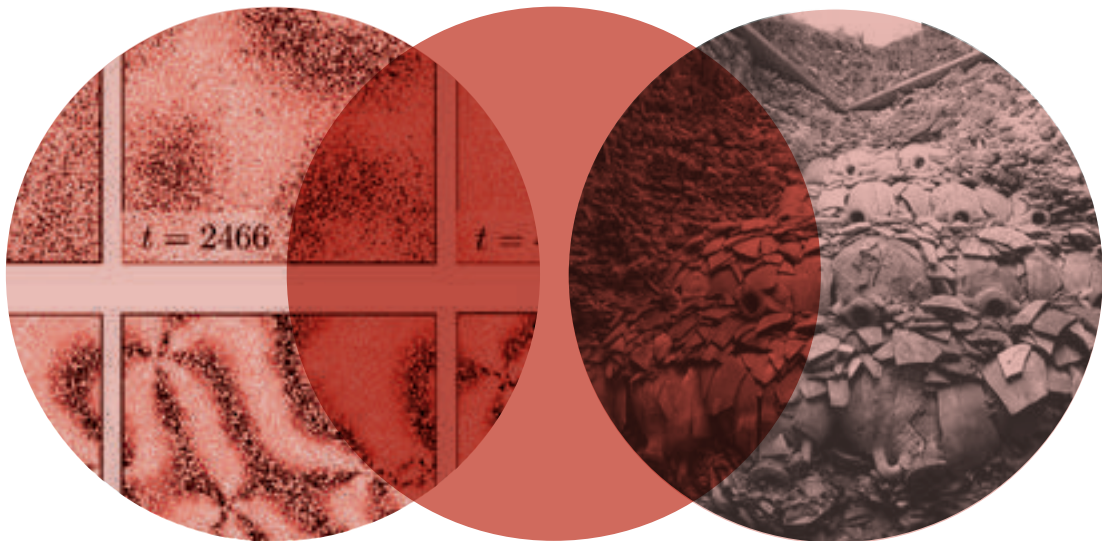


Universitat de Barcelona

# UBICS Institute of Complex Systems

## Annual Report

### 2018



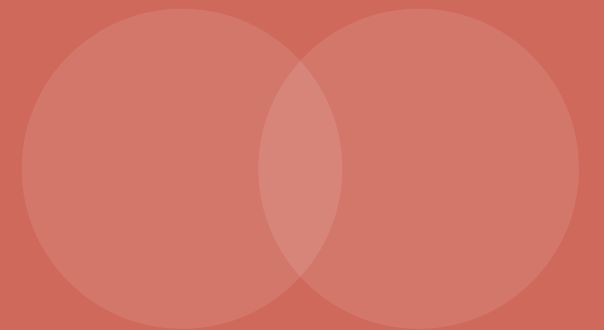
Institute of Complex Systems



UNIVERSITAT DE  
BARCELONA

Universitat de Barcelona

**UBICS Institute of Complex Systems**  
**Annual Report**  
**2018**





## **FOREWORD**

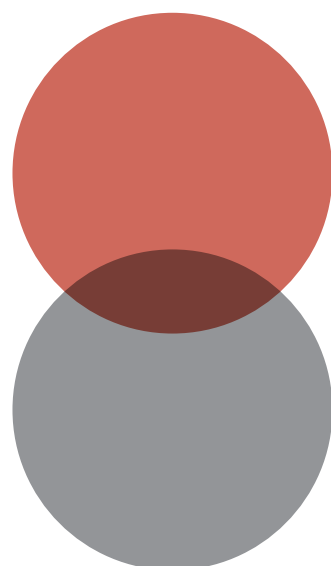
The Institute of Complex Systems (UBICS), created in 2016, is an interdisciplinary research institute of the Universitat de Barcelona that currently hosts more than 60 senior and young researchers.

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 this 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.

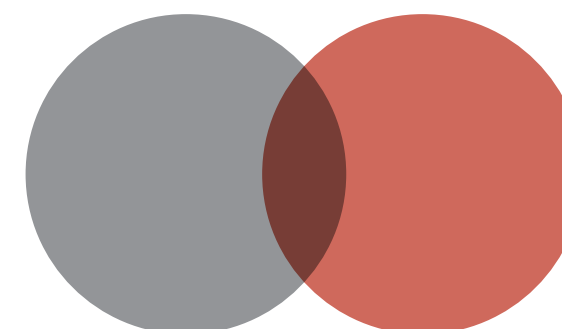
*Albert Díaz Guilera*  
*Director*



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# INSTITUTE STRUCTURE

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## 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

Massip Bonet, Maria Àngels

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

Teller Amado, Sara

## Advisory Board

Cugliandolo, Leticia  
→ *Université Pierre et Marie Curie - Paris VI*

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 (2017SGR-1061)

<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 (2017SGR-1614)

<http://www.ffn.ub.es/ritort/index.html>

Palassini, Matteo	Física de la Matèria Condensada
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### GRUP DE FÍSICA ESTADÍSTICA (2017SGR-884)

<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

### COMPLEXITY LAB BARCELONA (CLabB) (2017SGR-1064)

<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 (2017SGR-0598)

[http://www.ub.edu/web/ub/ca/recerca\\_innovacio/recerca\\_a\\_la\\_UB/grups/fitxa/M/MATEFASE/index.html?](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
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### GRUP DE COMPLEXITAT, COMUNICACIÓ I SOCIOLINGÜÍSTICA (2017SGR175)

<http://www.sociocomplexitat.ub.edu>

Bastardas i Boada, Albert	Filologia Catalana i Lingüística General
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### GRUP D'ESTUDI DE LA VARIACIÓ (2017SGR-94)

<http://www.ub.edu/GEV>

Massip Bonet, Àngels	Filologia Catalana i Lingüística General
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### CENTRE PER A L'ESTUDI DE LA INTERDEPENDÈNCIA PROVINCIAL A L'ANTIGUITAT CLÀSSICA (CEIPAC) (2017SGR-512)

<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

### PSICOLOGIA QUANTITATIVA (2017SGR-269)

<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 (2017SGR-1637)

[http://www.inefc.cat/inefc/AppPHP/main.php?id\\_pagina=183](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 (CLIC) (2017SGR-341)

<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



2

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## **UBICS IN FIGURES**

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# 2 UBICS IN FIGURES

## UBICS

**40**

Senior Researchers

**19**

Early Stage Researchers

**18**

External Members

**1**

Services and Administration Personnel

## ICREA

Catalan Institution For Research And Advanced Studies

**3**

Research Professors

**3**

Academia Professors

## ERC

European Research Council

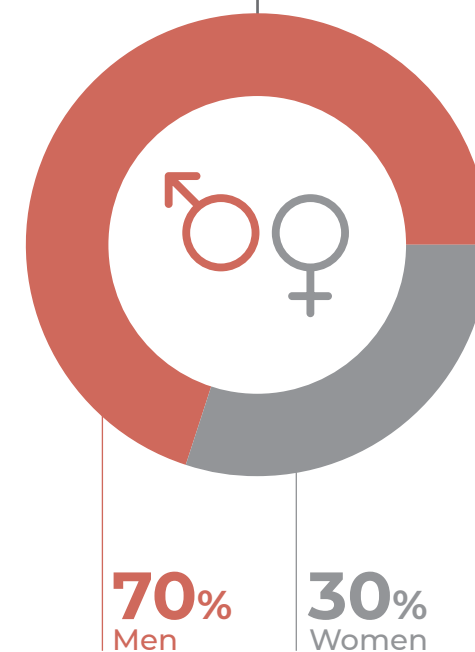
**1**

Advanced Grant

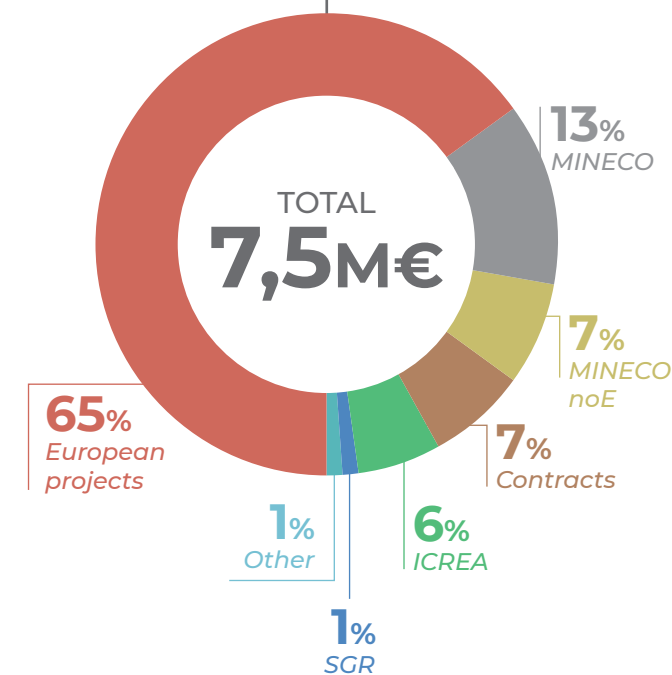
**1**

Starting Grant

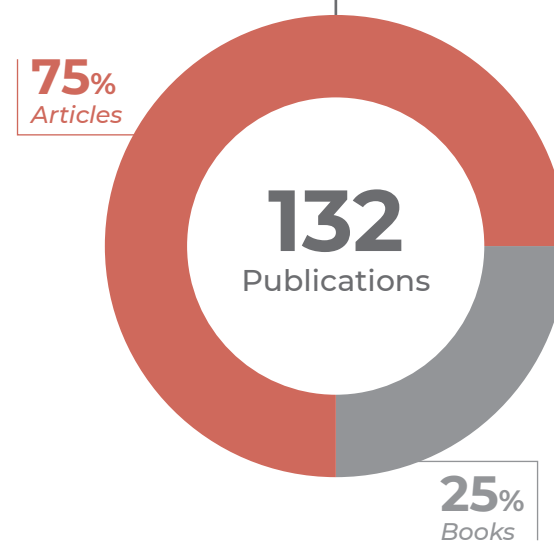
## GENDER



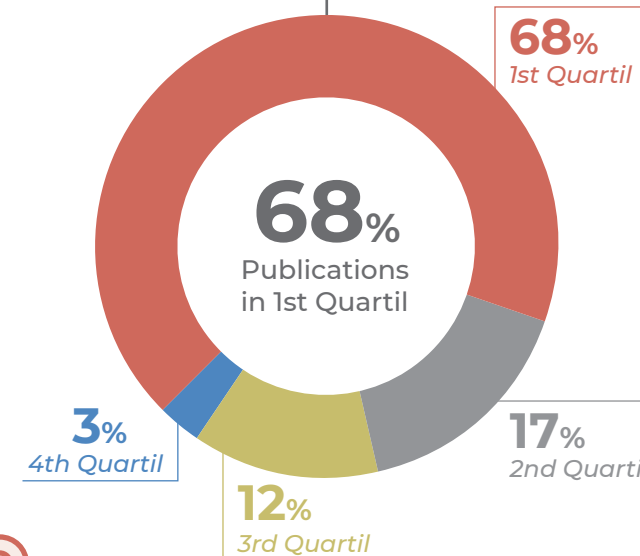
## FUNDING



## PUBLICATIONS



## ARTICLES



## Where to find us

Martí i Franquès, 1, 08028 Barcelona | e-mail: [ubics@ub.edu](mailto:ubics@ub.edu) | web: [ubics.ub.edu](http://ubics.ub.edu) | twitter: @UB\_ICs

