute of Complex Systems
Annual Report
2017

FOREWORD

The Institute of Complex Systems (UBICS), created in 2016, is an interdisciplinary research institute of the Universitat de Barcelona that currently hosts more than 60 senior and young researchers.

At the UBICS, physicists, mathematicians, neurologists, psychologists, historians, linguists and computer scientists work together to advance research in a broad range of disciplines. The UBICS research covers from the most basic aspects of complex systems to applications of new knowledge at the interface between matter, life and social sciences.

The Institute also aims to integrate young researchers with a diversity of profiles with the goal to encourage their training in this multidisciplinary challenging environment.

In our first annual report, we present both a global picture of the research conducted at the Institute and the results of the scientific effort in terms of publications, funds, and activities.

Albert Díaz Guilera
Director

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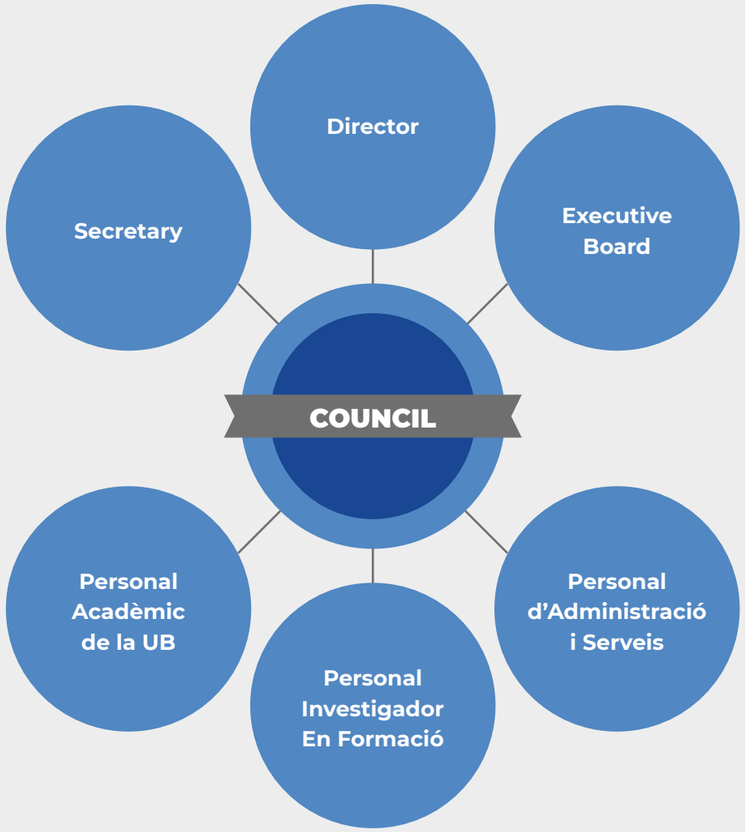
INSTITUTE STRUCTURE

1 INSTITUTE STRUCTURE

Organization chart



Executive Board

Díaz Guilera, Albert
→ *Director*
Soriano Fradera, Jordi
→ *Secretary*
Casademunt Viader, Jaume
Miguel López, M. del Carmen
Serrano Moral, Maria Ángeles
Taulé Delor, Maria

Council

Casademunt Viader, Jaume
Díaz Guilera, Albert
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Miguel López, M. del Carmen
Ortín Rull, Jordi
Palassini, Matteo
Pérez Vicente, Conrado Juan
Revilla Calvo, Víctor
Serrano Moral, Maria Ángeles
Soriano Fradera, Jordi
Taulé Delor, Maria
Tierno, Pietro
García Pérez, Guillermo
Navarro Argemí, Eloy
Rosell Tarragó, Gemma
Figueras i Raurell, M. Mercè

Advisory Board

Cugliandolo, Leticia
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Joanny, Jean Francois
→ *ESPCI, École Supérieure de Physique et de Chimie Industrielles de la Ville de Paris*

Manrubia, Susanna
→ *Spanish National Centre for Biotechnology (CSIC)*

Roggero, Pascal
→ *Université Toulouse Capitole*

Vespignani, Alessandro
→ *MOBS Lab - Laboratory for the Modeling of Biological and Socio-technical Systems*

Research Groups

GRUP DE FÍSICA NO-LINEAL (2014SGR-878)
http://www.ecm.ub.es/nonlinphys/english/index.html

Casademunt Viader, Jaume	Física de la Matèria Condensada
Ibañes Miguez, Marta	Física de la Matèria Condensada
Ortín Rull, Jordi	Física de la Matèria Condensada
Sancho, José Maria	Física de la Matèria Condensada
Soriano Fradera, Jordi	Física de la Matèria Condensada
Tierno, Pietro	Física de la Matèria Condensada

GRUP DE FÍSICA DE BIOMOLÈCULES I SISTEMES PETITS (2014SGR-1379)
http://www.ffn.ub.es/ritort/index.html

Palassini, Matteo	Física de la Matèria Condensada

GRUP DE FÍSICA ESTADÍSTICA (2014SGR-922)
http://www.ffn.ub.edu/statphysgroup

Miguel López, Maria del Carmen	Física de la Matèria Condensada
Pagonabarraga Mora, Ignasi	Física de la Matèria Condensada
Reguera López, David	Física de la Matèria Condensada

COMPLEX SYSTEMS LAB BARCELONA (2014SGR-608)
http://www.clabb.eu

Boguñà Espinal, Marian	Física de la Matèria Condensada
Díaz Guilera, Albert	Física de la Matèria Condensada
Masoliver García, Jaume	Física de la Matèria Condensada
Montero Torralbo, Miquel	Física de la Matèria Condensada
Perelló Palou, Josep	Física de la Matèria Condensada
Pérez Vicente, Conrado Juan	Física de la Matèria Condensada
Serrano Moral, Maria Ángeles	Física de la Matèria Condensada

MATERIALS: TRANSICIONS DE FASE I SISTEMES MULTIESCALA (2014SGR-182)
http://www.ub.edu/web/ub/ca/recerca_innovacio/recerca_a_la_UB/grups/fitxa/M/MATEFASE/index.html?

Vives Santa-Eulalia, Eduard	Física de la Matèria Condensada

GRUP DE COMPLEXITAT, COMUNICACIÓ I SOCIOLINGÜÍSTICA (2014SGR-359)
http://www.sociocomplexitat.ub.edu

Bastardas i Boada, Albert	Filologia Catalana i Lingüística General

GRUP D'ESTUDI DE LA VARIACIÓ (2014SGR-918)
http://www.ub.edu/GEV

Massip Bonet, Àngels	Filologia Catalana i Lingüística General

CEIPAC (CENTRE PER A L'ESTUDI DE LA INTERDEPENDÈNCIA PROVINCIAL A L'ANTIGUITAT CLÀSSICA) (2014SGR-218)
http://ceipac.ub.edu

Remesal Rodríguez, José	Història i Arqueologia
Revilla Calvo, Víctor	Història i Arqueologia
Aguilera Martin, Antonio	Història i Arqueologia
Pons Pujol, Luís	Història i Arqueologia

GRUP DE TÈCNIQUES ESTADÍSTIQUES AVANÇADES APLICADES A LA PSICOLOGIA (GTEAAP) (2014SGR-326)
http://www.ub.edu/gteaap

Guàrdia Olmos, Joan (1/2)	Psicologia Social i Quantitativa
Peró Cebollero, Maribel (1/2)	Psicologia Social i Quantitativa

SISTEMES COMPLEXOS I ESPORT (2014SGR-975)
http://www.inefc.cat/inefc/AppPHP/main.php?id_pagina=183

Balagué Serré, Natàlia	INEFC- Educació Física
Mateu Serra, Mercè	INEFC- Educació Física

CENTRE DE LLENGUATGE I COMPUTACIÓ (2014SGR-623)
http://clic.ub.edu

Taulé Delor, Maria	Filologia Catalana i Lingüística General
Martí Antonín, Maria Antònia	Filologia Catalana i Lingüística General
Salamó Llorente, Maria	Matemàtiques i Informàtica
Rodríguez Santiago, Inmaculada	Matemàtiques i Informàtica

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UBICS IN FIGURES

2 UBICS IN FIGURES

UBICS

40 Senior Researchers

16 Early Stage Researchers

16 External Members

1 Services And Administration Personnel

ICREA

Catalan Institution For Research And Advanced Studies

2 Research Professors

2 Academia Professors

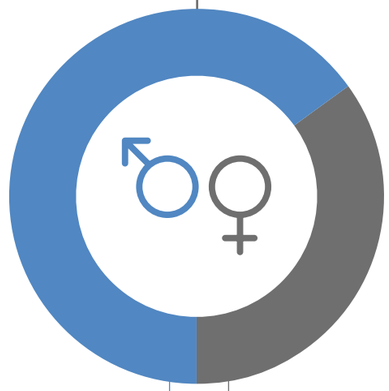
ERC

European Research Council

1 Advanced Grant

1 Starting Grant

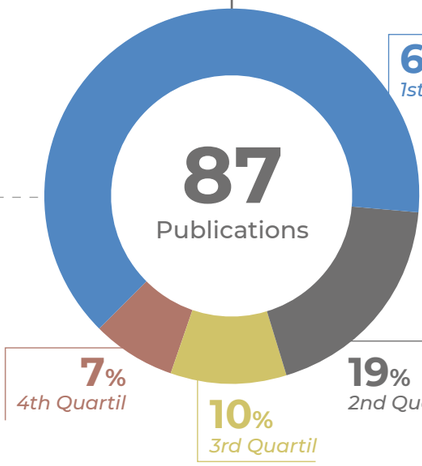
GENDER



65% Men

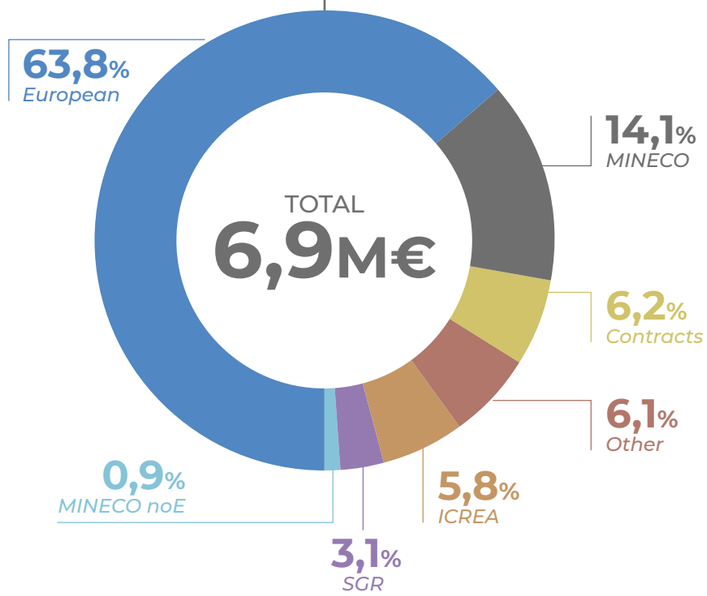
35% Women

PUBLICATIONS



64% Publications in 1st Quartil

FUNDING



Where to find us

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Twitter @UB_ICS

Campuses

Mundet Campus
Passeig de la Vall d'Hebron, 171
08035 Barcelona

Barcelona Knowledge Campus
Baldiri Reixac, 2
08028 Barcelona

Humanities Campus
Gran Via de les Corts Catalanes, 585
08007 Barcelona

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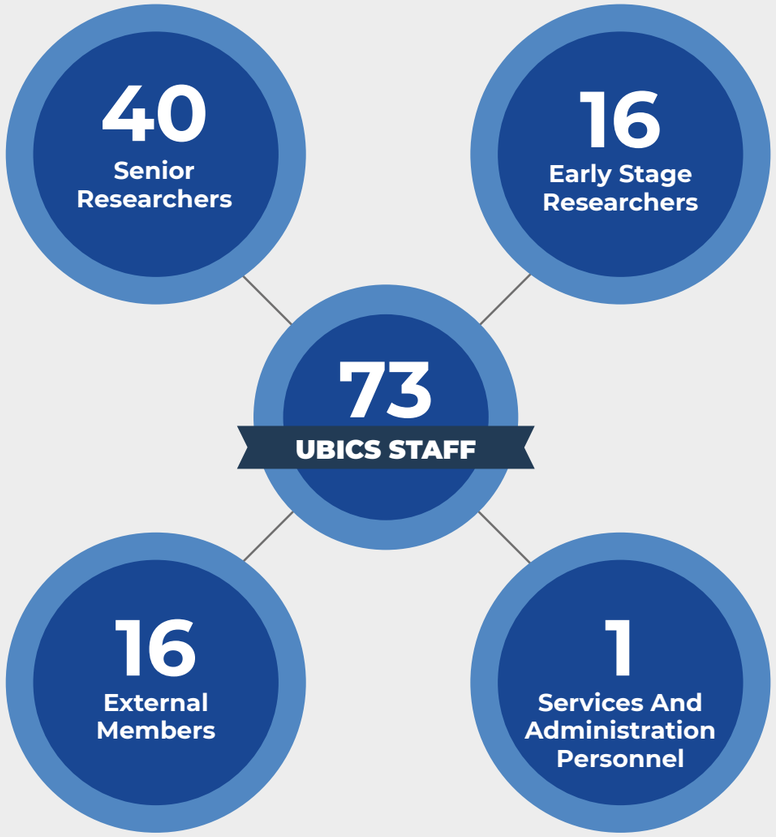
UBICS STAFF

