

IFISC

INSTITUTO DE FÍSICA INTERDISCIPLINAR Y SISTEMAS COMPLEJOS

INSTITUTE FOR CROSS-DISCIPLINARY PHYSICS AND COMPLEX SYSTEMS

Joint Research Center



Universitat de les
Illes Balears



CSIC

CONSEJO SUPERIOR DE INVESTIGACIONES CIENTÍFICAS

 IFISC



Universitat de les Illes Balears



Founded in 1978

14,000 students

750 Permanent Researchers and Teaching staff



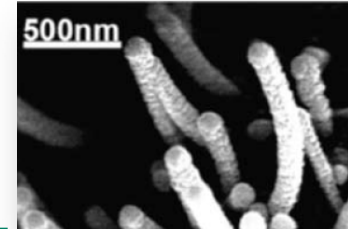
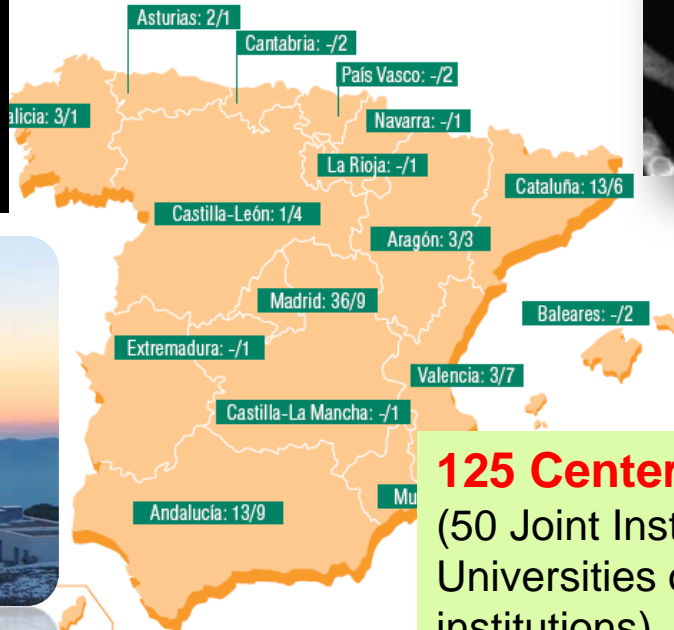
**3 Research Institutes:
IFISC
IMEDEA
IUNICS**





CSIC
CONSEJO SUPERIOR DE INVESTIGACIONES CIENTÍFICAS

Spanish National Research Council



125 Centers
(50 Joint Institutes with Universities or other institutions)

Total personnel: 10,000
(2369 Staff Scientists)



IFISC: Institute for Cross-Disciplinary Physics and Complex Systems

Joint Research Institute of CSIC and UIB created in June 2007 building upon the former Cross-Disciplinary Physics Department of IMEDEA (1995)

Argentina
Brasil
France
Germany
Italy
Japan
Portugal
Poland
South Korea
Spain
UK
Uruguay
Venezuela



Tenured researchers (9 UIB + 7 CSIC): 16

Postdoctoral Research Associates: 16

PhD fellows/contracts: 22

Long term visitors: 8

62 scientists from 13 different nationalities

 **IFISC**



Universitat de les
Illes Balears



CSIC





22 PhD students
International level: Foreign 9/22
Mobility: UIB students 4/22
7 Master and collaboration students

*** Cross-Disciplinary and Strategic research from the perspective of physicists**


Cross-Disciplinary: Transfer of knowledge, concepts and methods across the borders among established fields and colonization of frontier spaces.

Strategic: Phocus in fields of strong potential for the future and emerging topics beyond the traditional physics of the XXth century.
Avoid incremental research and the basic-applied dichotomy

Responsible Research and Innovation

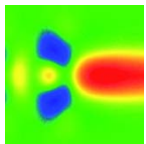
*** IFISC ASSESSMENT International ESF Panel: Strategic Plan CSIC 2010-13**

 **Assesment within CSIC Institutes: 5/5**

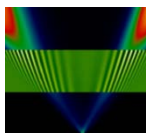
 ***“IFISC is unique in the Spanish context and also has internationally a very strong standing. It challenges the world best centres and it is a major actor of emergence of complex science.”***