## Campuses

<b>Mundet Campus</b> Passeig de la Vall d'Hebron, 171 08035 Barcelona	<b>Barcelona Knowledge Campus</b> Baldiri Reixac, 2 08028 Barcelona	<b>Humanities Campus</b> Gran Via Corts Catalanes, 585 08007 Barcelona
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**3**

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**UBICS STAFF**

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## 40 SENIOR RESEARCHERS

- **Aguilera Martin, Antonio**  
*Departament d'Història i Arqueologia*
- **Allard, Antoine**  
*Departament Física de la Matèria Condensada*
- **Bastardas Boada, Albert**  
*Departament Filologia Catalana i Lingüística General*
- **Boeckx, Cedric**  
*Departament Filologia Catalana i Lingüística General*
- **Boguñà Espinal, Marian**  
*Departament Física de la Matèria Condensada*
- **Casademunt Viader, Jaume**  
*Departament Física de la Matèria Condensada*
- **Cozzo, Emmanuelle**  
*Departament Física de la Matèria Condensada*
- **Díaz Guilera, Albert**  
*Departament Física de la Matèria Condensada*
- **Fernández Nieves, Alberto**  
*Departament de la Física de la Matèria Condensada*
- **Granell Martorell, Clara**  
*Departament Física de la Matèria Condensada*
- **Guàrdia Olmos, Joan**  
*Departament Psicologia Social i Psicologia Quantitativa*
- **Ibañes Míguez, Marta**  
*Departament Física de la Matèria Condensada*
- **Levis Sotomayor, Demian Francisco**  
*Departament Física de la Matèria Condensada*
- **Martí i Antonín, M. Antònia**  
*Departament Filologia Catalana i Lingüística General*
- **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**  
*Departament Psicologia Social i Psicologia Quantitativa*
- **Planet Latorre, Ramon**  
*Departament Física de la Matèria Condensada*
- **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*
- **Serrano Moral, Maria Àngeles**  
*Departament Física de la Matèria Condensada*
- **Soriano Fradera, Jordi**  
*Departament Física de la Matèria Condensada*
- **Starnini, Michele**  
*Departament Física de la Matèria Condensada*
- **Tahat, Amani**  
*Departament de la Física de la Matèria Condensada*

## SENIOR RESEARCHERS

- **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*
- **Zheng, Muhua**  
*Departament de la Física de la Matèria Condensada*

## 19 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**  
*Departament Psicologia Social i Psicologia Quantitativa*
- **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, Lluís**  
*Departament Física de la Matèria Condensada*
- **Mancho Fora, Nuria**  
*Departament Psicologia Social i Psicologia Quantitativa*
- **Montalà Flaquer, Marc**  
*Departament Psicologia Social i Psicologia Quantitativa*
- **Muñoz Andirkó, Alejandro**  
*Departament Filologia Catalana i Lingüística General*
- **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*
- **Theofanopoulou, Constantina**  
*Departament Filologia Catalana i Lingüística General*
- **Tiago Martins, Pedro**  
*Departament Filologia Catalana i Lingüística General*
- **Venelin Orlinov, Kovatchev**  
*Departament Filologia Catalana i Lingüística General*

## 18 EXTERNAL MEMBERS

- **Balaguer, Natàlia**  
*INEFC - Institut Nacional d'Educació Física de Catalunya*
- **Bermúdez Lorenzo, Juan Manuel**  
*FBG - Fundació Bosch i Gimpera*
- **Bonhoure, Isabelle**  
*FBG - Fundació Bosch i Gimpera*
- **Cigarini, Anna**  
*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*
- **Vicens Bennasar, Julián**  
*FBG - Fundació Bosch i Gimpera*

## 1 SERVICES AND ADMINISTRATION PERSONNEL

- **Teller Amado, Sara**



# 4

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## RESEARCH LINES

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# 4 RESEARCH LINES

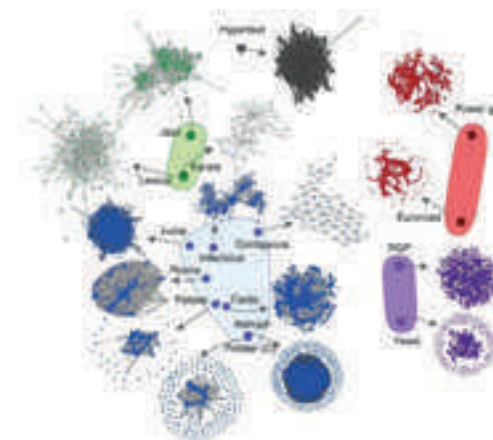
## Foundations

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.

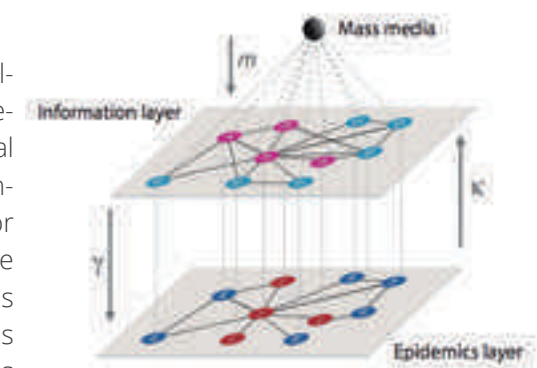
At the Institute, statistical physicists generalize the applicability of this discipline by studying other types of microscopic elements



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 different 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

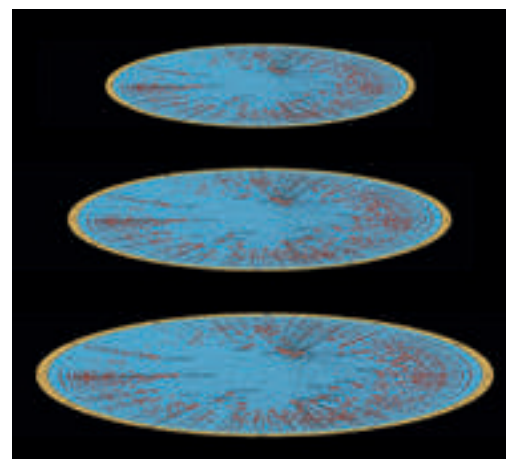
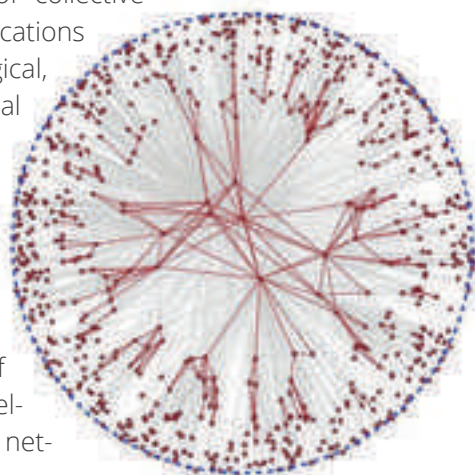
Complex systems are inherently dynamic and both properties and processes change over time. Dynamical systems theory provides a mathematical framework for treating time dependence in complex systems, typically involving continuous time and stochastic or random events. Apart from time dependence in geometrical 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.

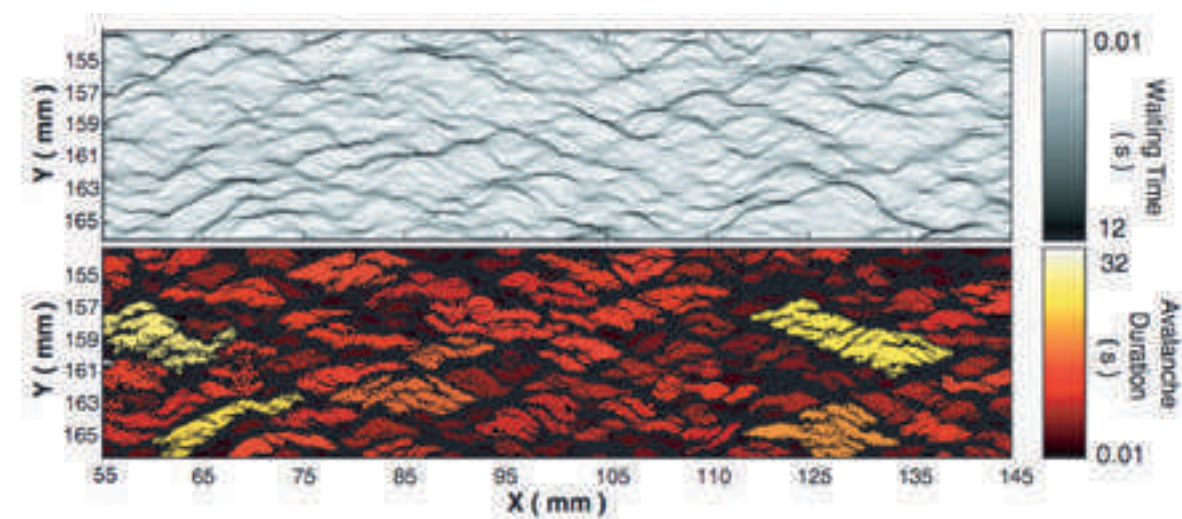
An important field of research within the science of complex matter focuses on soft matter materials, which include colloids, polymers and gels, complex fluids, and biological materials. What these systems have in common is that they are easily deformed by external forces and that their behavior is governed 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.