3 UBICS STAFF



40 SENIOR RESEARCHERS

- **Aguilera Martin, Antonio**
  Departament d'Història i Arqueologia
- **Allard, Antoine**
  Departament Física de la Matèria Condensada
- **Bastardas Boada, Albert**
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- **Boeckx, Cedric**
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- **Cigarini, Anna**
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- **Cozzo, Emmanuelle**
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- **Díaz Guilera, Albert**
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- **Granell Martorell, Clara**
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- **Guàrdia Olmos, Joan**
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- **Ibañes Míguez, Marta**
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- **Levis Sotomayor, Demian Francisco**
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- **Marti Antonin, M. Antonia**
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- **Masoliver García, Jaume**
  Departament Física de la Matèria Condensada
- **Massip Bonet, Maria Àngels**
  Departament Filologia Catalana i Lingüística General
- **Miguel López, M. Del Carmen**
  Departament Física de la Matèria Condensada
- **Montero Torralbo, Miquel**
  Departament Física de la Matèria Condensada
- **Ortín Rull, Jordi**
  Departament Física de la Matèria Condensada
- **Pagonabarraga Mora, Ignacio**
  Departament Física de la Matèria Condensada
- **Palassini, Matteo**
  Departament Física de la Matèria Condensada
- **Perelló Palou, Josep**
  Departament Física de la Matèria Condensada
- **Pérez Vicente, Conrado Juan**
  Departament Física de la Matèria Condensada
- **Peró Cebollero, Maribel**
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- **Planet Latorre, Ramon**
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- **Pons Pujol, Luis**
  Departament Història i Arqueologia
- **Reguera López, David**
  Departament Física de la Matèria Condensada
- **Remesal Rodríguez, José**
  Departament Història i Arqueologia
- **Revilla Calvo, Víctor**
  Departament Història i Arqueologia
- **Rodríguez Santiago, Inmaculada**
  Departament Matemàtiques i Informàtica
- **Salamó Llorente, Maria**
  Departament Matemàtiques i Informàtica
- **Sancho Herrero, José María**
  Departament Física de la Matèria Condensada

SENIOR RESEARCHERS

- **Serrano Moral, Maria Ángeles**
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- **Soriano Fradera, Jordi**
  Departament Física de la Matèria Condensada
- **Starnini , Michele**
  Departament Física de la Matèria Condensada
- **Taulé Delor, Maria**
  Departament Filologia Catalana i Lingüística General
- **Tierno, Pietro**
  Departament Física de la Matèria Condensada
- **Vives Santa-Eulalia, Eduard**
  Departament Física de la Matèria Condensada

16 EARLY STAGE RESEARCHERS

- **Alert Zenon, Ricard**
  Departament de Física de la Matèria Condensada
- **Amato, Roberta**
  Departament de Física de la Matèria Condensada
- **Baldeón Medrano, Johan Paul**
  Departament Matemàtiques i Informàtica
- **Codina Sala, Joan**
  Departament Física de la Matèria Condensada
- **Farràs Permanyer, Laia**
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- **García Pérez, Guillermo**
  Departament Física de la Matèria Condensada
- **González Vázquez, Mateo**
  Departament Història i Arqueologia
- **Guardado Alonso, Luis**
  Departament Física de la Matèria Condensada
- **Hernández Navarro, Lluis**
  Departament Física de la Matèria Condensada
- **Mancho Fora, Nuria**
  Departament Psicologia Social i Psicologia Quantitativa
- **Navarro Argemí, Eloy**
  Departament Física de la Matèria Condensada
- **Ortiz Castillo, Elisenda**
  Departament Física de la Matèria Condensada
- **Rosell Tarragó, Gemma**
  Departament Física de la Matèria Condensada
- **Sánchez Cobos, Agustín**
  Departament Física de la Matèria Condensada
- **Suñé Simon, Marc**
  Departament Física de la Matèria Condensada
- **Theofanopoulou , Constantina**
  Departament Filologia Catalana i Lingüística General

16 EXTERNAL MEMBERS

- **Balaguer, Natàlia**
  INEFC - Institut Nacional d'Educació Física de Catalunya
- **Bermúdez Lorenzo, Juan Manuel**
  FBG - Fundació bosch i Gimpera
- **Bonhour, Isabelle**
  FBG - Fundació bosch i Gimpera
- **Corvera Poiré, Eugenia**
  UNAM - Universidad Nacional Autónoma de México
- **Estévez Priego, Estefania**
  FBG - Fundació bosch i Gimpera
- **Guillamó, Eli**
  INEFC - Institut Nacional d'Educació Física de Catalunya
- **Ludl, Adrian**
  FBG - Fundació Bosch i Gimpera
- **Malagarriga, Daniel**
  FBG - Fundació Bosch i Gimpera
- **Mateu, Mercè**
  INEFC - Institut Nacional d'Educació Física de Catalunya
- **Morer Zapata, Ignacio**
  FBG - Fundació Bosch i Gimpera
- **Pérez González, Jordi**
  FBG - Fundació Bosch i Gimpera
- **Prignano , Luce**
  FBG - Fundació Bosch i Gimpera
- **Sanmartí Osuel, Enric**
  FBG - Fundació Bosch i Gimpera
- **Simas, Tiago**
  Telefonica Innovation Alpha
- **Slapsinskaite, Agne**
  INEFC - Institut Nacional d'Educació Física de Catalunya
- **Vázquez, Pablo**
  FBG - Fundació Bosch i Gimpera

1 SERVICES AND ADMINISTRATION PERSONNEL

- **Figueras i Raurell, M. Mercè**

4

RESEARCH LINES

4 RESEARCH LINES

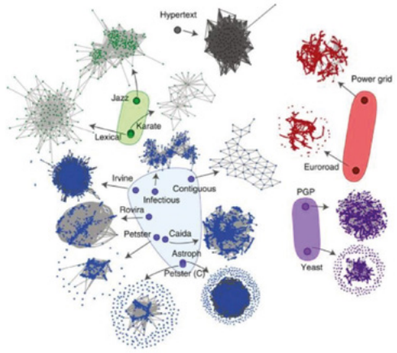
Foundations

An important number of the Institute's researchers are carrying out their own research on the identification and description of the general principles and key mechanisms that govern complex systems. This includes, on the one hand, the study of theoretical aspects within the framework of network science and the modeling of the basic agents that make up a system and the study of emerging behaviors through their interactions. On the other hand, the analysis of many complex systems often involves processing a large amount of information, which requires the continuous development of tools in the context of so-called "Big Data", with clear applications in the context of the Institute. Finally, a large number of complex systems are intrinsically dynamic, that is, they evolve over time. Problems ranging from fluid dynamics and plasticity in neural networks and metabolic networks to the dynamics of social networks, all require the development of common tools. This is a fundamental aspect that focuses the research activities carried out by the members of the Institute. Not to mention the field of Statistical Physics, from which most of the physics researchers at the Institute come, which still has fundamental problems to be solved.

Statistical Physics

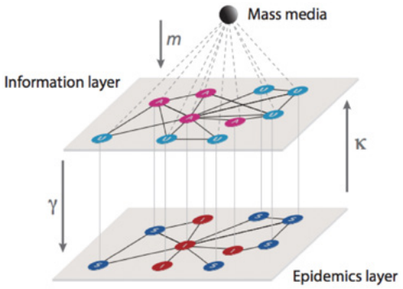
Statistical Physics techniques are at the basis of our approach to the study of complex systems. Statistical Physics uses the methods of probability theory and statistics to bridge the gap between the microscopic properties of individual atoms and molecules and the macroscopic or bulk properties of materials.

At the Institute, statistical physicists generalize the applicability of this discipline by studying other types of microscopic elements that interact to give place to collective macroscopic phenomena. Apart from the philosophical approach, some specific techniques that we have adapted for the study of complex systems are statistical models of anomalous diffusion and transport, models for the study of phase transitions and criticality --such as the Ising model--, and renormalization group theory.



Networks

Network Science focuses on the study of interactions as graph representations of complex systems. Complex networks display patterns of connection that are neither purely regular nor totally random, and are common to many real systems in differents domains. These non-trivial topological features, combined with dynamical processes and evolutionary changes, explain many of the emergent phenomena observed in complex systems.



Researchers at the Institute are working on the development of theoretical and computational tools and methodologies for the study of complex networks, and on their application to the construction of predictive models for physical, biological, and social phenomena. Among the Network Science topics studied at UBICS are network geometry, multilayer networks and dynamical processes, and our research also extends to a wide range of real complex systems, including the molecular networks of interactions in cells, the brain, online and offline social networks, the Internet, and international trade webs.

Dynamical Systems

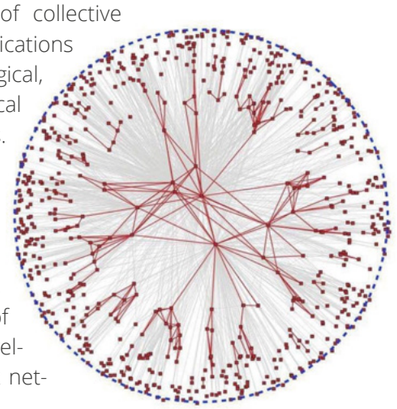
Complex systems are inherently dynamic and both properties and processes change over time. Dynamical systems theory provides a mathematical framework for treating time dependence in complex systems, typically involving continuous time and stochastic or random events. Apart from time dependence in geometrical space, it is common to deal with extended versions for systems with discrete elements. This serves, for instance, to study dynamical processes in networks.

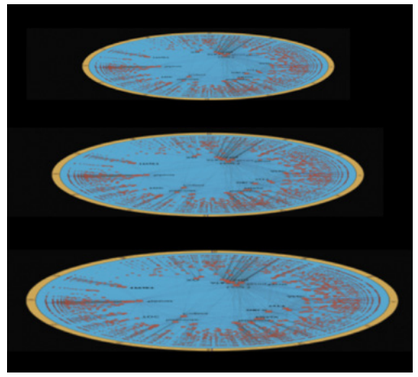
Among the different dynamical processes, the phenomenon of synchronization has received a lot of attention, becoming one of the paradigmatic examples of the emergence of collective properties with applications in physical, biological, chemical, technological and social systems. UBICS researchers have devoted great efforts to understanding synchronization phenomena, taking advantage of the most recent developments in complex network science.