COMPLEX SYSTEMS: STATISTICAL AND NONLINEAR PHYSICS



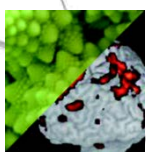
QUANTUM PHYSICS: PHOTONS, ELECTRONS
AND INFORMATION



NONLINEAR OPTICS AND DYNAMICS OF
OPTOELECTRONIC DEVICES



FLUID DYNAMICS, BIOFLUIDS, AND
GEOPHYSICAL FLUIDS

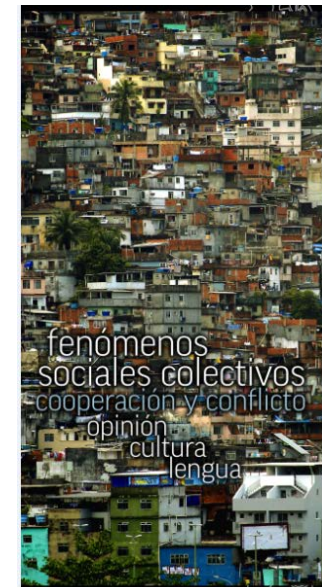
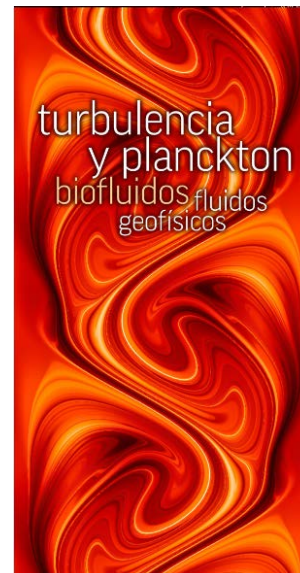
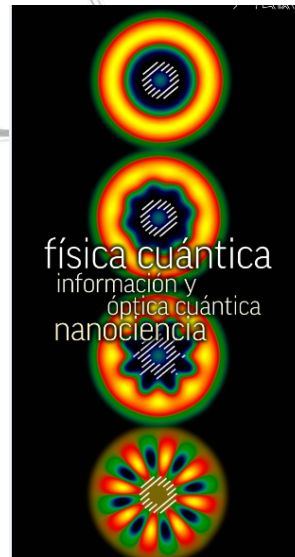
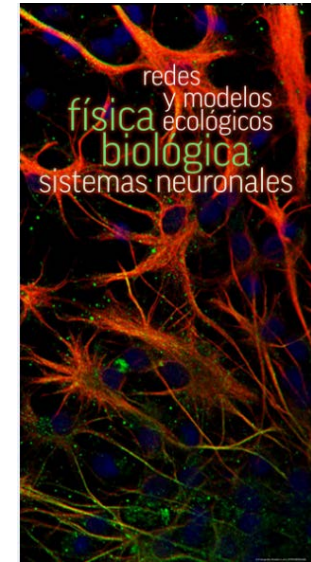
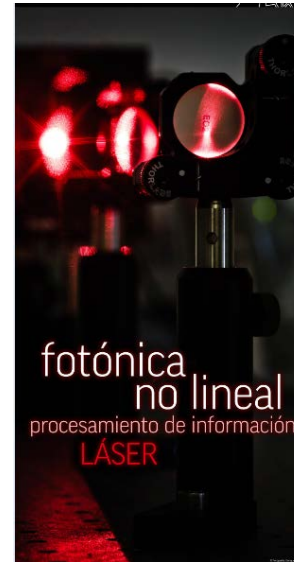


BIOLOGICAL PHYSICS AND NONLINEAR
PHENOMENA IN ECOLOGY AND PHYSIOLOGY



DYNAMICS AND COLLECTIVE PHENOMENA
OF SOCIAL SYSTEMS

* Associated Unit: **UIB** Group on Human Cognition and Evolution →



Complexity:

S. Hawking:

Complexity is the science of the 21st century

Triumph of emergence over reductionism



In many large ensembles, the property of the system as a whole cannot be understood from studying the individual entities alone — these ensembles can be made up by neurons in the brain, transport users in traffic networks or data packages in the Internet. The past decade has seen important progress in our fundamental understanding of what such seemingly disparate 'complex systems' have in common; some of these advances are surveyed here.

<http://www.nature.com/nphys/journal/v8/n1/full/nphys2198.html>

Complex systems are systems where the collective behavior of their parts entails emergence of properties that can hardly, if not at all, be inferred from properties of the parts. Examples of complex systems include ant-hills, ants themselves, human economies, climate, nervous systems, cells and living things, including human beings, as well as modern energy or telecommunication infrastructures.