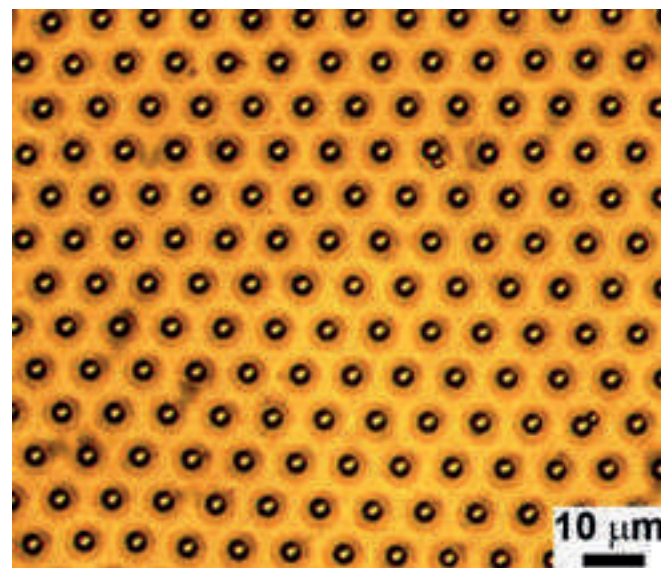
UBICS researchers have recently discovered a new scenario for a first-order phase transition that occurs via a complete inversion of the system energy landscape. This phenomenon was termed the "landscape inversion phase transition" (LIPT) and was observed by applying an external magnetic field to an 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.

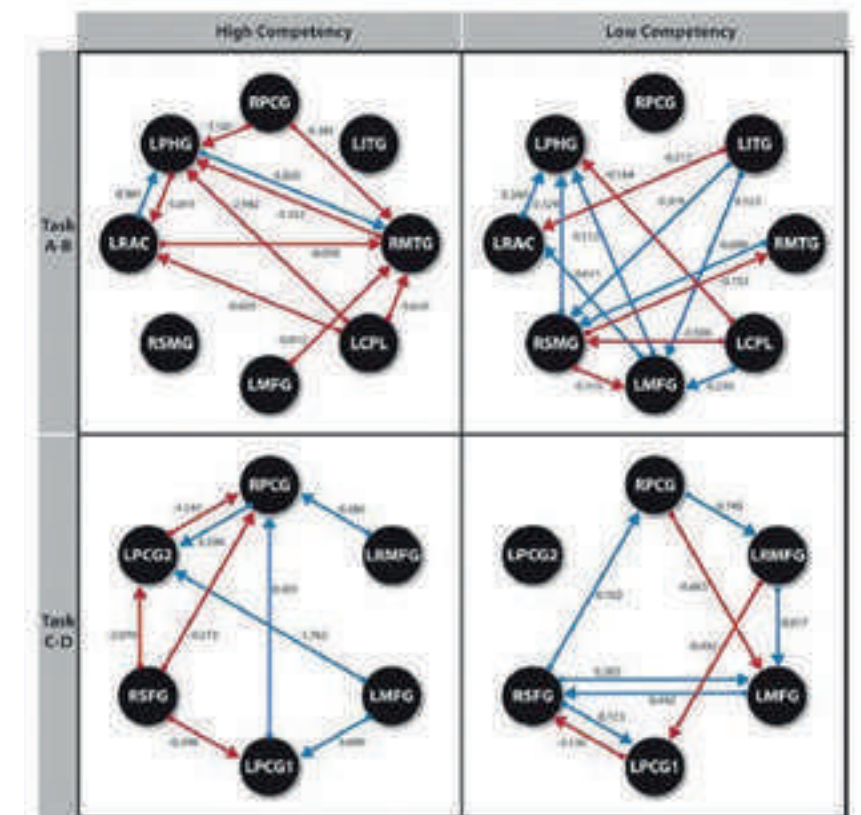
In this context, the Institute is developing a first important line of research in single-molecule physics in an effort to understand the structural properties of relevant biomolecules through mechanical measurements of single molecules. A second line of research addresses the collective effects of molecular 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



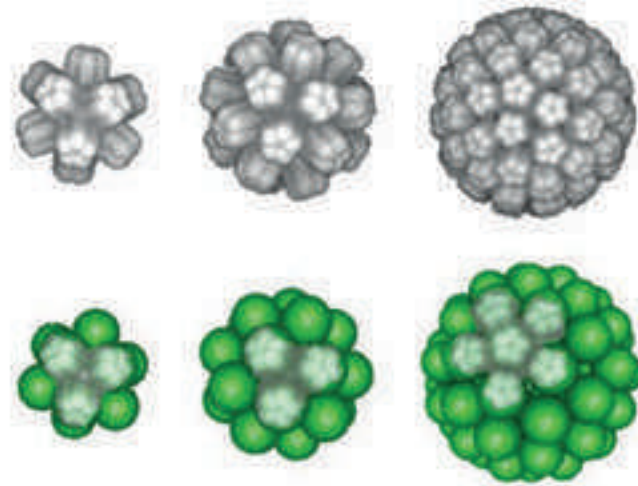
cell motility and cell division, and to the processes associated with membrane dynamics. At a higher level of organization, the Institute also studies collective phenomena of cells in tissues. Here our emphasis is on mechanical aspects and includes the study of collective cell migration of epithelial 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.

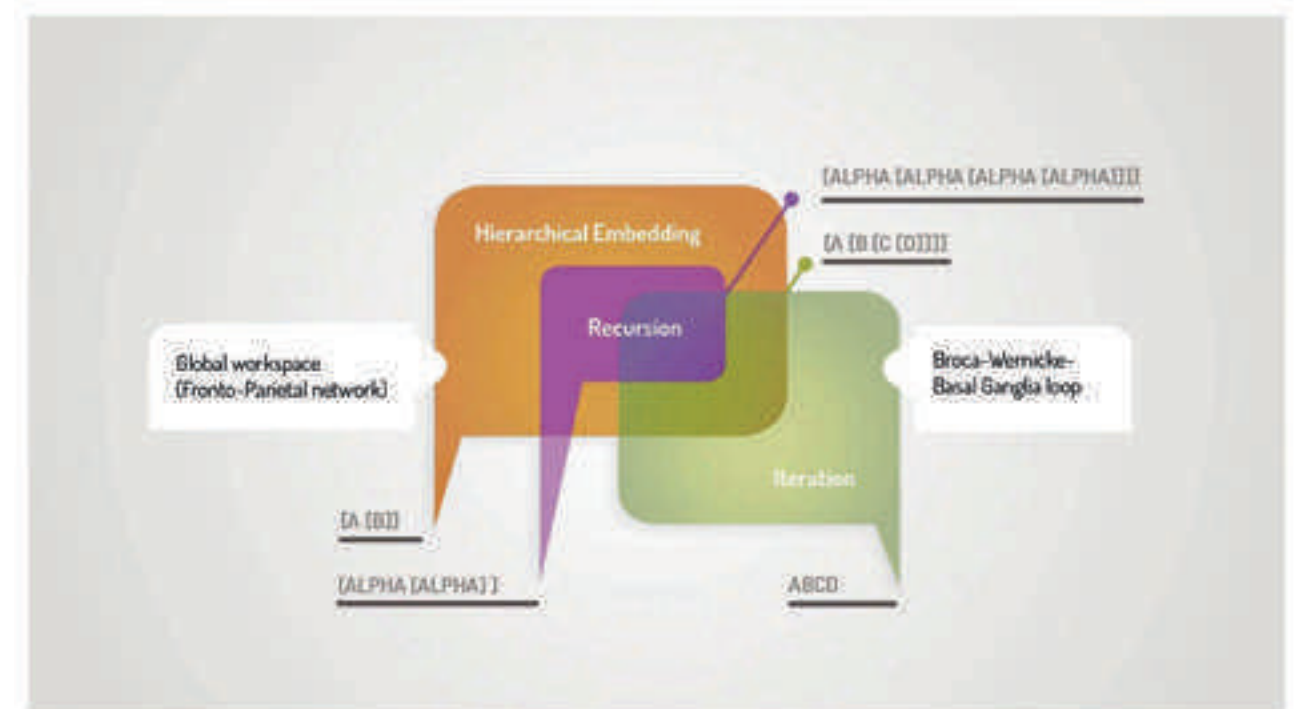
## Social Sciences

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 sociocommunicative and sociopolitical factors influencing language use, evolutionary change and maintenance and replacement phenomena.