Data Science

The study of real complex systems requires the curation, structuring, filtering, analysis, and visualization of large amounts of empirical and experimental data. The main goal is to extract knowledge from data by combining a data-driven approach, based on different statistical, data mining, and machine learning techniques, with analytic and computational methodologies that allow us to construct and simulate meaningful models with predictive power.

Applications have been developed at the Institute to be applied in fields ranging from language structure to social networks and urban mobility. Concretely, UBICS researchers have proposed a Collaborative Conversational Recommender framework, in which a synchronous and online 3D interface for multiple consumers integrates with a recommender system. Our work has also focused on game-based learning tools for both teachers and students. In the case of teachers, mechanisms for the design of educational games have been proposed. Moreover, related to social awareness (i.e., energy awareness), there are implementations of several gamified solutions that incorporate virtual agents to motivate and educate children in energy issues. These virtual agents communicate with users in natural language.





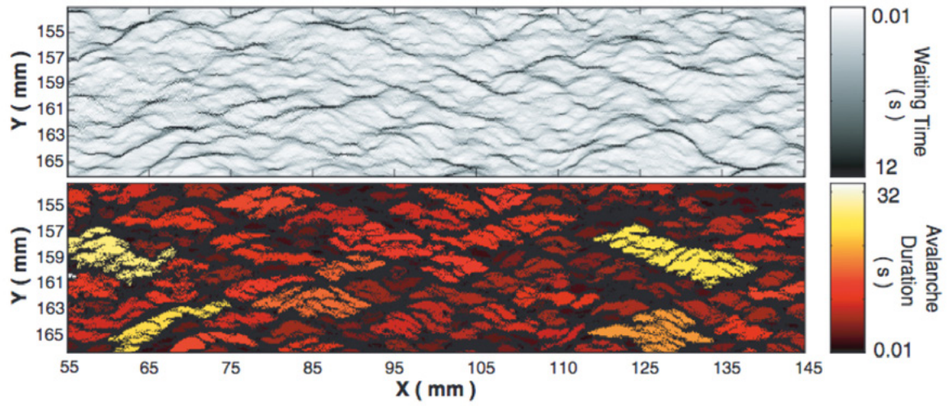
Science Of Matter

Condensed matter systems exhibiting phase transitions and criticality are probably the very first examples of complex systems. In such situations, the system's response to external changes is not a simple superposition of the response of its constituents but rather an emerging collective property. Understanding it through the use of techniques from the fields of statistical and nonlinear physics increases its predictability and allows for the design of new and useful tailored materials. Indeed, a broad variety of physical and chemical systems and processes can be described as complex systems, and their degree of complexity demands the adaptation or the extension of currently existing tools to new situations.

An important field of research within the science of complex matter focuses on soft matter materials, which include colloids, polymers and gels, complex fluids, and biological materials. What these systems have in common is that they are easily deformed by external forces and that their behavior is governed by weak interactions at energy scales comparable to thermal energy. While research on soft matter has traditionally been focused on synthetic materials, rapid developments in molecular biology have provided evidence that soft interactions and fluctuation phenomena also play a vital role in biology. Soft materials display complex spatiotemporal responses and special physical properties, including high deformability and complex rheology, which makes them very attractive for technological applications, in particular, in the food and cosmetics industries. Regarding complex materials, it is also worth emphasizing the interest of the research community in developing intelligent materials, i.e. materials that are able to adapt their properties or structure according to specific needs or to environmental changes (in some cases mimicking natural materials and processes), and thus have a huge technological and industrial impact.

Soft Matter

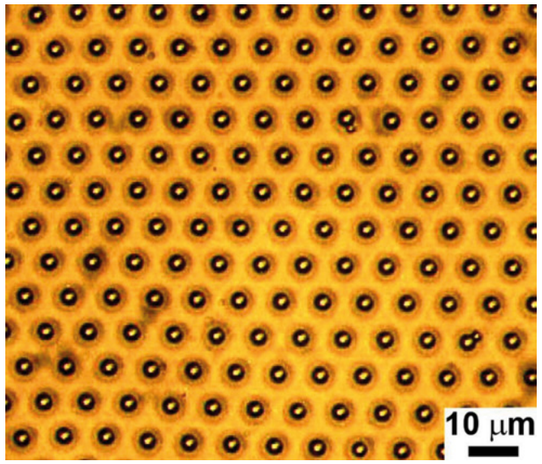
Among the extensive variety of soft matter materials, colloidal systems, i.e. fluid suspensions of micron-sized polymer spheres, are particularly interesting, not only for their ubiquitous nature (colloids are present in creams, foams, smoke, paints, etc..), but also because they provide a rich playground for basic Condensed Matter Physics. Colloidal particles display Brownian motion, size in the visible wavelength and dynamics in experimentally accessible time frames. Yet interactions in colloidal systems can be easily tailored in strength and range via the application of rela-



tively small external fields. These striking features make colloids excellent models for the study of behavior and dynamics in dissipative systems with intrinsic noise, i.e. systems broadly distributed in many physical, chemical and biological disciplines.

UBICS researchers have recently discovered a new scenario for a first-order phase transition that occurs via a complete inversion of the system energy landscape. This phenomenon was termed the "landscape inversion phase transition" (LIPT) and was observed by applying an external magnetic field to an assembly of paramagnetic colloids two dimensionally confined above a stripe patterned magnetic substrate. Another recent breakthrough in the optical manipulation of colloidal microspheres demonstrated the possibility of confining a cluster of particles into a circular assembly, and rotating the outer particle corona via laser tweezing. This colloidal model system was used as a microscopic clutch to investigate the transmission of torque through soft materials at the nanoscale. Another line of UBICS research focuses on understanding how curved colloidal crystalline shells can adapt their shape and resist failure. This is of fundamental importance because these structures are at the forefront of the drive to fabricate new functionalized self-assembled materials. Some biological structures, such as virus capsids, also represent nearly-ideal examples of spherical crystallography. Studies by UBICS researchers highlight the fundamental role played by geometrically necessary crystal defects, such as the pentagons in a soccer ball, in controlling mechanical stability and plastic deformation of these colloidal shells.

Complex flows and complex fluids



Complex fluids are seemingly homogeneous at macroscopic scale, but they are disordered at the microscopic scale and possess structure at intermediate scales. As a result their deformation and flow response to external solicitations is usually very different from that of conventional liquids and solids. Examples of complex fluids include polymeric melts or solutions, glasses, gels and foams. Complex fluids are ubiquitous in industry (e.g. in food and cosmetics) and in living organisms (e.g. blood and mucus).

Researchers at UBICS study hydrodynamic flows in complex scenarios that involve both Newtonian and complex fluids, and either bulk or interfacial instabilities such as vortex ring formation and viscous fingering. Combining experimental work, statistical analysis and theoretical modeling, they also explore the morphological and dynamic properties of two-phase displacements in disordered media, in which scale-invariance, non-Gaussian velocity fluctuations, avalanches, and intermittency can be observed. Current lines of research include the study of (i) the origin of instabilities (vortex ring formation and elastic turbulence) in the oscillatory pipe flow of non-Newtonian fluids, and (ii) the basic mechanism behind hysteresis in drainage/imbibition displacements in laboratory models of single pores.

Active Matter

Condensed matter systems composed of self-propelled units operating far from thermodynamic equilibrium belong to the realm of active matter. Such active "particles" possess internal degrees of freedom that allow them to self-propel by extracting energy from their environment and dissipating it to move in a preferred direction. Interaction between these elements originates patterns of self-organization and characteristic flows similar to those found in natural flocking systems. Flocking is very frequent in nature. Indeed, the phenomenon can be observed at a broad range of length scales, from mammal herds and fish schools to bacteria colonies and cellular migrations. These systems give rise to new fundamental questions and the possibility of synthesizing new types of smart materials, for example, those based on assemblies of filamentous proteins and molecular motors.
Researchers at UBICS are investigating how biological cells sense and respond to mechanical stimuli, which involves the interplay of several cytoskeletal constituents: primarily filaments, such as actin microfilaments or microtubules, crosslinking proteins, and molecular motors. The transport of various types of cargoes in cells is, for example, based on molecular motors moving along the cytoskeleton. Often, these motors work in teams rather than as isolated molecules. Our studies attempt to understand the effects of elastic coupling on (i) the dynamics of motor complexes (small number of motors), and (ii) the mechanical stability of actin assemblies. Another line of research investigates the propulsion of colloidal systems at the micro/nanoscale. It has recently been demonstrated that elongated DNA-linked paramagnetic colloids subjected to external precessing fields are capable to propel in a controlled way in viscous fluids. Future investigations will focus on determining interactions among micro-swimmers and the role played by hydrodynamic interactions, and on implementing optical forces to test swimmers' performance and their constrained motion into microscopic pores or microfluidic networks. As stated before, flocking is a phenomenon by which a general class of self-propelled entities, using limited environmental information and simple rules, organize themselves into an ordered state of motion. In some cases, interactions among moving entities are quite heterogeneous, and this feature has an important impact on collective motion. The presence of heterogeneous social interactions, naturally represented in terms of social networks, has been, for instance, observed in mammals and fish. UBICS researchers are also investigating the effects of such a broad class of interactions among group members, as well as behavioral contagion, on flocking dynamics.

Smart Materials

The design of new useful tailored materials benefits from its fundamental understanding using techniques from statistical and nonlinear physics. In many cases an efficient design implies the control of the amount of disorder as well as the use of multiscale modelling approaches from the nanoscale to large thermodynamic scales.

Our research focuses on the study of functional materials for sensors and actuators, super-elastic materials, shape memory alloys, ferrocaloric materials for efficient refrigeration, as well as the problem of critical failure of materials under compression (up to geophysical scales)

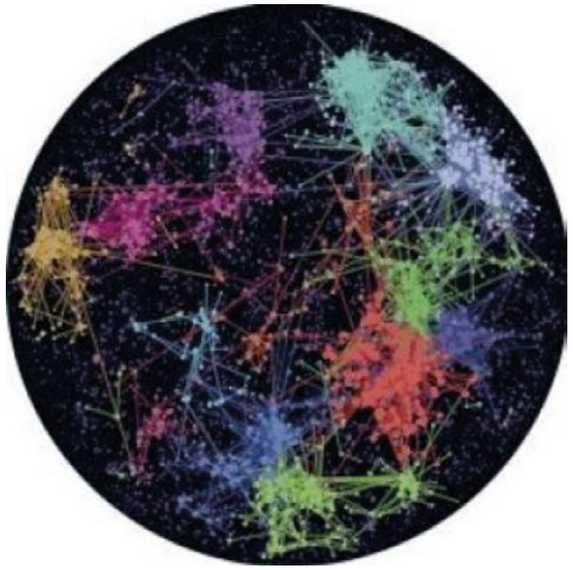
Life Sciences

Biological systems, both for their intrinsic wealth and because of their importance, have received special attention from the complex systems viewpoint. Much of the Institute's research activity is geared towards solving a large variety of problems in the biological context, and at diverse spatial and temporal scales. Investigations cover experimental, computational and theoretical approaches. Research areas include the study of fundamental molecular mechanisms, genomics and proteomics, the generation of forces and the mechanics of cells and tissues, morphogenesis and development, systems biology at the cellular level, and neuroscience. For the latter, the Institute houses its own laboratories. Additionally, the associated studies carried out at the level of microorganisms and tissues exhibit, thanks to their fundamental perspective, a clear connection with the research conducted in active matter, an area that is also central to the Institute.