<http://css.csregistry.org/tiki-index.php?page=What%20are%20Complex%20Systems%20?>

Many interacting units, so that **EMERGENT PHENOMENA** arise which are not reducible to individual unit behavior: *More than the sum of the parts*

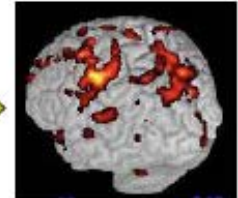
NEURON



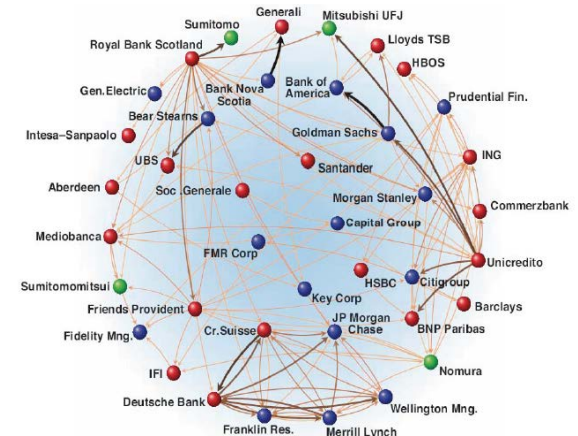
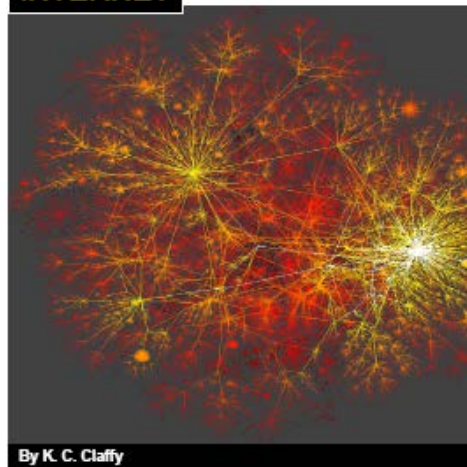
BRAIN



MIND



INTERNET



Financial networks

Bottom-up: Order **emerges** from disorder

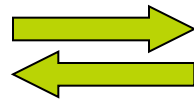
Order at large scales emerges from interactions at small scales

Individual behavior is not a guide for the collective behavior

 **THE WHOLE IS MORE THAN THE SUM OF ITS PARTS**

cutting a horse in two does not result in two small horses

REDUCTIONISM



EMERGENCE

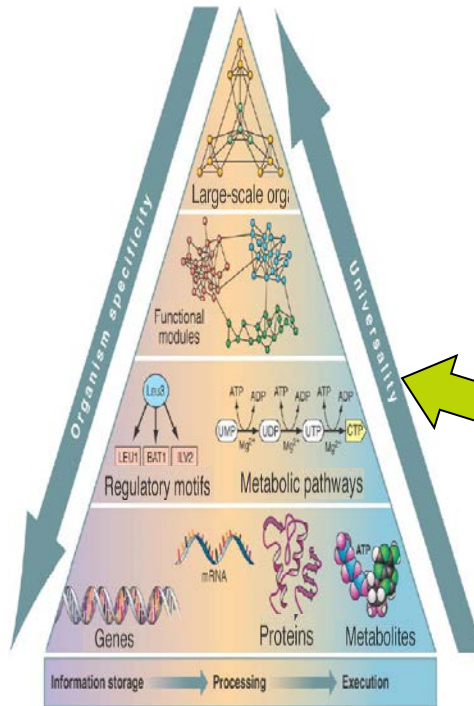
The reductionist hypothesis does not by any means imply a "constructionist" one: The ability to reduce everything to simple fundamental laws does not imply the ability to start from those laws and reconstruct the universe. P.W. Anderson (1972)