## Psychology and behaviour

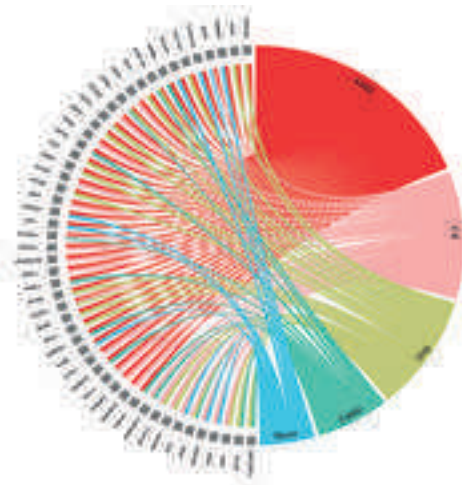
Social dilemmas and game theory provide tools and strategies for measuring and quantifying an individual's social traits based on their actions when these individuals confront their own benefit with another's interest or with the collective interest. These dilemmas therefore make it possible to analyze, for example, the levels of cooperation, trust, reciprocity and sense of collectivity that arise when participants in these types of experiments play together and inter-

act 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 by means of citizen science participatory strategies and methodologies. Our methodologies are 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.

na. 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**

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**FUNDING**

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# 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
- **An e-infrastructure for software, training and consultancy in simulation and modelling (E-CAM)**  
Period: 01/10/2015 to 30/07/2020  
Principal Investigator: Pagonabarraga Mora, Ignacio
- **People with intellectual disabilities with physical activities leaders in the community (P-PALs)**  
Period: 01/01/2018 to 31/12/2018  
Principal investigator: Guàrdia Olmos, Joan
- **Towards novel nano-scale technologies based on phoretic flow effects (nanophlow)**  
Period: 01/02/2018 to 31/01/2021  
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
- **Mapping big data systems: reembedding large complex network in dimensional hidden metric spaces**  
Period: 15/06/2018 to 14/06/2020  
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 Excellence

- **Ingeniería de la frustración en hielos coloidales artificiales: degeneración y redes exóticas**  
Period: 01/12/2018 to 30/11/2019  
Principal investigator: Tierno, Pietro



## AGAUR Consolidated Groups

- **Complexity Lab Barcelona (CLabB)**  
2017SGR1064  
Period: 01/01/2017 to 31/12/2020  
Principal Investigator: Perello Palou, Josep
- **Grup de complexitat, comunicació i sociolingüística**  
2017SGR175  
Period: 01/01/2017 to 31/12/2020  
Principal Investigator: Bastardas Boadas, Albert
- **Centre per a l'Estudi de la Interdependència provincial a l'Antiguitat Clàssica (CEIPAC)**  
2017SGR512  
Period: 01/01/2017 to 31/12/2020  
Principal Investigator: Revilla Calvo, Víctor
- **Física no-lineal**  
2017SGR1061  
Period: 01/01/2017 to 31/12/2020  
Principal Investigator: Ortín Rull, Jordi
- **Psicologia Quantitativa**  
2017SGR269  
Period: 01/01/2017 to 31/12/2020  
Principal Investigator: Guàrdia Olmos, Joan
- **Centre de Llenguatge i Computació (CLIC)**  
2017SGR341  
Period: 01/01/2017 to 31/12/2020  
Principal Investigator: Taulé Delor, Maria

## Contracts With Public And Private Entities

16  
CONTRACTS

FOR A TOTAL AMOUNT  
OF

588.063,14 €



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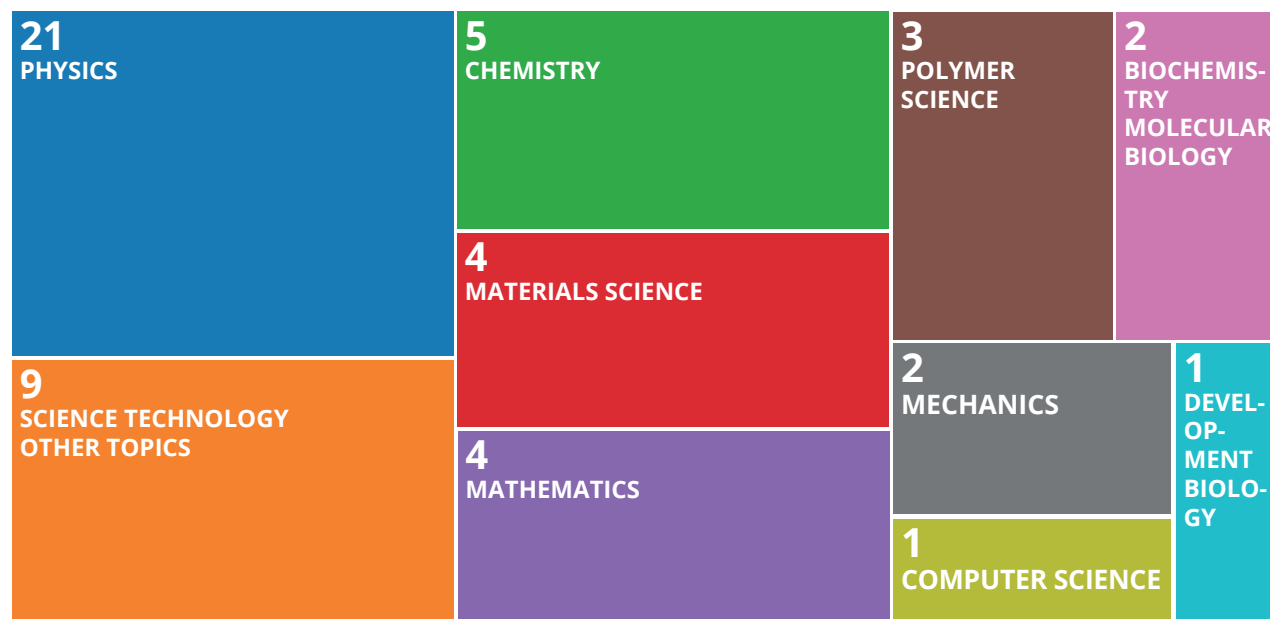
## **PUBLICATIONS**

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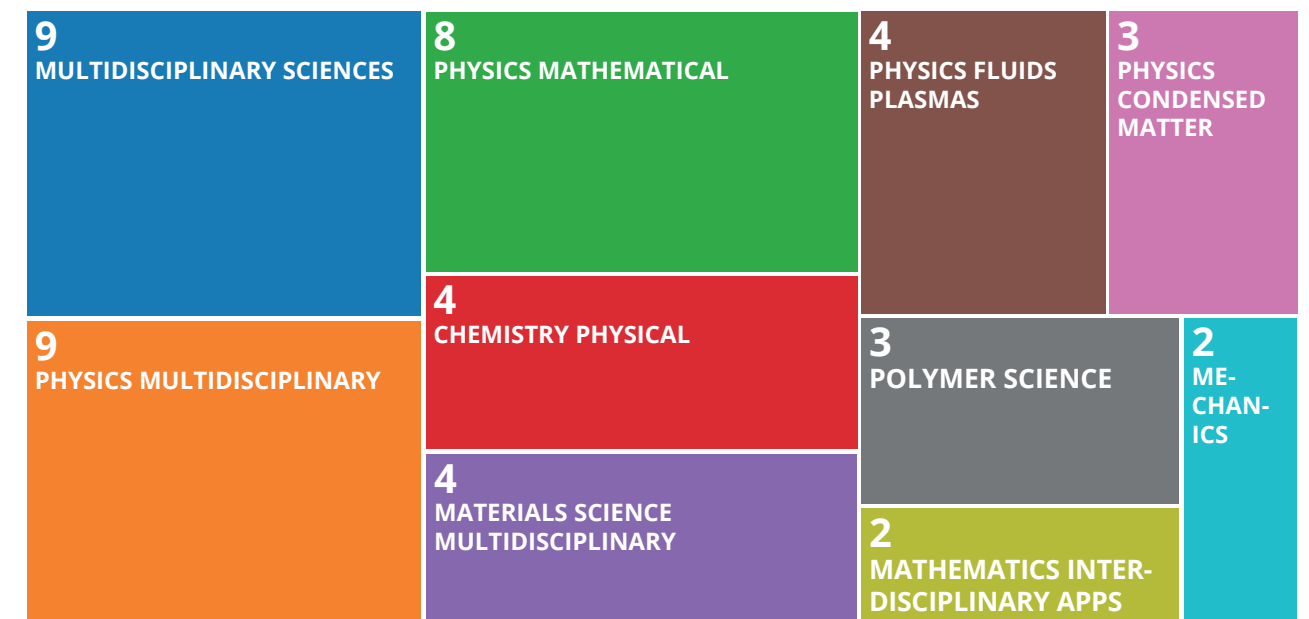




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- **Epidemic spreading in modular time-varying networks**  
Nadini, M. ; Sun, K. Y. ; Ubaldi, E. ; Starnini, M. ; Rizzo, A. ; Perra, N.  
Scientific reports, vol. 8, no 1, p. 2352  
<https://doi.org/10.1038/s41598-018-20908-x>
- **A Complex Network Framework to Model Cognition: Unveiling Correlation Structures from Connectivity.**  
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- **Editorial for the topical issue on the Continuous Time Random Walk**  
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- **Physical properties of voltage gated pores**  
Ramírez-Piscina, L.; Sancho, J.M.

- European Physical Journal B, vol. 91, no 1, p. 10  
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Physical Review Letters , vol. 121, no 3, p. 034101  
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Sancho, J.M.  
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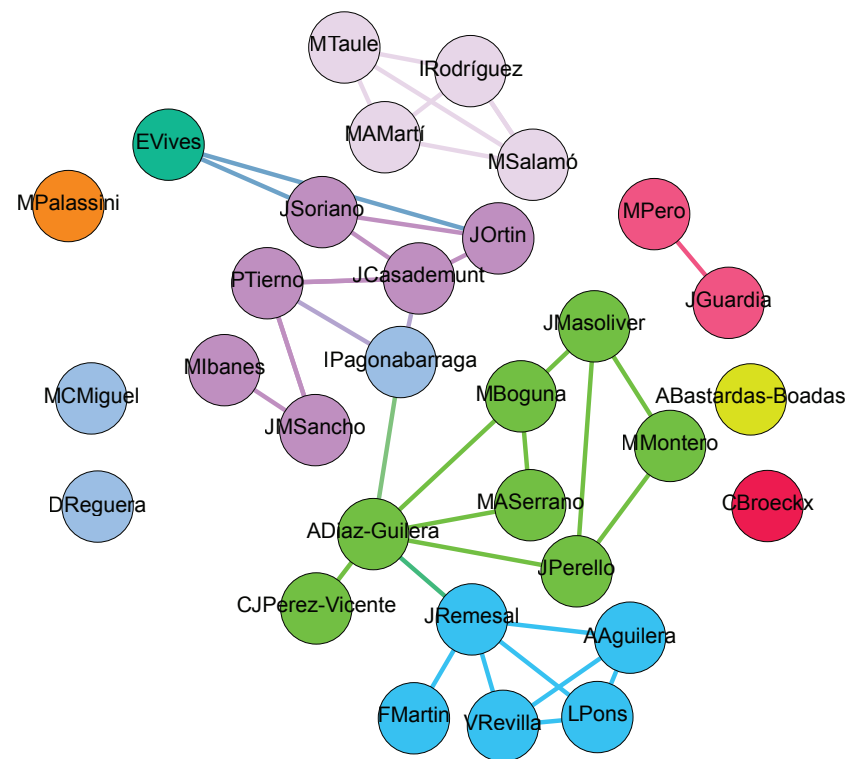
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- **A unified description of colloidal thermophoresis**  
Burelbach, J.; Frenkel, D.; Pagonabarraga, I.; Eiser, E.  
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- **Laning, thinning and thickening of sheared colloids in a two-dimensional Taylor-Couette geometry**  
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- **Energetics and the ground state quest in an artificial triangular colloidal ice**  
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- **Ice Rule Fragility via Topological Charge Transfer in Artificial Colloidal Ice**  
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- **Experimental Evidence of Accelerated Seismic Release without Critical Failure in Acoustic Emissions of Compressed Nanoporous Materials**  
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Artificial Intelligence Research and Development: Current Challenges, New Trends and Applications, vol. 308, p. 312-321. The Netherlands: IOS Press, 2018.