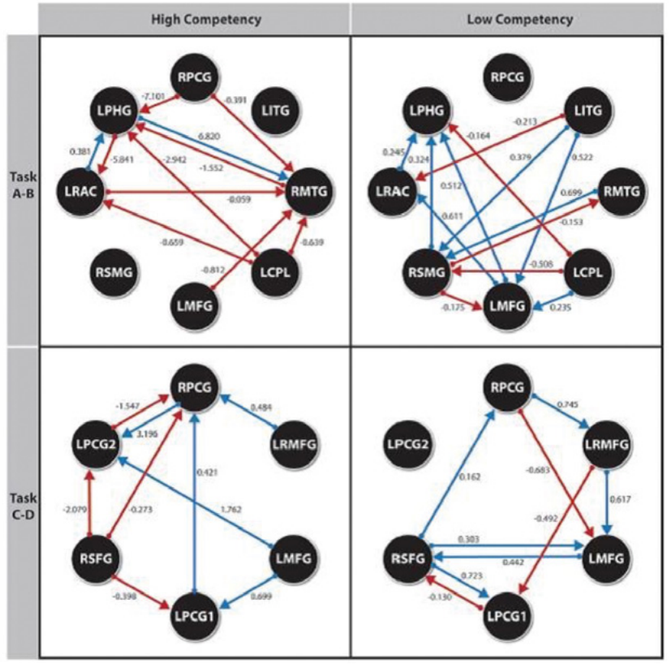
Molecular Biophysics

The advent of nanotechnologies in recent decades has made it possible to probe and measure biological systems down to the molecular scale. This has given rise to a more physical approach to traditional molecular biology, and, in particular, to attempts to solve the longstanding puzzles of biological building blocks and their behavior. This includes, for instance, the structure of proteins as a result of their folding dynamics, and the performance of molecular machines such as motor proteins.

In this context, the Institute is developing a first important line of research in single-molecule physics in an effort to understand the structural properties of relevant biomolecules through mechanical measurements of single molecules. A second line of research addresses the collective effects of molecular motors, i.e. cooperation among motor proteins to perform complex tasks, including the development of efficient strategies in intracellular transport and collective force generation. The latter is a problem that is directly relevant to medical applications, such as in neurodegenerative diseases.



Cell and Multicellular Biology



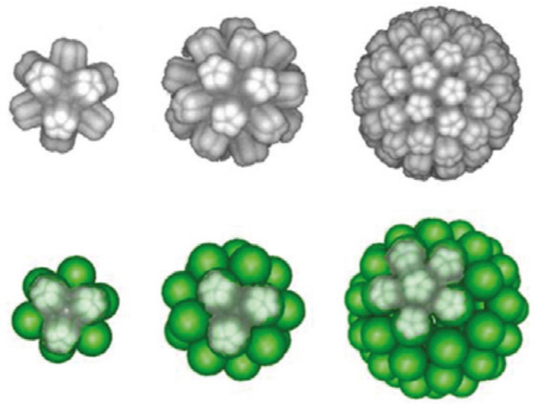
The biological cell is the basic unit of life, and constitutes in itself a remarkably complex system that combines thousands of chemical reactions by thousands of molecular species, all happening at the same time with fascinating harmony within an extremely crowded and noisy environment. The current access to quantitative data enabled by modern technologies has revealed the cell to be a whole new universe for physical inquiry and quantitative modeling, posing a formidable challenge for interdisciplinary science.

In this context, the research at the Institute aims at understanding the physical mechanisms of self-organization that can integrate such a variety of processes at very different scales. The problem is highly complex given the formidable information processing required to orchestrate cellular mechanisms in response to external stimuli; or to accomplish a variety of tasks required for survival, from metabolism to cell division. Research also focuses on different aspects of the physics within cells, with an emphasis on collective effects and emerging phenomena. Among the aspects that are more amenable to physical modeling under study, we can highlight those referring to force generation and cell mechanics, which are crucial for instance to cell motility and cell division, and to the processes associated with membrane dynamics. At a higher level of organization, the Institute also studies collective phenomena of cells in tissues. Here our emphasis is on mechanical aspects and includes the study of collective cell migration of epithelial cells, an area that is relevant to a variety of problems related to wound healing, cell regeneration, and, ultimately, to the understanding of cancer. Our goal is to extract the generic physical principles that govern the complex network mechanical and biochemical interactions underlying these systems. At the multicellular level, our ultimate goal is to achieve an integration of mechanics and information in development; that is, to understand the organization of physical forces and biological regulation in the context of embryogenesis, organogenesis and beyond.

Systems Biology

Systems Biology is a growing research field that aims at characterizing and understanding living organisms from the interaction among their building blocks, for instance the gene-gene interactions that dictate the animal body plan.

The research performed at UBICS within the field of Systems Biology uses mathematical and computational models of these blocks and interactions, and integrates methodologies from fields like dynamical systems and complex networks. This research includes important collaborations with wet laboratories and uses reported public data. The derived models, tools and approaches are applied to the comprehension of several aspects relating to living systems. A first aspect aims at the understanding of the patterning and growth processes that underlie the development of multicellular organisms. Such studies range from the embryonic animal development of vertebrates to plant growth. A second aspect focuses on the relationship between the large-scale architecture of the biological networks of interactions at different levels and their functionality.



Neuroscience

Living neuronal networks, in particular the human brain, are considered to be among the most complex systems in nature. The quest to understand them has caught the attention of different research groups at the Institute, who are exploring them through a rich repertoire of experimental, computational and theoretical tools.

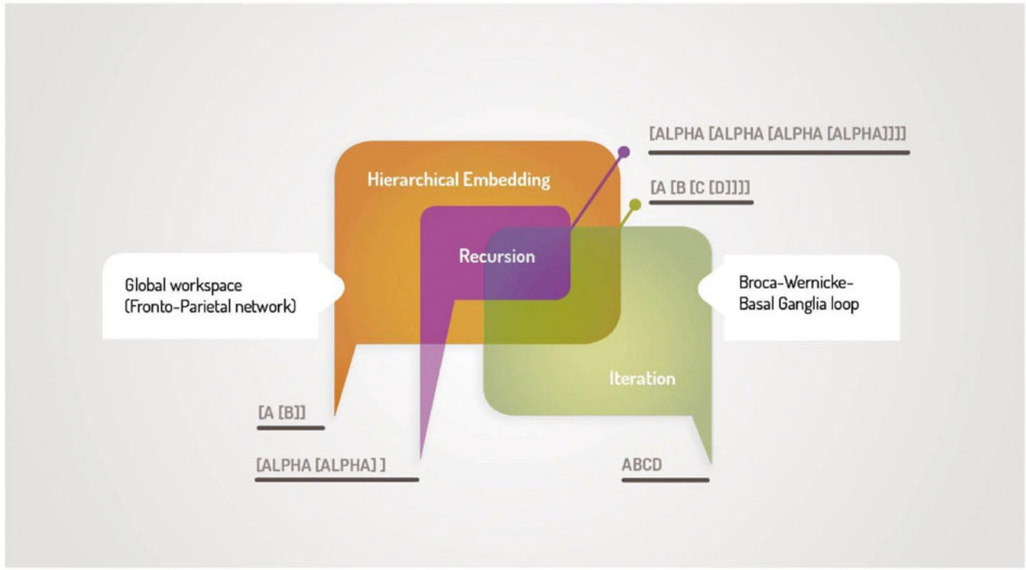
Two major lines of action shape neuroscience research, centered at either the scale of the brain or at the scale of mesoscopic neuronal circuits. At the scale of the brain, researchers study statistical models for the complex representation of the behavior of brain signal recordings in Functional Magnetic Resonance Imaging (fMRI) paradigms. Statistical, computational and mathematical models are generated with the aim of understanding the features of functional and effective connectivity maps between brain regions. These models provide a framework not only for systematic analysis, but also to diagnose and understand brain pathologies such as Mild Cognitive Impairment, Major Depressive Disorder, or simply aging. At the mesoscale, our research focuses on the emergence of collective phenomena in neuronal circuits. Neuronal cultures derived from either rat primary cells or human induced pluripotent stem cells are used as the main experimental platforms, and laboratory data is combined with theoretical modeling and numerical simulations. The investigation of complex phenomena in cultures include the ability of neuronal circuits to exhibit spontaneous activity patterns, synchronization mechanisms, and the capacity of these circuits to manifest an exquisite robustness in combination with broad flexibility. Given the relation between neuronal networks and connectivity, research also covers the modeling of neurological disorders in vitro and in silico, in particular in Huntington's, Parkinson's and Alzheimer's disease.

Social Sciences

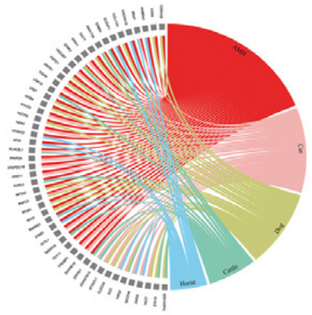
Applications in the social sciences range from aspects at the individual level to the study of large scale sociopolitical and economic structures, including those of the past. One of the applications that we can already consider as traditional in complex system science is economy and finance. But the activities of the institute aim to open up other fields of applicability. For example, concepts such as coordination dynamics and other characteristics of networks are being applied to the study of behaviors related to sports, both individually and at team level. Similarly, we are also working on issues related to the biological nature of human language ability, its development at the individual level, its emergence in species, and its implementation at the brain level. In the same way, the complex perspectives we are adopting illuminate more thoroughly the dynamics of the sociocomunicative and sociopolitical factors influencing language use, evolutionary change and maintenance and replacement phenomena.

Psychology and behaviour

Social dilemmas and game theory provide tools and strategies for measuring and quantifying an individual's social traits based on their actions when these individuals confront their own benefit with another's interest or with the collective interest. These dilemmas therefore make it possible to analyze, for example, the levels of cooperation, trust, reciprocity and sense of collectivity that arise when participants in these types of experiments play together and interact with each other generally through a digital interface capable of gathering the data related to their decisions. The research carried out along these lines combines experimental performance with empirical analysis either through basic statistics or sophisticated clustering algorithms and with the provision of new models to better interpret what is been observed in the experiments.



At UBICS, researchers work together with many actors to build tailored-made research collectives to address concerns and issues grounded mostly in urban contexts. Our methodology is based on community processes and provides a large set of social dilemmas and dyadic games for the understanding of specific behavioural traits in social interactions. By means of citizen science strategies, our experimental setup was placed in the wild with situated, public and participatory experiments involving citizens at different levels. We have been working in several neighborhoods, applying this methodology to study the mechanisms behind collective climate actions to provide innovative tools for schools to increase student's motivation or to better understand mental health care in community ecosystem.



Economy and finance

Stock markets exhibit several universal statistical stylized facts and patterns that can be studied and modelled thanks to the large data sets available. Relevant issues can therefore be studied to obtain a better understanding of stock price movements and a better description of risk. Physics, complex systems science and their way of looking at natural phenomena have all contributed in a multidisciplinary way to this field, which, since the early 1990s, has been labelled econophysics.

UBICS researchers apply stochastic processes and other tools from the field of statistical physics to model volatility, to understand the statistics of extreme times such as first-passage time, to interpret emerging prices with agent based models and even to identify the relevant information that triggers the actions of individual traders. Other topics that have been studied recently include the economics of climate change and game theory.

Linguistics

Linguistics is a diverse field of research, and several different disciplines within it relate to the notion of complex systems. The study of language can be used to access information about human behaviour, the human brain and its processes, and about social and cultural structures on a larger scale. The field of linguistics further generates some very concrete applications, mostly related to technology and human-machine interactions, as well as clinical applications.