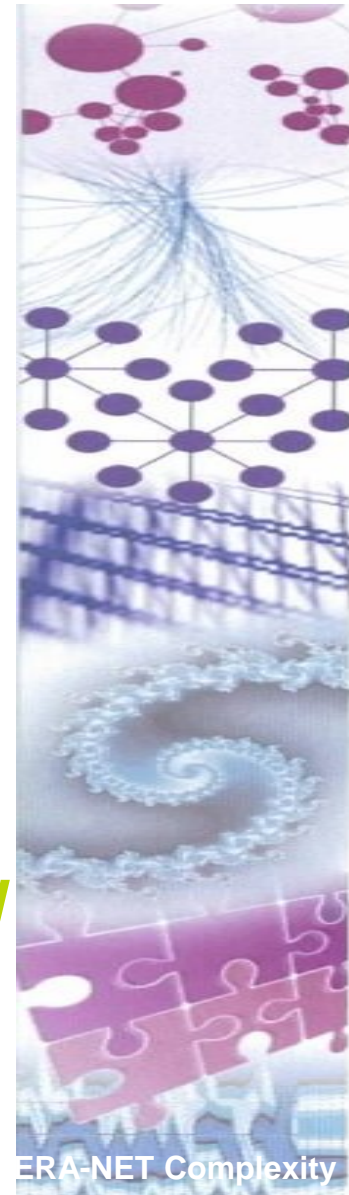
LCE-Helsinki

There is no unique definition of **COMPLEXITY**:

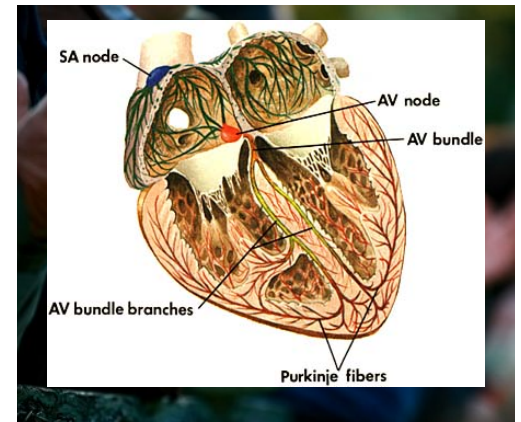
- * Emergent properties
- * Adaptation
- * Nonlinearity: THRESHOLDS
- * Multilevel: Bridge between individual and collective: From organisms to ecosystems, from PC to WWW
- * Feedback



Z.N. Oltvai and A.-L. Barabasi
Science, 298, 2002.