ISBN: 978-1-61499-917-1

• **Bibliographie Analytique de l'Afrique Antique XLVI (2012)**

Briand-Ponsart, C.; Coltelloni-Trannoy, M.; Guédon, S.; Pons Pujol, L.; De Bruyn, G.

Guédon Stéphanie (Edt.), num: 46

ISBN: 978-2-7283-1374-7

• **Colonia Ulpia Traiana (Xanten) y el Mediterráneo. El comercio de alimentos**

Remesal Rodríguez, J.

Col·lecció Instrumenta 63, Publicacions i edicions de la Universitat de Barcelona, Barcelona 2018.

ISBN: 978-84-9168-197-7

• **Prólogo**

**Remesal Rodríguez, J.**

Colonia Ulpia Traiana (Xanten) y el Mediterráneo. El comercio de alimentos. Instrumenta 63. Barcelona. Págs: 9-10. ISBN: 978-84-9168-197-7

• **Introducción**

**Remesal Rodríguez, J.**

Colonia Ulpia Traiana (Xanten) y el Mediterráneo. El comercio de alimentos. Instrumenta 63. Barcelona. 11-20. ISBN: 978-84-9168-197-7

• **Conclusiones**

**Remesal Rodríguez, J.**

Colonia Ulpia Traiana (Xanten) y el Mediterráneo. El comercio de alimentos. Instrumenta 63. Barcelona. 463-466. ISBN: 978-84-9168-197-7

• ***I provvedimenti annonari: la Baetica, l'olio per Roma e il Monte Testaccio***

**Remesal Rodríguez, J.**

Panella, C. (Ideazione di) D'Alessio, A., Panella, C., Rea, R. (A cura di) I severi. Roma Universalis. L'Impero e la dinastia Venuta dall'Africa. Milano.

• ***El monte Testaccio (30 años de investigación)***

**Remesal Rodríguez, J.**

Tribuna d'Arqueologia 2015-2016, pág: 72-87, (Spain, 2018)

• ***El valor estadístico de la epigrafía sobre ánforas Dressel 20***

**Remesal Rodríguez, J.**

Remesal Rodríguez, J., Revilla Calvo, V., Bermúdez Lorenzo, J. (Eds.) Cuantificar las economías antiguas. Problemas y métodos / Quantifying ancient economies: problems and methodologies. Instrumenta 60. Barcelona. Vol.60. Spain

• ***The new amphorae epigraphy found in Raetia***

**Bermúdez Lorenzo, J.M.**

Sommer, C. S., Matesic, S. (Hrsg.) Limes XXIII. Proceedings of the 23rd International congress of Roman frontier studies. Ingolstadt. 2015. vol. II. <http://ceipac.ub.edu/biblio/ficha.php?F=1009&IDM=>

• ***Las ánforas de alumbre de Lipari: Richborough 527***

**Pérez González, J.**

Colonia Ulpia Traiana (Xanten) y el Mediterráneo. El comercio de alimentos. Instrumenta 63. Barcelona. Págs:135-142. ISBN: 978-84-9168-197-7

• ***Las ánforas norteafricanas de Xanten***

**Revilla Calvo, V.**

Colonia Ulpia Traiana (Xanten) y el Mediterráneo. El comercio de alimentos, pág.171-179 ISBN: 978-84-9168-197-7

• ***Las ánforas olearias béticas Dressel 20***

**Remesal Rodríguez, J.**

Colonia Ulpia Traiana (Xanten) y el Mediterráneo. El comercio de alimentos. Instrumenta 63. Barcelona. 275-420. ISBN: 978-84-9168-197-7.

• ***Los grafitos sobre ánforas en Xanten***

**Remesal Rodríguez, J.; Pérez González, J.**

Colonia Ulpia Traiana (Xanten) y el Mediterráneo. El comercio de alimentos. Instrumenta 63. Barcelona ,pág. 421-462. ISBN: 978-84-9168-197-7

• ***La vil·la del Romeral (Albesa, La Noguera): un exemple d'ocupació del territori d'Ilerda en època imperial***

**Marí Sala, LL.; Revilla Calvo, V.**

Primeres Jornades d'Arqueologia i Paleontologia de Ponent (Balaguer i Lleida, 17 i 18 d'abril de 2015), Diputació de Lleida, 154-159. Depósito Legal: L373-18.

<http://ceipac.ub.edu/biblio/ficha.php?F=1019&IDM=es>

• ***El tossal de Cal Montblanc***

**Marí Sala, LL.; Revilla Calvo, V.**

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<http://ceipac.ub.edu/biblio/ficha.php?F=1018&IDM=es>

• ***Provincias, sellos e hipótesis nulas: la identificación de rutas de comercio a través de medidas de distancia cultural***

**Rubio-Campillo, X.; Bermúdez Lorenzo, J.M.; Montanier, J.M.; Moros Díaz, J.; Pérez González, J.; Rull Fort, G.; Remesal Rodríguez, J.**

Remesal Rodríguez, J., Revilla Calvo, V., Bermúdez Lorenzo, J.M. (Eds.) Cuantificar las economías antiguas: Problemas y métodos. Quantifying Ancient Economies: Problems and Methodologies. Col·lecció Instrumenta. Vol.60. p. 233-246. ISBN: 978-84-9168-107-6

• ***Reconstruir lo roto. Un método para vincular entre sí las inscripciones del Testaccio***

**Pérez González, J.; Morvan, M.; Prigano, L.; Morer, I.; Díaz-Guilera, A.; Bermúdez Lorenzo, J.M.; Remesal Rodríguez, J.**

Remesal Rodríguez, J., Revilla Calvo, V., Bermúdez Lorenzo, J.M. (Eds.) Cuantificar las economías antiguas: Problemas y métodos. Quantifying Ancient Economies: Problems and Methodologies. Col·lecció Instrumenta, vol.60, pág.:247-276, Spain ISBN: 978-84-9168-107-6

• ***El vino del noreste de Hispania Citerior en Xanten y la frontera germana. Características y dinámicas de un mercado secundario***

**Revilla Calvo, V.**

Colonia Ulpia Traiana (Xanten) y el Mediterráneo. El comercio de alimentos, pág.181-209 ISBN: 978-84-9168-197-7

• ***Importación y consumo de salazones del litoral de la provincia Baetica en la Colonia Ulpia Traiana (Xanten)***

**Lagóstena Barrios, L.; Revilla Calvo, V.**

Colonia Ulpia Traiana (Xanten) y el Mediterráneo. El comercio de alimentos. Instrumenta 63. 239-274. Barcelona. ISBN: 978-84-9168-197-7.

• ***A Platform for the Authoring of Educational Games***

**Baldeón, J. ; Puig, A. ; Rodríguez, I. ; Zardain, L.**

Proceedings of the 13th Iberian Conference on Information Systems and Technologies. CISTI 2018. Spain: 2018. ISBN: 978-989-98434-8-6

• ***Iterative Design of a Gamified Course in High Education: deployment and evaluation***

**Baldeón, J. ; Rodríguez, I. ; Puig, A.**

Proceedings of the 4th International Conference on Higher Education Advances. HEAd'18. Valencia (Spain): 2018. ISBN: 978-84-9048-690-0

• ***La integración dinámica de la persona con su entorno en la motricidad y el deporte.***

**Torrents, C., Balagué, N.**

E. J. Parreño (Ed.), Neuroacción, Barcelona: MCSports. ISBN: 978-84-94

• ***Sentient Embodied Conversational Agents: Architecture and Evaluation.***

**D. Tellols, M. Lopez-Sanchez, I. Rodríguez, P. Almajano**

Frontiers in Artificial Intelligence and Applications: Artificial Intelligence Research and Development. Vol 308., pp. 312 - 321. The Netherlands ISBN 978-1-61499-917-1



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## PHD THESES

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# 7 PHD THESES

- *Human collective behavior models: language, cooperation and social conventions*

Author: Roberta Amato

Director: Albert Díaz Guilera

- *Hydrodynamic effects on active colloidal suspensions*

Author: Eloy Navarro Argemí

Director: Ignacio Pagonabarraga Mora

- *A geometric approach to the structure of complex networks*

Author: Guillermo García Pérez

Director: M.Ángeles Serrano Moral, Marian Boguñá Espinal

- *Forces and flows in cells and tissues. Blebs, active gels, and collective cell migration*

Author: Ricard Alert Zenón

Director: Jaume Casademunt Viader

- *Theoretical and experimental approaches for the initiation and propagation of activity in spatially embedded neuronal cultures*

Author: Lluís Hernández Navarro

Director: Jordi Soriano Fradera

- *Activity Mediated Interactions in Soft Matter. Structure, Interactions and Phase Transitions*

Author: Joan Codina Sala

Director: Ignacio Pagonabarraga Mora





# 8

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## **UBICS ACTIVITIES**

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## UBICS Seminars

### • NanoBioMedicine: Current technology, challenges and future guidelines

Speaker: **Sonia Trigueros (Oxford University)**

Sala Eduard Fontseré, Facultat de Física, Universitat de Barcelona  
2018.01.11 15:00h

Nanotechnology is a new and exciting field that has the potential to transform the way medical and health solutions are being developed. In the Department of Physics, my group investigates new techniques and materials at a nanometric scale. In the Department of Zoology, my group applies this knowledge directly to know the most relevant biology on a single

molecule scale and then use science and technology to solve the most urgent medical problems of the 21st century. During the talk, I will focus on describing the field of nanotechnology, current applications and the potential of future applications. I will also explain the latest basic research projects and medical applications that we are developing.