The work done by the linguistics department of our university within the Institute for Complex Systems is focused on three very distinct lines of research. The research group for biolinguistics studies the neurobiological foundations of the human capacity for language, as well as human-specific cognition at a more general level. To do so it employs a combination of theoretical, computational and genetic methods. Some of the main lines of investigation within the group are studying phenomena like the Neandertal genome, vocal learning in songbirds and its relationship to the human capacity for language, and the molecular processes that are involved in memory formation. In the line of Sociolinguistics and Linguistic Variation, the focus is on the application of theories of complexity to the comprehension of social, communicative-cognitive and linguistic phenomena. Finally, concerning Computational Linguistics, we focus on the detection of the linguistic features that allow us to identify communicative attitudes, opinion (polarity), irony, emotions and socio-political stance in oral and written texts, especially those produced on social media. There is also interest in the development of language technology resources, which are the base of natural language processing applications (information extraction, question-answering, recommendation systems, machine translation, etc.).

History

The trade system of the Roman Empire is one of the first recognized networks of interaction and interdependence between the Mediterranean basin and northern Europe and is generally considered to be the first complex European trade network. In the last fifty years, many theories and hypotheses about the organization of the Roman Empire trade system have been proposed but, due to the lack of source material, these theories continue to be speculative.

Among the best archaeological semantic markers available for the Roman Empire are amphorae and their associated epigraphy. Amphorae provide information on geographical origin, transported products, economic transactions and the social positions and relationships between people involved in trade.

At UBICS, researchers model the dynamics of the amphorae trade system during the Roman Empire using geospatial and social network techniques in order to better understand the evolutionary trends of the trading network. The research undertaken is an example of a truly interdisciplinary perspective on trade network studies.

5

FUNDING

5 FUNDING

European Projects

- ***Production and distribution of food during the Roman Empire: Economics and Political Dynamics (EPNet)***
  Period: 01/03/2014 to 28/02/2019
  Principal Investigator: **Remesal Rodríguez, José**

- ***Dynamics and assemblies of colloidal particles under Magnetic and Optical forces (DynaMO)***
  Period: 01/01/2014 to 31/12/2018
  Principal Investigator: **Tierno, Pietro**

- ***Custom architecturally defined 3D stem cell derived functional human neural networks for transformative progress in neuroscience and medicine (MESO_BRAIN)***
  Period: 01/09/2016 to 31/08/2019
  Principal Investigator: **Soriano Fradera, Jordi**

- ***Transport of soft matter at the nanoscale (NANOTRANS)***
  Period: 01/03/2016 to 29/02/2020
  Principal Investigator: **Pagonabarraga Mora, Ignacio**

- ***Promotion of STEM education by key scientific challenges and their impact on our life and career perspectives (STEM4youth)***
  Period: 01/05/2016 to 31/10/2018
  Principal Investigator: **Perelló Palou, Josep**

- ***Collective Phenomena in dense Active Matter: phase transitions and non-equilibrium dynamics (COLPHAM)***
  Period: 15/07/2015 to 14/07/2017
  Principal Investigator: **Pagonabarraga Mora, Ignacio**

- ***An e-infrastructure for software, training and consultancy in simultion and modelling (E-CAM)***
  Period: 01/10/2015 to 39/07/2020
  Principal Investigator: **Pagonabarraga Mora, Ignacio**

Other International Projects

- ***Mapping complexity: Embedding networks in hidden metric spaces***
  Agency: James S. McDonnell Foundation
  Period: 01/10/2013 to 30/09/2019
  Principal Investigator: **Serrano Moral, Maria Ángeles**

- ***Inferential Analysis of Multilayered Time-Varying Complex Networks with Applications on Computational Social Sciences***
  Agency: James S. McDonnell Foundation
  Period: 15/04/2017 to 14/04/2018
  Principal Investigator: **Granell Martorell, Clara**

Spanish Government Funded Research Projects

- ***Materiales con respuesta activa para refrigeración limpia y eficiente***
  Period: 30/12/2016 to 29/12/2020
  Principal Investigator: **Vives Santa-Eulalia, Eduard**

- ***Fenómenos de no-equilibrio en Materia Blanda: de fluidos complejos a tejidos celulares***
  Period: 30/12/2016 to 29/12/2019
  Principal Investigator: **Casademunt Viader, Jaume**

- ***Adaptabilidad y Cooperación en Sistemas Biosociales en la Multiescala II***
  Period: 30/12/2016 to 29/12/2019
  Principal Investigator: **Serrano Moral, Maria Ángeles**

- ***Relaciones interprovinciales en el Imperio Romano. Producción y comercio de alimentos hispanos (provincias Baeticae y Tarraconensis)***
  Period: 01/01/2016 to 31/12/2017
  Principal Investigator: **Remesal Rodríguez, José**

- ***Estudio de transiciones dinámicas en redes complejas: una aproximación de red funcional multicapa, modelos y validación***
  Period: 01/01/2016 to 31/12/2018
  Principal Investigator: **Díaz Guilera, Albert**

- ***La globularidad y la aparición del cerebro apto para el lenguaje***
  Period: 30/12/2016 to 29/12/2019
  Principal Investigator: **Boeckx , Cedric**

- ***SomEMBED-Slang: comprensión del lenguaje en los medios de comunicación social. Representando contextos de forma continua-Lengua no estándar.***
  Period: 01/01/2016 to 31/12/2018
  Principal Investigator: **Taulé Delor, Maria**

- ***Statistical Mechanics for Modeling and Prediction of Human Behaviour***
  Period: 30/12/2016 to 29/12/2019
  Principal Investigator: **Perelló Palou, Josep**

- ***Diatopía y cambio lingüístico. Scripta y proyección dialectal***
  Period: 30/12/2016 to 29/12/2020
  Principal Investigator: **Massip Bonet, Maria Àngels**

- ***Sistemas físicos y biofísicos complejos: hacia una visión global de su dinámica y fluctuaciones***
  Period: 01/01/2016 to 31/12/2018
  Principal Investigator: **Ibañes Míguez, Marta**

- ***La evolución (inter)generacional de las bilingüizaciones: contextos, mantenimiento y sustitución lingüísticos***
  Period: 01/01/2016 to 31/12/2019
  Principal Investigator: **Bastardas Boada, Albert**

Spanish Government Funded Networks Of Excelence

- ***Sistemas Complejos Socio-tecnològicos***
  Period: 27/11/2015 to 26/11/2017
  Principal Investigator: **Perelló Palou, Josep**

- ***Avalanchas en biofísica, geofísica, materiales y plasmas***
  Period: 27/11/2015 to 26/11/2017
  Principal Investigator: **Vives Santa-Eulalia, Eduard**

AGAUR Consolidated Groups

- ***Complexity Lab Barcelona (CLabB)***
  2014SGR608
  Period: 01/01/2014 to 30/04/2017
  Principal Investigator: **Boguñà Espinal, Marian**

- ***Grup de complexitat, comunicació i sociolingüística***
  2014SGR359
  Period: 01/01/2014 to 30/04/2017
  Principal Investigator: **Bastardas Boadas, Albert**

- ***Centre per a l'Estudi de la Interdependència provincial a l'Antiguitat Clàssica (CEIPAC)***
  2014SGR218
  Period: 01/01/2014 to 30/04/2017
  Principal Investigator: **Remesal Rodríguez, Jose**

- ***Física no-lineal***
  2014SGR878
  Period: 01/01/2014 to 30/04/2017
  Principal Investigator: **Ortín Rull, Jordi**

- ***Grup de Tècniques Avançades Aplicades a la Psicologia***
  2014SGR326
  Period: 01/01/2014 to 30/04/2017
  Principal Investigator: **Guàrdia Olmos, Joan**

- ***Centre de Llenguatge i Computació (CLIC)***
  2014SGR623
  Period: 01/01/2014 to 30/04/2017
  Principal Investigator: **Martí Antonin, Maria Antònia**

- ***Materials, Transicions de Fase i Sistemes Multiescala***
  2014SGR182
  Period: 01/01/2014 to 30/04/2017
  Principal Investigator: **Planes, Antoni**

Contracts With Public And Private Entities

6

PUBLICATIONS

6 PUBLICATIONS

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- ***A Hypothesis On A Role Of Oxytocin In The Social Mechanisms Of Speech And Vocal Learning***

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- ***Amela Valverde, Luis. Varia Nummorum Vi.*** Prólogo Pellicer i Bru, J.

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- ***Analysis Of Crackling Noise Using The Maximum-Likelihood Method: Power-Law Mixing And Exponential Damping***

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- ***Aproximacions A La Perspectiva De La Persona En Tractament De Manteniment Amb Metadona: Reflexions A Propòsit De 10 Anys De Recerca***

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- *Effect Of Verbal Task Complexity In A Working Memory Paradigm In Patients With Type 1 Diabetes. A fMRI Study*

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- *Evaluación Y Rediseño De Una Experiencia De Gamificación En El Aula Basada En Estilos De Aprendizaje Y Tipos De Jugador. Gamificación En Aulas Españolas*

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- *EventAware: A Mobile Recommender System For Events*

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- *Fluid Front Morphologies In Gap-Modulated Hele-Shaw Cells*

  Díaz-Piola, L.; Planet, R.; Campàs, O.; Casademunt, J.; Ortín, J.

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- *Fluidization And Active Thinning By Molecular Kinetics In Active Gels*

  Oriola, D.; Alert, R.; Casademunt, J.

  Physical Review Letters **118** 088002
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- *Food-Bridging: A New Network Construction To Unveil The Principles Of Cooking*

  Simas, T.; Ficek, M.; Díaz-Guilera, A.; Obrador, P.; Rodríguez, P.R.

  Frontiers in ICT **4**, 14
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- *From Cultural Probes Tasks To Gamified Virtual Energy Missions*

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- *Gamification Design Framework To Support Multi-Agent Systems Theory Classes. Advances In Social Computing And Digital Education*

  Baldeon, J.; López-Sanchez, M.; Rodríguez, I.; Puig, A.

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- *Geometric Correlations Mitigate The Extreme Vulnerability Of Multiplex Networks Against Targeted Attacks*

  Kleineberg K.-K.; Buzna, L.; Papadopoulos, F.; Boguñá, M; Serrano, M.Á.

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- *Geometrical Model For Martensitic Phase Transitions: Understanding Criticality And Weak Universality During Microstructure Growth*

  Torrents, G.; Illa, X.; Vives, E.; Planes, A.

  Physical Review E **95**, 013001
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- *Guía De Cómo Reportar Un Estudio Epidemiológico Observacional En Salud: Elementos Imprescindibles*

  Peró-Cebollero, M.

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- *Hydrodynamic Instabilities, Waves And Turbulence In Spreading Epithelia*

  Blanch-Mercader, C.; Casademunt, J.

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  10.1039/C7SM01128H

- *Implementation And Evaluation Of A Collaborative Conversational Recommender In A 3D Virtual World*

  Contreras, D.; Salamó, M.; Rodríguez, I.; Puig, A.

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- *Influence Of Topology In The Mobility Enhancement Of Pulse-Coupled Oscillator Synchronization*

  Beardo, A.; Prignano, L.; Sagarra, O.; Díaz-Guilera, A.

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  Journal of Intellectual Disability Research **61**, 1021-2033
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- *Linguistic Knowledge By Descent: An Evolutionary Approach To Stress Typology*

  Bridget, B. D.; Martins, P. T.; Boeckx, C.

  Journal of the Phonetic Society of Japan **21**, 71

- *Magnetic Propulsion Of Recyclable Catalytic Nanocleaners For Pollutant Degradation*

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- *Mare Nostrum Et Mare Erythraeum: El Canal Del Wadi Tumilat*

  Pérez González, J.

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- *Membrane-Assisted Viral Dna Ejection*

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- *Morphology Of Clusters Of Attractive Dry An Wet Self-Propelled Spherical Particle Suspensions*

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- *Navigability Of Temporal Networks In Hyperbolic Space*

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- *Noise Focusing In Neuronal Tissues: Symmetry Breaking And Localization In Excitable Networks With Quenched Disorder*

  Orlandi, J. G.; Casademunt, J.