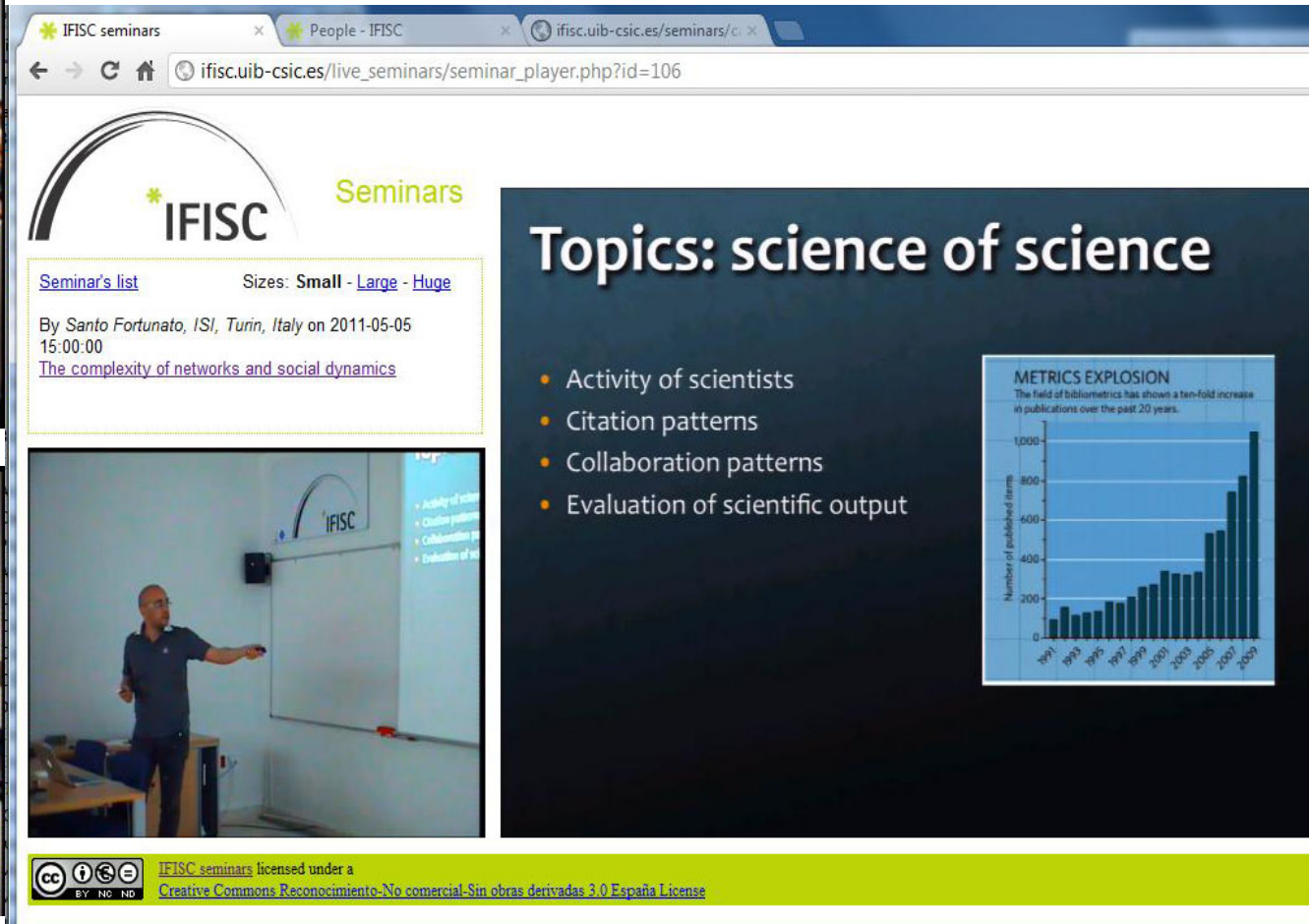
ERA-NET Complexity



Our seminars are webcast live

<http://ifisc.uib-csic.es/live.php>

2011: 60 seminars

IFISC Seminars

Seminar's list Sizes: [Small](#) - [Large](#) - [Huge](#)

By Santo Fortunato, ISI, Turin, Italy on 2011-05-05
15:00:00
[The complexity of networks and social dynamics](#)

Activity of scientists
Citation patterns
Collaboration patterns
Evaluation of scientific output

METRICS EXPLOSION
The field of bibliometrics has shown a ten-fold increase in publications over the past 20 years.

Year	Number of published items
1991	100
1992	120
1993	150
1994	180
1995	220
1996	280
1997	350
1998	450
1999	550
2000	700
2001	850
2002	1000
2003	1200
2004	1500
2005	1800
2006	2200
2007	2800
2008	3500
2009	4500
2010	5500
2011	7000

IFISC seminars licensed under a [Creative Commons Reconocimiento-No comercial-Sin obras derivadas 3.0 España License](#)

IFISC STUDENT INTERNSHIPS 2013	
TUTOR	PROJECT
Claudio Mirasso	<i>Simulating neuronal models</i>
Damià Gomila	<i>Control of fluctuations in the power grid by consumer-consumer interaction.</i>
David Sánchez	Energy flow in tight-binding models.
Emilio Hernández	<i>Competition of biological organisms and species: A continuous and stochastic modelling approach.</i>
Ingo Fischer	<i>Experimental characterization of a semiconductor laser with external optical feedback. Optical linewidth measurements. Application of homodyne and heterodyne techniques.</i>
Llorenç Serra	<i>Modeling of Majorana modes in semiconductor nanowires.</i>
Raúl Toral	From ants to financial markets.
Roberta Zambrini	<i>Quantum synchronization in presence of driving.</i>



50 ANIVERSARI DEL LÀSER
IFISC (CSIC-UIB)

22 d'octubre, 18.00 h.
18.00: Inauguració de la Setmana de la Ciència i la Tecnologia de les Illes Balears 2010.
18.30: Conferència: El làser: 50 anys d'un invent que ha canviat les nostres vides.
19.30: Exhibició Làser Graffiti a la Murada de Ses Voltes.
Ses Voltes. Dalt Murada s/n (Palma)

24 de novembre, 19.30 h.
Taula rodona: Làser i medicina: aplicacions i reptes.
Sala d'actes de CaixaForum.
Plaça de Weyler, 3 (Palma)

14 de desembre, 19.00 h.
Conferència: Aplicacions del làser en la conservació artística: l'obra ceràmica de Gaudí a la Catedral de Mallorca.
Seu. Plaça de l'Almoina, s/n (Palma)