### • Limb development, Turing patterns and Computer modelling

Speaker: **James Sharpe (EMBL)**

Sala Eduard Fontseré, Facultat de Física, Universitat de Barcelona  
2018.05.16 18:30h

Dramatic progress has been made over the last 2 decades in how we access key types of biological data - in particular sequence-based data on genomic information. However, integrating this data to produce dynamic and predictive models of higher level biological phenomena (e.g. development, regeneration, homeostasis and cancer) has been limited. Questions about tissues and organs are still most often tackled at the molecular or cellular level. We tend to ask how individual progenitor cells respond to signals from their "environment", and thus to focus on signal transduction pathways, gene regulatory events, and epigenetic memory. But an organ is more than just an environment for cells to "act" in - it is an integrated whole, a coherent community, with cells in constant genetic, chemical and mechanical communication with each other. New technical advances such as organoid culture, 3D mesoscopic imaging, multicellular omics and computer modeling are helping us to go beyond the molecular and cellular level, to under-

stand multicellular feedback loops, long-range signaling networks and emergent collective decisions, and thus to see tissues and organs as systems in their own right. Modelling these higher-level processes in vitro and in silico will help us understand these complex processes at a deeper level, and I will discuss our own attempts in this direction, to understand one example of complex organogenesis - namely mammalian limb development.



### • La semàntica de la intel·ligència artificial

Speaker: **Marta Recasens (Google Inc.)**

Sala Aula Capella, Facultat de Filologia, Universitat de Barcelona  
2018.06.19 15:00h

Malgrat els avenços recents de la intel·ligència artificial i fins i tot les veus que auguren els seus "perills", la realitat és que la semàntica i pragmàtica del llenguatge segueixen sent un gran repte per als sistemes automàtics de processament del llenguatge natural (PLN). En aquesta xerrada exemplificaré aquest repte a través de dues tasques de PLN: la resolució de la coreferència i els sistemes de diàleg. S'oferirà una descripció general d'aquestes tasques juntament amb estudis recents i exemples per il·lustrar quins aspectes semàntics estan resolts i quins són encara el focus de la recerca actual, especialment des de la perspectiva de les aplicacions de PLN en productes comercials.



## UBICS Activities

### • UBICS Day 2018

In June 19<sup>th</sup> 2018, UBICS celebrated its 2018 Day. This event offered many interdisciplinary short talks by Institute researchers including N. Balaguer, J. Guàrdia, J. Ortín, M.A. Serrano, I. Pagonabarraga, J. Remesal, M. Ibañes, M. Montero, C. Boeckx and networking activities. To close the meeting there was an open talk by Marta Recasens (Google Inc.). This event took place at the Facultat de Filologia Universitat de Barcelona, internal talks at Aula Gabriel Oliver and the public talk at Aula Capella.

The title of the talks were:

- **N. Balaguer:** *Percolation as a general protective mechanism*
- **J. Guàrdia:** *El cervell és una xarxa*
- **J. Ortín:** *Haines jumps in drainage/imbibition displacements involving a single pore*
- **M.A. Serrano:** *Mapping complexity: embedding networks in hidden metric spaces*
- **I. Pagonabarraga:** *Active matter: intrinsically out of equilibrium complex systems*
- **J. Remesal:** *EPNet project. Production and Distribution of Food during the Roman Empire: Economic and Political Dynamics*
- **M. Ibañes:** *On the cessation of cell elongation in plant roots*
- **M. Montero:** *Modeling and Prediction of Human Behavior*
- **C. Boeckx:** *Complex Systems and Language Sciences*
- **Marta Recasens:** *La semàntica de la intel·ligència artificial*

Abstracts of the talks can be downloaded here:

🔗 <https://drive.google.com/file/d/1MZt1ewp7adVWGWl5wfbj-hptSf7L-2k/view>



To end up the UBICS Day event, we organized a video contest for UBICS members as well as master and graduate students that were doing their project thesis with a UBICS member. The topic of the video was "What is Complex Systems for you?". The winners of the competition were Gemma Rossell and Pedro Tiago. Both received a tablet as a prize. Videos can be seen here: 🔗 <https://vimeo.com/user86445263>

More information:

🔗 <http://ubics.ub.edu/days2018>

### • International Day of Women and Girls in Science:

In February 13<sup>th</sup> UBICS celebrated the *International Day of Women and Girls in Science*. In the morning, there was a seminar titled *Gender differences in science: Resources, impact, risk and collaboration* imparted by Marta Sales-Pardo (Universitat Rovira i Virgili, Tarragona). Afterwards, a round table titled *La dona a l'inici de la carrera científica* took place where a great number of students participated. This round table was led by Arantxa Fraile (IN<sup>2</sup>UB, Universitat de Barcelona), Carmen Miguel (UBICS, Universitat de Barcelona), Marta Sales-Pardo (Universitat Rovira i Virgili), Iza Romanowska (Barcelona Supercomputing Center) and Mariona Taulé (UBICS, Universitat de Barcelona).



And what about gender parity in UBICS?

%		TOTAL	♂	% ♀	♀	% ♂
21.05%	<b>PHD candidates</b>	16	6	37.50%	10	62.50%
6.58%	<b>Scholars</b>	5	0	0.00%	5	100.00%
50.00%	<b>PDI</b>	38	11	28.95%	27	71.05%
21.05%	<b>External members</b>	16	7	43.75%	9	56.25%
1.32%	<b>Administration</b>	1	1	100.00%	0	0.00%
	<b>TOTAL</b>	<b>76</b>	<b>25</b>	<b>32.89%</b>	<b>51</b>	<b>67.11%</b>

As we can observe in the table, we are not proud of our parity figures. We hope that celebrating events like this one could help to increase the number of women in Science, and in particular, in our Institute.

More information:

🔗 [http://ubics.ub.edu/events\\_past.php](http://ubics.ub.edu/events_past.php)





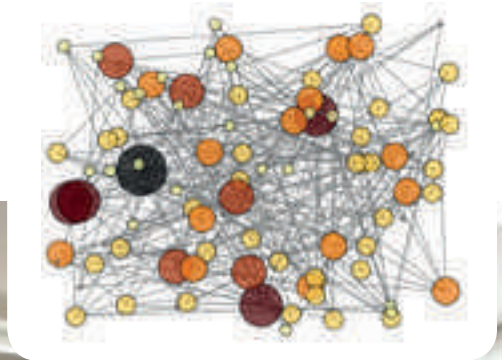
## UBICS Participation in other events

### • Explorant els sistemes complexos:

This activity was carried out at the Faculty of Physics in November 10<sup>th</sup> 2018. It was organized by <http://complexitat.cat> with the support of UBICS. The aim of the activity was to introduce the fascinating world of complex system's science to secondary school teachers.

More information:

[www.ub.edu/ice/cursos/ips/explorant](http://www.ub.edu/ice/cursos/ips/explorant)



### • IV Festa de la Ciència

In May 11<sup>th</sup> 2018 five groups of the UBICS participated in IV Festa de la Ciència at l'Edifici Històric in the University of Barcelona (UB). This event takes place every year and its main objective is to present the research that is carried out in the UB in an innovative and amusing way. In addition, this event allows to project into the society the importance of science in the daily life.

More information:

[www.ub.edu/laubdivulga/festacienciaub](http://www.ub.edu/laubdivulga/festacienciaub)



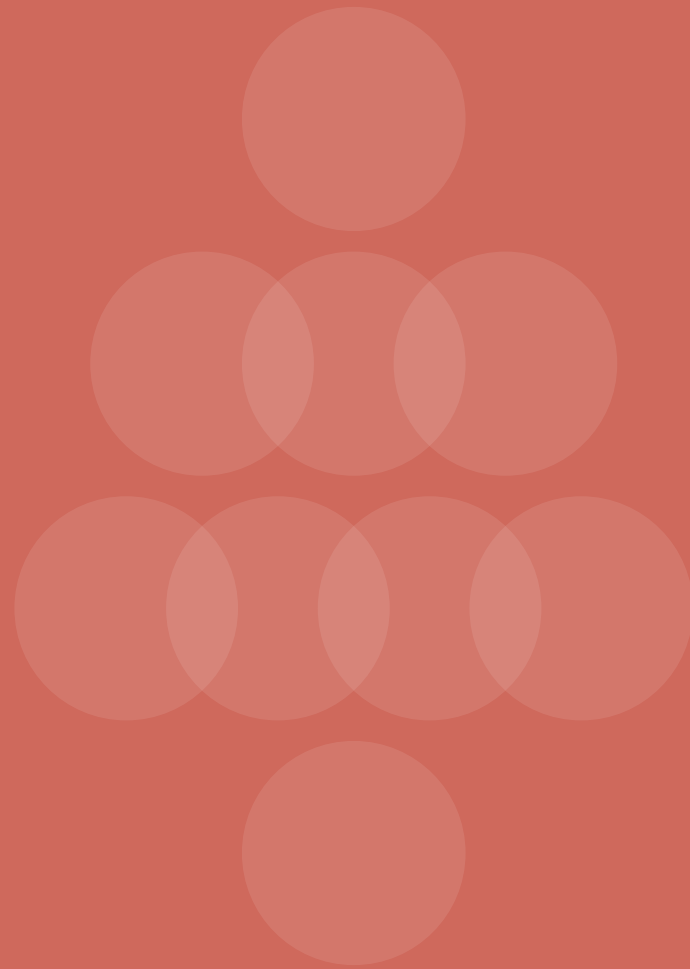
### • XIII Fira d'empreses

In April 11<sup>th</sup> 2018, UBICS participated in XIII Fira d'Empreses with its own stand, where many students came to request information. This event was organized by the following faculties: Física, Química, Matemàtiques i Informàtica, Ciències de la Terra i Biologia at Física i Química building. This fair represented a favorable opportunity for the students to get in contact with private business sectors and research institutes related to their studies.