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- *Nonlinear Amplitude Dynamics In Flagellar Beating*

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- *Normative Data For The Montreal Cognitive Assessment (Moca) In A Spanish Sample Of Community-Dweller Adults*

  Pereiro, A.X.; Ramos, S.; Lojo, C.; Guàrdia, J.; Facal, D.; Juncos, O.

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- *Nuevos Ejemplares De Marcas Sobre Ánforas Dressel 20 En El Territorio Del Conventus Hispalensis: Villar Tesoro, Azanaque Y La Catria*

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- *Opinion Competition Dynamics On Multiplex Networks*

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- *Orientational Dynamics Of Fluctuating Dipolar Particles Assembled In A Mesoscopic Colloidal Ribbon*

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- *Purpurarii Et Vestiarii. El Comercio De Púrpuras Y Vestidos En Roma*

  Pérez González, J.

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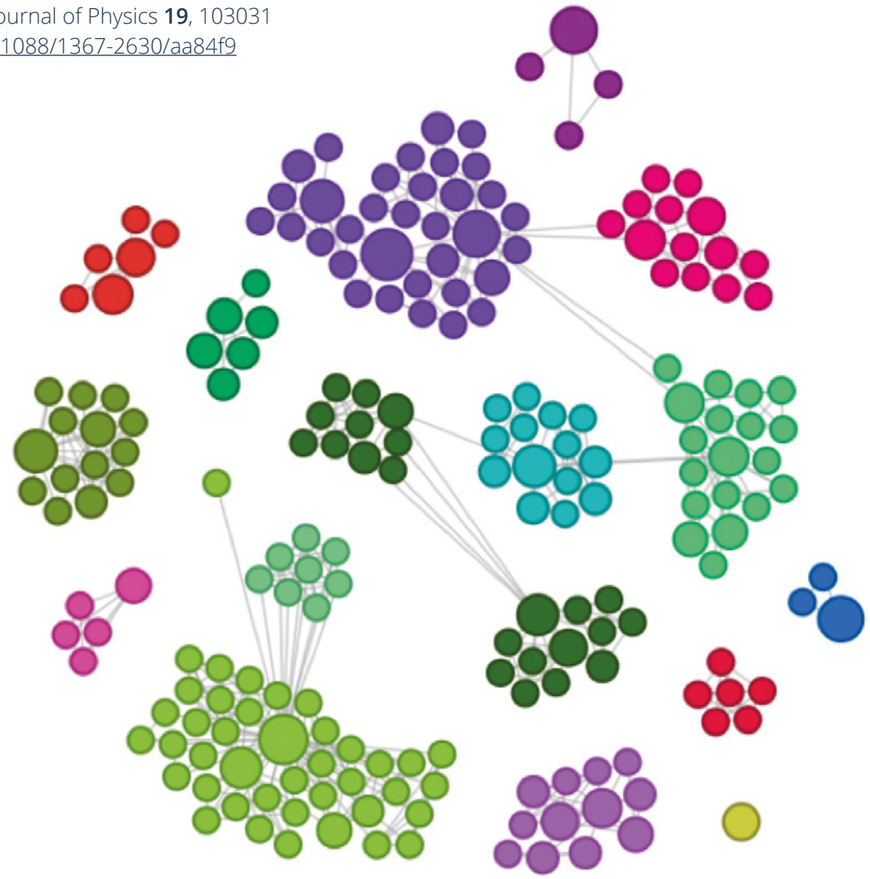

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- *Review De Vides Monumenta Veterum. Madrid Y Su Entorno En Época Romana, Zona Arqueológica-20*

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- *Rural Religion, Religious Places And Local Identities In Hispania: The Sanctuary At Can Modolell (Cabrera De Mar, Barcelona)*

  Sinner, A. G.; Revilla Calvo, V.

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- *Salary Scholarships As A Factor Associated With Improved Academic Performance*

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  Advances and Applications in Statistics

- *Self-Determination, Intellectual Disability And Context: A Meta-Analytic Study*

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- *Self-Domestication In Homo Sapiens: Insights From Comparative Genomics*

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- *Sfu Reviewsp-Neg: A Spanish Corpus Annotated With Negation For Sentiment Analysis A Typology Of Negation Patterns*

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- *Stationary Patterns In Star Networks Of Bistable Units: Theory And Application To Chemical Reactions*

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- *The Continuous Time Random Walk, Still Trendy, Fifty-Year History, State Of Art And Outlook*

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- *The Geometric Nature Of Weights In Real Complex Networks*

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- *Three-Dimensional Telegrapher's Equation And Its Fractional Generalization*

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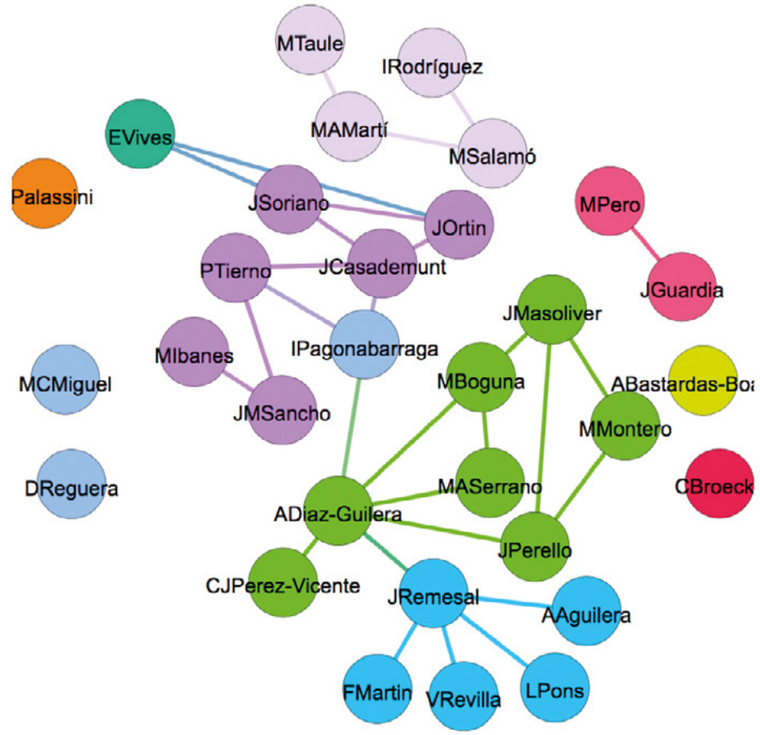

- *Validation Of The Cachexia Score (Casco). Staging Cancer Patients: The Use Of Minicasco As A Simplified Tool*

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- *Vulnerability And Perceived Insecurity In The Public Spaces Of Barcelona / Vulnerabilidad Y Percepción De Inseguridad En El Espacio Público De La Ciudad De Barcelona*

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  Psyecology

- *When Do Redundant Fluidic Networks Outperform Non-Redundant Ones?*

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- *Wiring The Past: A Network Science Perspective On The Challenge Of Archeological Similarity Networks*

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7

PHD THESES

7 PHD THESES

- ***Regresión Logística Bayesiana: Una Aproximación Empírica Para El Estudio De Fenómenos Psicológicos***
  Author: Amàlia Gordóvil Merino
  Director: Guàrdia Olmos, J.; Peró Cebollero, M.

- ***La Imagen Pública De Julio César. Una Revisión A Partir De Aspectos Bélicos Y Legislativos***
  Author: Ruiz del Poz, P.
  Director: Remesal Rodríguez, J.; Revilla Calvo, V.

- ***Linear And Nonlinear Approaches To Unravel Dynamics And Connectivity In Neuronal Cultures***
  Author: Elisenda Tibau Martorell
  Director: Soriano, J.

- ***Estudio Social De Los Comerciantes De Aceite Bético En Época Altoimperial (S. I-Iii D.c.)***
  Author: Sergi Calzada Baños
  Director: Remesal Rodríguez, J.

- ***Entre El Mediterráneo Y El Limes Germánico: El Río Ródano Como Factor De Comunicación E Integración*** Económica
  Author: Marimon Ribas, Pau
  Director: Remesal Rodríguez, J.; Revilla Calvo, V.

- ***El Comercio De Lujo En Roma. Elaboración Y Comercio De Objetos De Lujo En Roma En El Alto Imperio: Joyería, Vestidos, Púrpuras Y Ungüentos***
  Author: Pérez González, Jordi
  Director: Remesal Rodríguez, J.; Revilla Calvo, V.

- ***Raetia: Las Relaciones Socioeconómicas De Una Provincia Romana Centroeuropea Con Las Provincias Mediterráneas***
  Author: Juan Manuel Bermúdez Lorenzo
  Director: Remesal Rodríguez, J.; Ozcáriz Gil, P.

- ***Política, Estrategia Y Pensamiento Militar Bajo Los Antoninos (96-192)***
  Author: Andrés Sáez Geoffroy
  Director: Remesal Rodríguez, J.; Martín, F.

- ***Integración De Técnicas De Personalización Basadas En El Comportamiento Colaborativo Del Ser Humano Con Interfaces De Usuario Inteligentes***
  Author: David Contreras Aguilar
  Director: Salamó Llorente, M.

8

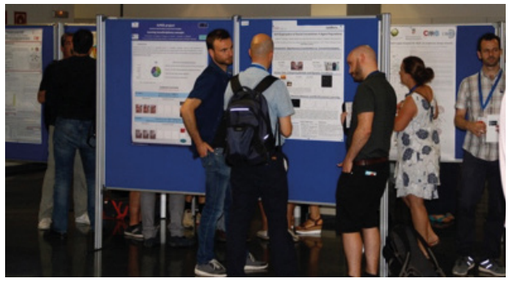
UBICS ACTIVITIES

8 UBICS ACTIVITIES

UBICS Founding Symposium

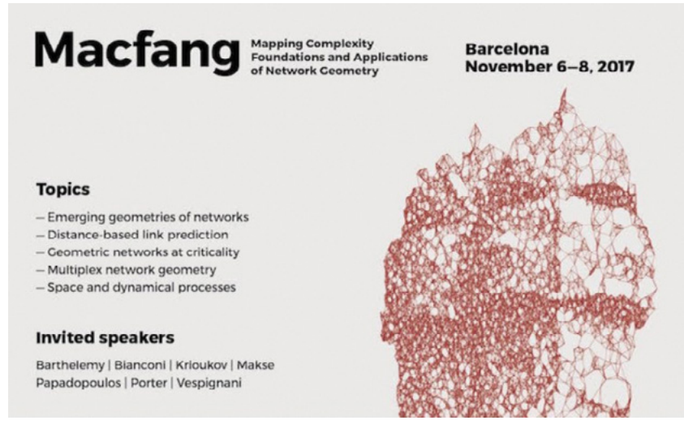
In June 12th 2016 we celebrated our Founding Symposium with a series of plenary speakers by three members of our Scientific Advisory Board (Susanna Manrubia, Leticia Cugliandolo, and Jean-François Joanny) and two excellent researchers (Gustavo Deco and Tom Brughman).

The Symposium also had a very active participation of other researchers from our geographic area and research topics, thus highlighting the impact that our Institute will have in the next future on the Catalan Complex Systems community.