Activitats gratuïtes - Més informació: Tel. 971259719 - E-mail: ifisc@ifiscub-csic.es - http://ifiscub-csic.es

LASER Graffiti Exhibitions



Ses Voltes, Palma



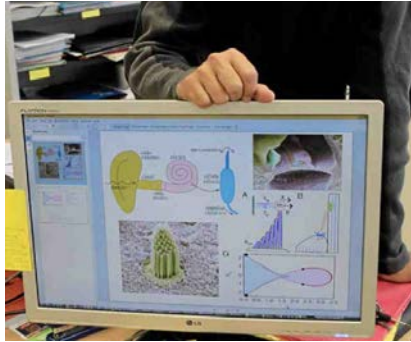
Menorca Museum





Press releases

EL MUNDO-EL DIA DE BALEARES (B@LEÓPOLIS) 10/04/12



Ciliadas, los altavoces de nuestro oído

>Biofísica/ Un estudio en el que participan investigadores de Baleares descifra los secretos que permiten al oído amplificar sonidos muy débiles y la clave son un tipo de células denominadas ciliadas. **Elena Soto**

OUTREACH 2013

Jornada de puertas abiertas @ IFISC

21 de Febrero, 15:00h - 18:00h
Sala de Seminarios del IFISC



Opening Science

Obrint la Ciència · Abriendo la Ciencia · Opening Science

<http://www.aciencia2013.blogspot.com.es>

Organiza: Obra Social Fundación 'la Caixa'

Coordina: IFISC

Colaboran: Universitat de les Illes Balears, CSIC

Feb-May 2013

Explorant les Fronteres entre els Sabers VI "Nuevas formas de divulgar la ciencia" CaixaForum, May 2013



HOME ABOUT IFISC PEOPLE RESEARCH LINES PUBLICATIONS SEMINARS OUTREACH MASTER IFISC JOB OPENINGS CONTACT

IFISC OUTREACH

- Home
- Presentations
- Publications
- Press & Media
- Science and technology week
- Science fair

EVENTS, PRESS & MEDIA

All 2013 2012 2011 2010 2009 2008 2007 2006 2005 2004

SEARCH

From

OUTREACH

HOME

La Universitat respon

Researchers solve scientific questions in micro audiovisual spaces.

IFISC researchers propose a theoretical framework to study the combined effects of temperature and electric fields in nanostructures.

nature.com

Parallel photonic information processing at gigabyte per second data rates using transient states.

II Premios Onda Cero Mallorca 2012



@IFISC_mallorca



<http://www.facebook.com/ifisc>

<http://ifisc.uib-csic.es>



Connecting Science,
Understanding Complexity

HIGHLIGHTS

- * Jornada de puertas abiertas @ IFISC, 21 de Febrero de 15:00 a 18:00h.
- * Abriendo la Ciencia: Cómo construir puentes entre investigación y sociedad. 20 de Febrero 9hs, CaixaForum Palma. Inscripción abierta.
- * IFISC Master in Physics of Complex Systems.

RESEARCH LINES



- ▶ **Complex systems. Nonlinear and Statistical Physics**
 - ▶ [Quantum physics: photons, electrons and information](#)
 - ▶ [Nonlinear Optics and Dynamics of Optoelectronic Devices](#)
 - ▶ [Fluid dynamics, Biofluids, and Geophysical fluids](#)
 - ▶ [Biological Physics and nonlinear phenomena in ecology and physiology](#)
 - ▶ [Dynamics and collective phenomena of social systems](#)

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

COMPUTING SERVICES UNIT

The Computing Services Unit manages the computational resources at IFISC. [Nuredduna](#) is our main computer cluster.

NEWS & EVENTS

- ▶ IFISC Seminar, 19-02-2013, 14:30: [Anticipated Synchronization in Neuronal Circuits](#) Fernanda S. Matias, IFISC
- ▶ Jornada de puertas abiertas @ IFISC, 21 de Febrero de 15:00 a 18:00h
- ▶ [Sci. Reports: Systemic delay propagation in air traffic networks](#). Data, realistic modeling & forecasting.

WORKSHOPS, CONFERENCES & SCHOOLS

- ▶ (06/05/2013) [THEfoDA: Theory and mechanisms of social interactions in the big data era](#)