More information:

[www.ub.edu/fisica/firaempreses](http://www.ub.edu/fisica/firaempreses)





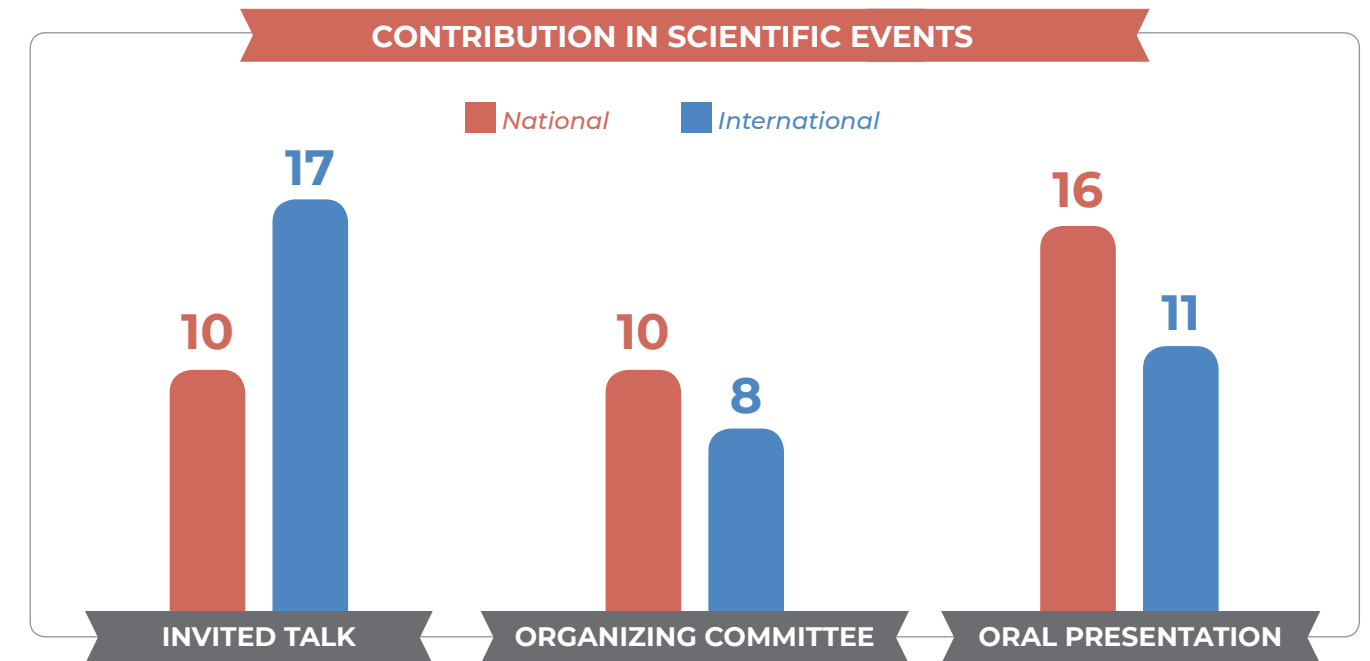
# 9

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## ACTIVITIES OF UBICS MEMBERS

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# 9 ACTIVITIES OF UBICS MEMBERS



- **Computer Applications and Quantitative Methods in Archaeology (CAA)**  
Tübingen (GERMANY)  
S. Cebrián; N. Morera; Juan A. Barceló; I. Bogdanovic; O. López-Bultó; I. Campana; A. Palomo; R. Piqué; J. Revelles; X. Terradas; J. L. Arcos; J. A. Rodríguez-Aguilar; A. Bogdanovich; S. Simoff5; T. Trescak; I. Rodríguez; A. Puig:  
*Beyond the Virtual Reconstruction of An Archaeological Settlement (Invited talk)*

- **IEEE EDUCON 2018 Global Engineering Education Conference**  
Santa Cruz de Tenerife, (SPAIN), 15-20 April  
I. Rodríguez : *Organizing committee*

- **Jornada Internacional 'El jardí com a font històrica. Mesopotàmia, Egipte, Grècia i Roma'**  
Barcelona (SPAIN), 29 January  
Pons Pujol, Ll.: *'Enfoques metodològics en el estudio de los jardines romanos. Jornada Internacional' (Invited talk and Program committee)*

- **XLVII Winter Meeting on Statistical Physics**  
Puebla (MEXICO)  
Miguel, M.C.: *Avalanches in the mechanical response of bio-structured materials (Invited talk)*

- **International Conference on Big Data Analytics, Data Mining and Computational Intelligence**  
Madrid (SPAIN), 18-20 July  
Salamó, M.: *Organizing committee*

- **International Conference of the Catalan Association for Artificial Intelligence**  
Roses (SPAIN), 8-10 October  
Salamó, M.: *Organizing committee*

- **Industrial Conference on Data Mining. International Workshop Case-Based Reasoning CBR-MD**  
New York (UNITED STATES)  
Salamó, M.: *Organizing committee*



• **El jardí com a font històrica: Mesopotàmia, Egipte, Grècia i Roma**

Barcelona (SPAIN)

Pérez González, J.: *El jardí com a font històrica: Mesopotàmia, Egipte, Grècia i Roma (Organizing committee)*

• **Summer Solstice 2018 International Conference on Discrete Models of Complex Systems**

Gdansk (POLAND), 25-27 June

Serrano, M.Á.: *Organizing committee*

• **Senior Programme Committee International School and Conference on Network Science, NetSci 2018**

Paris (FRANCE), 11-15 June

Serrano, M.Á.: *Organizing committee*

• **NetSciX2018, International School and Conference on Network Science**

Hangzhou (CHINA), 5-8 January

Serrano, M.Á.: *Organizing committee*

• **6<sup>th</sup> RIEC International Symposium on Brain Functions and Brain Computer**

Sendai (JAPAN)

Soriano, J.: *Dynamics and Effective Connectivity in Neuronal Cultures: from Experiments to Medical Applications (Invited talk)*

• **Flowing Matter 2018**

Lisbon (PORTUGAL)

Tierno, P.: *Emerging hydrodynamic bound states between magnetically driven micro propellers (Invited talk)*

• **From active matter to complex fluids**

Niza (FRANCE)

Pagonabarraga, I.: *Clogging transition through a single or multiple constrictions: from passive to active matter (Invited talk)*

• **Flowing Matter 2018**

Lisbon (PORTUGAL)

Pagonabarraga, I.: *Emergent patterns and synchronization in active rotor suspensions (Invited talk)*

• **X Congreso internacional de Docencia Universitaria e Innovación (CIDUI) 2018**

Girona (SPAIN)

Aparicio-Chueca, P.; Triado-Ivern, X.; Guardia-Olmos, J.; Elasri-Ejjaberi, A.; Maestro-Yarza, I.; Bernardo, M.; Presas, P.; Turull Rubinat, M.; Roca Acedo, B.: *¿Por qué creen los profesores que no asisten los estudiantes al aula? Análisis de la percepción del absentismo por parte del profesorado de la Universidad de Barcelona. (Oral presentation)*

Aparicio-Chueca, P.; Triado-Ivern, X.; Guardia-Olmos, J.; Elasri-Ejjaberi, A.; Bernardo, M.; Presas, P.; Maestro-Yarza, I.; Turull Rubinat, M.; Roca Acedo, B.: *Reflexiones acerca del absentismo universitario en las aulas. ¿Un mismo patrón de conducta para diversos grados? (Oral presentation)*

• **EDULEARN18 (10<sup>th</sup> annual International Conference on Education and New Learning Technologies)**

Palma de Mallorca (SPAIN)

Triado-Ivern, X.; Guardia-Olmos, J.; Presas, P.; Bernardo, M.; Aparicio-Chueca, P.; Elasri-Ejjaberi, A.; Maestro-Yarza, I.; Turull, M.; Roca, B.: *Students' absenteeism in higher education: An exploratory qualitative study (Oral presentation)*

• **3<sup>rd</sup> International Conference on Quality Engineering and Management**

Barcelona (SPAIN)

Bernardo, M.; Aparicio-Chueca, P.; Elasri-Ejjaberi, A.; Triado-Ivern, X.M.; Guàrdia-Olmos, J.; Presas, P.; Maestro-Yarza, I.; Turull-Rubinat, M.; Roca-Acedo, B.: *University absenteeism: Students' and lecturers' point of view (Oral presentation)*

• **4<sup>th</sup> Annual Workshop on Complex Sociotechnical Systems**

Zaragoza (SPAIN)

Montero, M.: *Quantum and random walks: Affinities and disparities (Oral presentation)*

• **19<sup>th</sup> International Congress of Classical Archaeology (AIAC)**

Cologne/Bonn (GERMANY), 22-26 May

Cuadra Rubio, R.M., Pérez González, J.: *Mobiliario textil en la casa romana. La comodidad perdida (Oral presentation)*

Pérez González, J.: *The Singularity of Rome. The sumptuary city (Oral presentation)*

• **XXXVII Congreso Nacional de Estadística e Investigación Operativa (SEIO 2018)**

Oviedo (SPAIN)

Villarroel, J.; Montero, M.: *On the distribution of the maximum of the backward recurrence time (Oral presentation)*

• **Analysis and Modeling of Complex Oscillatory Systems**

Barcelona (SPAIN)

Diaz-Guilera, A.: *Synchronization in populations of moving oscillators (Invited talk)*

• **Open Science & The Humanities / Ciencia Abierta y las Humanidades**

Barcelona (SPAIN)

Remesal, J.; Labastida, I.; Rondello, B.; Yubero, M.; Bermúdez, J., M.; Pérez González, J.; González Vázquez, M.; Rodríguez Segura, J.: *Open Science & The Humanities (Organizing committee)*

• **19<sup>th</sup> World Congress of Psychophysiology**

Lucca (ITALY)

Guàrdia-Olmos, J.; Gudayol-Ferré, E.; Carbó-Carreté, M.; Peró-Cebollero, M.: *A systematic revision of brain connectivity in fMRI data in language task paradigms. En A.A. González-Garrido (chair), Orthographic processing and language transparency (Simposio) (Oral presentation)*

• **15<sup>th</sup> Experimental Chaos and Complexity Conference**

Madrid (SPAIN)

Diaz-Guilera, A.: *Synchronization in populations of moving oscillators (Oral presentation)*

• **II Seminario Internacional de Ciencia Ciudadana**

Santiago de Chile (CHILE)

Perelló, J.: *Ciencia ciudadana social: intervenciones experimentales en el espacio público (Invited talk)*

• **Connecting Technologies for the Social Good**

Brussels (BÈLGICA)

Perelló, J.: *Connecting Technologies for the Social Good (Oral presentation)*

• **4<sup>th</sup> Workshop COMSOTEC**

Zaragoza (SPAIN)