UBICS participation in other events

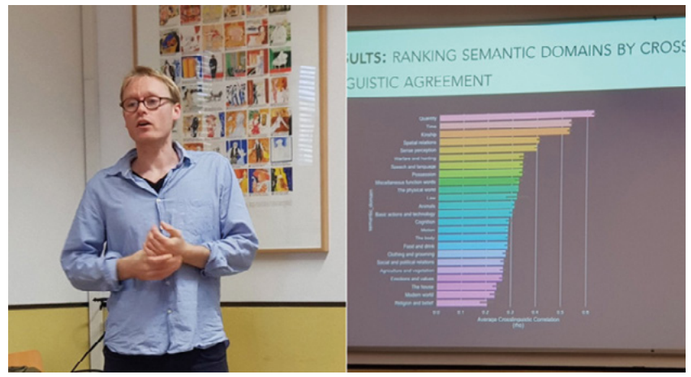
- MACFANG Workshop



- Joint Workshop Red de excelencia "Avalanches in Biophysics. Geophysics, Materials and Plasmas" & Universitat de Barcelona Institute of Complex Systems
- Complex Systems in Sports. International Conference
- Setmana de la ciència

UBICS seminars

- Mapping the Structure of Meaning Across Human Languages with Large Scale Semantic Networks



9

ACTIVITIES OF UBICS MEMBERS

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- **2nd SEPLN Workshop On Evaluation Of Human Language Technologies For Iberian Languages (IBEREVAL)**
  Murcia (Spain)
  Taulé M.; Martí, M.; Rangel, F.; Rosso, P.; Bosco, C.; Patti, V.: *Task Of Stance And Gender Detection In Tweets On Catalan Independence At Ibereval 2017* (Proposed Task)

- **Citizen Science Training School: Improving Urban Environmental Health By Aligning Civic Participation And Policymaking**
  Perelló, J.: *Citizen Science Training School: Improving Urban Environmental Health By Aligning Civic Participation And Policymaking*

- **I Congrés Internacional d'Universitat I Diversitat**
  Guàrdia, J.: Chair

- **International School On Network Science NetSci 2017**
  Indianapolis (Indiana, USA), June 19-23
  » **Serrano, M.Á.:** Co-Chair
  » **Serrano, M.Á.:** *Multiscale Unfolding Of Complex Networks By Geometric Renormalization* (Invited talk)

- **International Workshop Maping Complexity: Foundations And Applications Of Network Geometry Macfang 2017**
  Barcelona, November 6-8
  Serrano, M.Á.: Chair

- **Minisymposium On Chemical Networks, Engineering Of Chemical Complexity International Conference 2017**
  Vilanova I la Geltrú (Spain), June 19-22
  Serrano, M.Á.: Chair

- **10th Liquid Matter Conference**
  Ljubljana (Slovenia)
  Tierno, P.: *Engineering Of Frustration In Colloidal Artificial Ices Realized On Microfeatured Grooved Lattices* (Invited talk)

- **1st Biology For Physics: Is There New Physics In Living Matter?**
  Barcelona (Spain)
  » **Casademunt, J.:** Chair
  » **Pagonabarraga, I.:** *Emergent Structures In Synthetic And Biological Communities* (Invited talk)

- **1st EMMC International Workshop**
  Viena (Austria)
  Pagonabarraga, I.: *E-CAM, Chemical (And Other) Industries And Model Development* (Invited talk)

- **5th RIEC International Symposium On Brain Functions And Brain Computer**
  Sendai (Japan)
  Soriano, J.: *Collective Dynamics In Neuronal Cultures: Activity Patterns, Propagation, And Resilience* (Invited talk)

- **Addressing Metastability In Interfacial Phenomena Across Multiple Time And Length Scales**
  Laussane (Switzerland)
  Pagonabarraga, I.: *Wetting- And Confined-Induced Instabilities Of Forced Fluid Fronts* (Invited talk)

- **Annual Meeting Of The German Physical Society**
  Dresden (Germany)
  Pagonabarraga, I.: *Emergent Structures In Actuated Magnetic And Active Colloidal Suspensions* (Invited talk)

- **APS March Meeting**
  New Orleans (Louisiana, USA)
  Tierno, P.: *Engineering Of Frustration In Colloidal Artificial Ices Realized On Microfeatured Grooved Lattices* (Invited talk)

- **Avalanche Processes In Condensed Matter Physics And Beyond**
  Barcelona (Spain)
  Soriano, J.: *Experiments In Living Neuronal Networks: Dynamics And Avalanche Phenomena In A Dish* (Invited talk)

- **Barcelona Intrepid Training School On Inter And Transdisciplinary Urban Research**
  Barcelona (Spain), 13-16 February
  Perelló, J.: *Environmental Health Clinic By Natalie Jeremijenko: Merging Participatory Processes, Research Activities And Artistic Practices*

- **Cecam Workshop Exploiting Finite-Size Effects In Simulations**
  Paris (France)
  Pagonabarraga, I.: *Finite Size Effects In Active And Confined Suspensions* (Invited talk)

- **Conference On Complex Systems**
  Cancun (Mexico)
  » **Díaz-Guilera, A.:** *Synchronization In Populations Of Moving Oscillators* (Oral presentation)
  » **Díaz-Guilera, A.; Serrano, M.Á.:** Program Committee
  » **Gracia-Lázaro, C.; Poncela-Casasnovas, J.; Gutiérrez-Roig, M.; Vicens, J.; Gómez-Gardeñes, J.; Perelló, J.; Moreno, Y.; Duch, J.; Sánchez, A.:** *Humans Display A Reduced Set Of Consistent Behavioral Phenotypes In Dyadic Games*

- **Congreso de Fisica Estadistica, FisEs 17**
  Sevilla (Spain)
  - » **Pagonabarraga, I.:** *Active Matter: Emerging Behavior Of Intrinsically Out Of Equilibrium Systems* (Invited talk)
  » **Díaz-Guilera, A.:** *Dynamics In Multiplex Networks* (Oral presentation)
  - » **Planet, R.; Díaz-Piola, L.; Campàs, O.; Casademunt, J.; Ortín, J.:** *Steady-State Fluid Front Morphologies In Gap-Modulated Narrow Channels* (Oral presentation)
  - » **Hernández-Navarro, Ll.; Orlandi, J. G.; Casademunt, J.; Vives Santa-Eulalia, E.; Soriano, J.:** *Assessing Connectivity In Living Neuronal Networks: Experiments And Model* (Oral presentation)
  » **Soriano, J.:** *Assessing Connectivity In Living Neuronal Networks: Experiments And Model* (Oral presentation)

- **COST Action Mp1305 Workshop 2017**
  Barcelona (Spain)
  Tierno, P.: *Emerging Hydrodynamic Bound States Between Magnetically Driven Micro Propellers*

- **Cost Action MP1305: Dynamics Of Interfaces In Complex Fluids And Complex Flows**
  Erlangen (Germany)
  Martínez-Pedrero, F.; Ortiz-Ambriz, A.; Pagonabarraga, I.; Tierno, P.: *Colloidal Microworms Propelling Via A Cooperative Hydrodynamic Conveyor Belt*

- **Crossroads In Complex Systems**
  Palma de Mallorca (Spain)
  » **Perelló, J.; Cigarini, A.; Español, F.; Bonhoure, I.; Duch, J.; Sanchez, A.:** *The Value Of Social Welfare In The Mental Health Ecosystem* (Invited talk)
  » **Sancho, J.M.:** *Brownian Colloids Under Non Homogeneous Temperature* (Invited talk)

- **Encuentro De La Red Española De Excelencia De Supercomputación Y eCiencia**
  Madrid (Spain)
  Pagonabarraga , I.: *E-CAM, An e-Infrastructure For Software, Training And Consultancy In Simulation And Modelling* (Invited talk)

- **Escuela internacional de verano: Tendencias En Analytics: Ciencia de Redes**
  Bogotá (Colombia)
  Díaz-Guilera, A.: *Fundamentos De Redes Y Propiedades Dinámicas En Redes* (Lectures on the topic)

- **Fises17, Congress On Statistical Physics**
  Sevilla (Spain)
  Ortiz, A.; Tierno, P.: *Engineering Of Colloidal Artificial Ice In Frustrated Grooved Lattices* (Public lecture)

- **IBERSINC Winter School**
  Barcelona (Spain)
  » **Díaz-Guilera, A.:** *Synchronization In Complex Networks* (Invited talk)
  » **Soriano, J.:** *Analysis Of Multi-Neuron Fluorescence Calcium Imaging Data. Introduction To Gephi* (Invited talk)

- **International Conference On Applied Mathematics And Informatics**
  Isla de San Andrés (Colombia)
  Soriano, J.: *Connectivity Inference In Neuronal Cultures: Experiments, Simulations And Application To Neurological Disorders*

- **IV Photonics Meets Biology**
  Tarragona (Spain)
  Soriano, J.: *Calcium Imaging In Neuronal Cultures: Visualizing Collective Phenomena In A Dish*

- **Critical And Collective Effects In Graphs And Networks, CCEGN-17**
  Moscow (Russia), May 15-19
  Serrano, M.Á.: *Multiscale Unfolding Of Complex Networks By Geometric Renormalization* (Keynote speaker)

- **Networks Scientific Conference 2017**
  Amsterdam (The Netherlands), June 7-9.
  » **Serrano, M.Á.:** *The Hidden Geometry Of Complex Networks: Foundations And Applications* (Keynote speaker)
  » **Serrano, M.Á.:** *Networks: A Change Of Paradigm* (Public lecture)

- **LANET 2017 - Latin American Conference On Complex Networks 2017**
  Puebla (Mexico)
  » **Díaz-Guilera, A.:** *Synchronization In Populations Of Moving Oscillators* (Invited talk)
  » **Soriano, J.:** *Dynamics And Effective Connectivity In Neuronal Cultures: From Experiments To Medical Applications* (Invited talk)
  » **Díaz-Guilera, A.:** *Diffusion And Reaction On Multiplex Networks* (Invited talk in Minisymposium "Advances in multiplex networks")

- **Microswimmers, Self-Propelled Particles And Active Matter**
  Laussane (Suïssa)
  Pagonabarraga, I.: *Hydrodynamic Response In Actuated And Self-Propelled Suspensions*

- **Questioning Aesthetics Symposium**
  Barcelona (Spain)
  Perelló, J.: *Science Made By Artists? Collective Research And Participatory Strategies When Scientists And Artists Work Together* (Invited talk)

- **Red Temática de Física Virológica II Reunión**
  La Laguna (Spain)
  Reguera, D.; Aznar, M.: *Viral Nanomechanics With A Virtual Atomic Force Microscope* (Invited talk)

- **STAR Workshop 2017**
  Utrecht (The Netherlands)
  Boguñá, M.: *Towards A Cosmological Theory Of Complex Networks* (Invited talk)

- **Theroretical Roman Archaeology Conference**
  Durham (UK)
  » **Martín Oliveras, A.; Revilla Calvo, V.:** *The Economy Of The Roman Wine. Productive Landscapes, Archaeological Data, Quantification & Modellization. Case Study Research: "Regio Laeetana-Hispania Citerior Tarraconensis"* (1st century BC - 3rd century AD)
  » **Remesal Rodríguez, J.; Revilla Calvo, V.; Martín Oliveras, A.; Martín-Arroyo Sánchez, D. J.:** *Trac 2017 Session 1 - The Production And Distribution Of Food During The Roman Empire: Political, Economic & Social Dynamics*

- **Topical Problems Of Nonlinear Wave Physics**
  Moscow-Saint Petersbourg (Russia)
  » **Díaz-Guilera, A.:** *Dynamics On Multiplex Networks* (Invited talk)
  » **Soriano, J.:** *Experiments In Neuronal Cultures: Connectivity, Dynamics And Complexity In A Dish* (Invited talk)

- **VIII Congreso Nacional BIFI**
  Zaragoza (Spain)
  Soriano, J.: *Neuronal Cultures: Exploring Complex Phenomena In A Dish* (Invited talk)

- **Workshop On Avalanche Processes In Condensed Matter Physics And Beyond**
  Bellaterra (Spain)
  Miguel, M.C.: *Plastic Avalanches In Curved Nanocrystalline Shells* (Invited talk)

- **Workshop On Fluid Mechanics 2017**
  Tarragona (Spain)
  Pagonabarraga, I.: *Instabilities Of Forced Fluid Fronts Under Strong Confinement* (Invited talk)