Perelló, J.: *Measuring synchronization and anticipation between individual investors from their daily performance (Oral presentation)*

• **24<sup>th</sup> European Association of Archaeologists (EAA) Annual Meeting**

Barcelona (SPAIN)

Pons Pujol, L.; Pérez González, J.: *Mauretania Tingitana. A review of an Atlantic Province (Oral presentation)*

• **ECSA Conference**

Genève (SWITZERLAND)

Vicens, J.; Cigarini, A.; Bonhoure, I.; Perelló, J.: *Do you want to co-design a Citizen Science experiment for Social Change? (Oral presentation)*

Bonhoure, I.; Cigarini, A.; Vicens, J.; Perelló, J.: *Social local impact of Citizen Science projects. Myth or reality? (Oral presentation)*

• **Convegno internazionale Antichità in giardino, giardini nell'antichità**

Verona (ITALY)

Pons Pujol, L.: *Enfoques metodològics en el estudio de los jardines romanos (Invited talk)*

• **Summer Solstice 2018 International Conference on Discrete Models of Complex Systems**

Gdansk (POLAND), 25-27 June

M. Ángeles Serrano: *Multiscale unfolding of real networks by geometric renormalization (Invited talk)*

• **UBICS Day 2018**

Barcelona (SPAIN), 19 June

**M. Ángeles Serrano:** *Mapping complexity: embedding networks in hidden metric spaces (Invited talk)*

**Ortín, J. ; Díaz-Piola, L.; Planet, R.:** *Haines jumps in drainage/imbibition displacements involving a single pore (Invited talk)*

• **XVIII World Economic History Congress, Session Networks, Intensity, Extensive Margins of Trade since the 19<sup>th</sup> Century: New Approaches to Globalization with Large Databases**

MIT, Boston (UNITED STATES), July 29-August 3

**M. Ángeles Serrano:** *The hidden hyperbolic geometry of international trade: World Trade Atlas 1870-2013 (Invited talk)*

• **Nordita Program 'Crackling Noise in Materials'**

Stockholm (SWEDEN), 30 April to 11 May

**Miguel, M.C.:** *Avalanches in the mechanical response of icosahedral virus and colloidal crystal shells (Invited talk)*

**Vives, E.:** *Revising the Gutenberg-Richter exponent in labquakes: acoustic emission during compression of coal & charcoal (Invited talk)*

• **VII Jornades Complexitat.cat**

Barcelona (SPAIN)

**Miguel, M.C.:** *Organizing committee*

**Ortiz, E.; Starnini M.; Serrano, M.Á:**

*Navigating temporal networks in hyperbolic space (Oral presentation)*

• **New Directions in Language Evolution Research, SLE 2018**

Tallinn University (ESTONIA)

**Samuels, B.; Martins, P. T.; O'Rourke, T.; Andirkó, A.; Alamri, S.; Theofanopoulou, C.; Boeckx, C. :** *Rethinking neoteny and neuroplasticity in language evolution (Oral presentation)*

• **Physics and ecology: Challenges at the frontier, XXXIV Trobades Científiques de la Mediterrània**

- **Josep Miquel Vidal**

Menorca (SPAIN)

**Miguel, M.C.:** *Introductory talk: Animal Flocking. Physics and ecology: Challenges at the frontier (Invited talk and Organizing committee)*

• **XXII Congreso de Física Estadística, FisEs'18**

Madrid (SPAIN)

**Miguel, M.C.:** *Organizing committee*

**Sancho, J.M:** *Statistical physics approach to: active ionic channels and thermophoresis (Invited talk)*

• **6<sup>th</sup> International Conference on Superconductivity and Magnetism conference**

Beldibi (TURKEY)

**Tierno, P.:** *Emerging hydrodynamic bound states between magnetically driven micro propellers (Invited talk)*

• **Emergent topological order in classical system**

Santa Fe (UNITED STATES)

**Lee, D. Y.; Tierno, P.:** *Energetics and the Ground State Quest in an Artificial Triangular Colloidal Ice (Invited talk)*

• **24<sup>th</sup> Annual Meeting of the European Association of Archaeologists (EAA)**

Barcelona (SPAIN), 5-8 September 2018

**Revilla Calvo, V.:** *Organizing committee*

• **Continuidades y rupturas en el callejero de las ciudades hispanas**

Alicante (SPAIN) 7-9 November

**García, J.; Revilla, V.:** *Continuidades y rupturas del paisaje urbano en los parva oppida del noreste de Hispania Citerior: el caso del municipium Iluro (Invited talk)*

• **24<sup>th</sup> Annual Meeting of the European Association of Archaeologists (EAA)**

Barcelona (SPAIN), 5-8 September

**Martín i Oliveras, A.; Revilla Calvo, V.:** *Reconstructing Laietanian roman Wine Economy using Agent-Based Modelling (1st c. BC-3rd c. AD) (Oral presentation)*

• **Las villas romana bajoimperiales de Hispania**

Palencia (SPAIN), 15-17 November

**Marí i Sala, Ll. ; Revilla Calvo, V.:** *La arquitectura de la villa del Romeral (Albesa, la Noguera) en la antigüedad Tardía (Invited talk)*

• **Arqueología del campesinado en la Hispania romana**

Madrid (SPAIN), 29-30 November

**Revilla Calvo, V.:** *¿En los márgenes del sistema de la villa? Tipología, función e imagen del hábitat rural en el noreste de Hispania Citerior (Oral presentation)*

• **IVème Colloque Ductus. Inscriptions mineures en miroir: textes, langues et supports (Rome, 5-6-7 décembre 2018). Institut suisse de Rome - École Française de Rome**

Roma (ITALY), 6-7 December

**Aguilera Martín, A.; Marí Sala, Ll.; Revilla Calvo, V.:** *Epigrafia quotidiana nell'ambito rurale della Spagna Citeriore: il caso del territorio di Ilerda. (Oral presentation)*

• **International work-conference on time series analysis, ITISE 2018**

Granada (SPAIN)

**Montero, M.:** *Organizing committee*

• **NetSciX2018, International School and Conference on Network Science**

Paris (FRANCE)

**Ortiz, E.; Starnini M.; Serrano, M.Á:** *Navigating temporal networks in hyperbolic space (Oral presentation)*

• **Evolang XII**

Toruń (POLAND)

**Alamri, S.; Andirkó, A.; O'Rourke, T.; Martins, P. T.; Boeckx, C.:** *The biocognitive 'guns, germs, and steel' underlying Homo sapiens' unique material culture (Oral presentation)*

**Martins, P. T.; Boeckx, C.:** *Sound Production Learning and the Contiguuum Hypothesis (Oral presentation)*

**Andirkó, A., Alamri, S., Sturm, S., O'Rourke, T., Tiago Martins, P., Boeckx, C.:** *The biocognitive 'guns, germs, and steel' underlying Homo sapiens' unique material culture (Oral presentation)*

• **"Tokyo Conference on Evolving Linguistics"**

Tokyo (JAPAN), 7 March

**Martins, P. T.:** *An Evolutionary Continuum Hypothesis for Sound Production Learning (Invited talk)*

• **Non-Equilibrium Complex Dynamics (NECD'18)**

Potsdam (GERMANY), 8-11 October

**Casademunt, J.:** *Active Wetting and Morphological Instabilities in Epithelial Tissues (Invited talk)*

• **Theoretical and Computational Modelling in Mechanobiology**

Barcelona (SPAIN), 29 May

**Casademunt, J.:** *Active wetting in epithelial tissues (Invited talk)*

• **III WorkShop Internacional "Dones i Esport. La igualtat en joc"**

Barcelona (SPAIN), 29 June

**N. Balagué, C. Torrents, M. Mateu, A. Ensenyat, M. Esteve, J. Martin, A. Gibert, R. Pol, A. Canton:** *Geder perspective. Understanding complexity to intervene effectively (Oral presentation)*

**Vázquez, P., García, S., Montull, Ll., Balagué, N.:** *Dynamic approaches reduce gender segregation in sport science (Oral presentation)*

• **Seminari Grup de Recerca Sistemes Complexos i Esport**

Vilallobent (SPAIN)

**Vázquez, P., Montull, Ll., Hristovski, R. & Balagué, N.:** *Anàlisis fractals en l'esport (Oral presentation)*



• **Jornada Catalana de Recerca en Ciències de l'Activitat Física i de l'Esport**

Barcelona (SPAIN)

**Montull, Ll., Vázquez, P., Martín, J., Hristovski, R. & Balagué, N.:** *Variabilitat temporal de l'acceleració en exercicis dinàmics. (Oral presentation)*  
*Grup de Recerca Sistemes Complexos i Esport : Sistemes Complexos i Esport: la (R)evolució pendent (Oral presentation)*

**Martín, J., Ric. A., Balagué. N., Hristovski, R.:** *Understanding performance analysis from a dynamic complex approach (Oral presentation)*

• **International Meeting Point 2018. ENSA Sport.**

Sevilla (SPAIN), 17-18 March

**Balagué, N.:** *Entrenamiento personal: Cómo intervenir eficazmente (Invited talk)*

• **Connecting Technologies for the Social Good**

Brussels (BELGIUM), 14-15 February

**Perelló, J.:** *Interactive workshop coorganized by COST Association and the CAPS Community*

• **Roadmap to consolidate and expand the knowledge base on participation and learning in citizen science**

Berlin (GERMANY)

**Perelló, J.:** *Participation on the Workshop of the Working Group 2 of the Citizen Science COST Action - CA15212: to promote creativity, scientific literacy, and innovation throughout Europe*

• **Workshop 'Statistical Physics in Biology'**

Tempe (UNITED STATES), 6-8 October

**Palassini, M.:** *Avalanches in systems of localized charges with long-range interaction (Invited talk)*

• **International Conference on Computer Graphics Theory and Applications (GRAPP)**

Madeira (PORTUGAL)

**Rodríguez Santiago, I.:** *Organizing committee*



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Martí i Franquès, 1  
08028 Barcelona  
ubics@ub.edu | ubics.ub.edu | @UB\_ICS

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CAMPUSES

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

**Barcelona Knowledge Campus**  
Baldri Reixac, 2  
08028 Barcelona

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