- **XIV Congreso Nacional De Virología**
  Cadiz (Spain)
  Reguera, D.: *Physical Virology: How Physics Can Help Us Understand Viruses* (Invited talk)

- **XLVI Winter Meeting on Statistical Physics**
  Taxco (Mexico)
  Pagonabarraga, I.: *Collective Behavior And Pattern Formation In Actuated Magnetic And Self-Propelled Co-Lloidal Suspensions* (Invited talk)

- **3rd Workshop COMSOTEC**
  Madrid (Spain), 26-28 April 2017
  » **Perelló, J.; Galán, J.; Cuesta, J.:** Chairs
  » **Vicems, J.; Sánchez, A.; Perelló, J.; Duch, J.; Moreno, Y.; Gracia, C.; Gómez, J.; Gutiérrez, M.; Bueno, N.:** *Climate Change Experiment, A Collective-Risk Social Dilemma*
  » **Cigarini, A.; Vicems, J.; Duch, J.; Sanchez, A.; Perelló, J.:** *The Value Of Social Welfare In The Mental Health Ecosystem*

- **9th International Conference Engineering Of Chemical Complexity ECC9**
  Vilanova I la Geltrú (Spain)
  » **Sancho, J. M.:** Organizing Committee
  » **Luna-Escalante, J.C.; Formosa-Jordan, P.; Palau-Ortín, D.; Sancho, J.M.; Ibañes, M.:** *Nonlinear Interactions For Self-Organized Discrete Cellular Patterns* (Invited talk)
  » **Tierno, P.:** *Emergent Hydrodynamic Bound States In Magnetically Driven Micropropellers*
  » **Pagonabarraga, I.:** *Mechanisms For Pattern Formation In Suspensions Of Self-Propelled Colloids*

- **ACM WomENcourage 2017**
  Barcelona (Spain)
  Rodríguez, I.: Program Commitee

- **Citizen Science Association Conference**
  Saint Paul (USA)
  » **Perelló, J.:** Academic Chair
  » **Perelló, J.; Español, F.; Sanchez, A.; Duch, J.; Bonhoure, I.:** *Mental Health Ecosystem: Co-Designing And Empowering With And For The Patients*

- **Cuantificar: Qué, Cómo Y Para Qué. Quantification In Classical Archaeology: Objects, Methodologies And Aims**
  Barcelona (Spain)
  Remesal, J.; Revilla Calvo, V.; Aguilera, A.; Díaz-Guilera, A.; Rondelli, B.; Romanowska, I.; Fabiao, C.: Organizing Committee

- **Interacció 2017 Ciència I Cultura: Restablim La Connexió**
  Sendra, G.; Ramoneda, J.; Perelló, J.; Lapuente, I.: Program Committee

- **International Conference Interacción**
  Cancún (Mexico)
  Rodríguez, I.: Program Committee

- **International Conference On Big Data Analytics, Data Mining And Computational Intelligence**
  Lisbon (Portugal)
  Salamó, M.: Organizing Committee

- **International Conference On Computer Graphics Theory And Applications (Grapp)**
  Porto (Portugal)
  Rodríguez, I.: Program Committee

- **International Conference On Information And Communication Theory (ICoICT)**
  Malacca (Malaysia)
  Salamó, M.: Organizing Committee

- **IV Photonics Meets Biology**
  Tarragona (Spain)
  Soriano, J.: *Local Organizer Of the IV Summer School 'Photonics Meets Biology'*

- **First International Conference On Revitalization Of Indigenous And Minoritized Languages**
  Barcelona (Spain)
  » **Bastardas, A.:** Organizing Committee
  » **Bastardas, A.:** *Linguistic Revitalization And Restoration Ecology*

- **Summer School On Complex Socio-Technical Systems**
  Palma de Mallorca (Spain)
  Arenas, A.; Benito, R.; Cabrales, A.; Colet, P.; Cuesta, J.; Díaz-Guilera, A.; Fernández, A.; Galán, J.M.; Grimaldo, F.; Marco, J.; Moreno, Y.; Perelló, J.; Ramasco, J.J.; San Miguel, M.; Sánchez, A.: Scientific Committee

- **21th Symposium On Mediterranean Archaeology (SOMA)**
  Cadiz (Spain)
  Pérez González, J.: *Gold In The Confines Of The Roman World. Silks In The Heart Of The Empire*

- **Brain Dynamics on Multiple Scales - Paradigms, their Relations, and Integrated Approaches**
  Dresden (Germany)
  Soriano, J.: *Neuronal Cultures: A Proxy For Brain Research At The Mesoscopic Scale?*

- **CECAM Workshop Cell And Tissue Motility**
  Lausanne (Switzerland)
  Pagonabarraga, I.: *Emergent, Self-Assembled Structures And Pattern Formation In Biological Colonies*

- **COST Action: Flowing Matter 2017**
  Porto (Portugal)
  » **Martínez-Pedrero, F.; Navarro-Argemí, A.; Pagonabarraga, I.; Tierno, P.:** *Emergence Of Hydrodynamic Bound States Between Magnetically Driven Micropropellers*
  » **Díaz, L.; Planet, R.; Ortín, J.:** *Deformation Of Fluid Fronts In A Gap-Modulated Hele-Shaw Cell*
  » **Ortín, J.; Fleming, C.; Casanellas, L.; Planet, R.; Clopés, J.; Meca, E.; Ramírez de la Piscina, L.:** *On The Origin Of Vortex Ring Formation In Oscillatory Pipe Flow Of Wormlike Micellar Solutions*

- **El Espejo Antroplógico Del Arte. Laboratories Creativos: Materia, Cuerpo, Identidad, Y Territorio Social. Talleres Dentro Del Programa De Doctorado En Historia Y Artes**
  Granada (Spain)
  Perelló, J.: *Participación Ciudadana Y Prácticas Artísticas Como Manera De Hacer Otra Ciencia*

- **EMBO Conference. Gene Regulatory Mechanisms In Neural Fate Decisions**
  Alicante (Spain)
  Boeckx, C.: *Candidate Gene Changes Underlying The Species-Specific Brain Growth Trajectory Of Homo Sapiens*

- **Fluids And Structures: Interaction And Modeling**
  Naples (Italy)
  Pagonabarraga, I.: *Collective Response Of Actuated And Self-Propelling Colloidal Suspensions*

- **Human Evolution: Fossils, Ancient And Modern Genomes (Wellcome Trust Sanger Institute)**
  Hinxton (UK)
  Kuhlwilm, M.; Boeckx, C.: *Paleogenomic Insights Into Human Brain Growth Trajectory*

- **Human Genome Meeting**
  Barcelona (Spain)
  Theofanopoulou, C.; Geldman, G.; Boeckx, C.; Jarvis, E. D.: *A Proposed Universal Nomenclature For The Oxytocin And Vasotocin Ligand And Receptor Families*

- **I Congrés Internacional Sobre Universitat I Inclusió**
  Barcelona (Spain)
  Guàrdia-Olmos, J.; Peró-Cebollero, M.; Carbó-Carreté, M.: *Estudi Descriptiu Del Mapa De La Recerca En Universitat I Inclusió En Els Darrers Cinc Anys A Catalunya*

- **I Congreso Internacional Sobre Geografía Histórica Y Mítica De La Antigüedad**
  Valencia (Spain)
  Pérez González, J.: *Manual Del Buen Sinodiarca O Cómo Evitar A Los Moradores De Las Arenas In Terra Nullius. El Tráfico Comercial Internacional En Los Márgenes Orientales Del Imperio Romano*

- **ICERI 2017**
  Sevilla (Spain)
  Aparicio-Chueca, P.; Triadó-Ivern, X.; Maestro-Yarza, I.; Elasri-Ejjaberi, A.; Bernardo, M.; Presas-Maynegre, P.; Guàrdia- Olmos, J.; Turull-Rubinat, M.; Roca-Acedo, B.: *Student Absenteeism In Higher Education: The Case Of The Faculty Of Economics And Business At The Universitat De Barcelona*
  IATED (International Association of Technology, Education and Development)
  Sevilla, Spain

- **II Encuentro Red IBERSINC**
  Madrid (Spain)
  » **Soriano, J.:** *Collective Dynamics In Neuronal Cultures: Activity Patterns, Propagation And Resilience*
  » **Levis, D.:** *Emergent Behaviour In Systems Of Mobile Self-Propelled Agents: Synchronization And Collective Motion*
  » **Prignano, L.:** *Lonely And Frustrated? Moving Faster Won't Help You Sync!*

- **III Congreso Nacional De Psicología**
  Oviedo (Spain)
  » **Martínez Ricart, M.; Gallardo Moreno, G.B.; Peró Cebollero, M.; Gudayol Ferre, E.; González Garrido, A.; Zarabozo-Hurtado, D.; Guàrdia Olmos, J.:** *Estimación De Redes De Conectividad Con Señal fMRI En Sujetos Diagnosticados De Diabetes Mellitus Tipo I Para El Estudio De Funciones Cognitivas Mediante Modelos De Ecuaciones Estructurales*
  » **Guàrdia Olmos, J.; Peró Cebollero, M.:** *Las Aportaciones De La Psicología Cuantitativa A Los Estudios Con Señal fMRI. Psicometría Y Neurociencia, Un Binomio Complicado*

- **International Conference On Nucleation And Atmospheric Aerosols ICNAA 2017**
  Helsinki (Finland)
  Wilhelmsen, O.; Bedeaux, D.; Reguera, D.: *Nucleation Under Strong Confinement*

- **Israel Society For The Promotion Of Classical Studies**
  Haifa (Israel)
  Pérez González, J.: *Sumptuous Rome: Socio-cultural Changes Linked To The Eastern Trade*

- **Key Questions And New Methods In The Language Sciences Workshop**
  Nijmegen (The Netherlands)
  Boeckx, C.: *Defeating Lewontin's Augury*

- **La Ruta De La Seda A Través De Los Imperios**
  Madrid (Spain)
  Pérez González, J.: *La Ruta De La Seda A Través De La Epigrafía Romana. De Sera Metropolis A Da Qin Metropolis*

- **Society For Neuroscience**
  Washington D.C. (USA)
  Theofanopoulou, C.; Geldman, G.; Boeckx, C., Jarvis, E. D.: *Oxytocin Receptor And The Vasotocin Paralogous Sister Genes Explaining Their Vasopressin/Receptor 1A Appear To Be Common Functions*

- **V Congreso Internacional De Docencia Universitaria**
  Vigo (Spain)
  Manolov, R.; Guàrdia, J.; Peró, M.; Solanas, A.: *Enseñando La Competencia Transversal De Comunicación Escrita Y Oral*

- **VI Jornada Complexitat.CAT**
  Castelldefels (Spain)
  Tierno, P.: *Engineering Of Frustration In Colloidal Artificial Ices Realized On Microfeatured Grooved Lattices*

- **Workshop About Spanish Negation (NEGES)**
  Murcia (Spain)
  Guzzi, E.; Taulé, M.; Martí, M.A.: *Criterios Para La Detección Del Foco De La Negación En Español*

- **XV Congreso De Metodología De Las Ciencias Sociales Y De La Salud**
  Oviedo (Spain)
  Guàrdia-Olmos, J.; Peró-Cebollero, M.; Farràs-Permanyer, L.; Mancho-Fora, N.; Montalà-Flaque, M.; Cañete-Massé, C.; García-García, O.: *Neurociencia Cuantitativa Y Computacional. Modelos Estadísticos Para La Representación Del Funcionamiento Cerebral*

- **Workshop On Avalanche Processes In Condensed Matter Physics And Beyond**
  Bellaterra (Spain)
  Vives, E.: Organizer

- **Cours De Formation Pour Les Conservateurs Du Musée: La Catalogation Et Le Cycle De Vie De La Céramique Romaine. De La Fabrication Au Réciclage**
  Tunis
  Revilla, V.: Organizer

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