WORKSHOP ON
COMPLEX SYSTEMS: NEW TRENDS AND EXPECTATIONS
Santander, Spain, 5-9 June 2006

SUMMARY

The workshop focused on the interdisciplinary character of complex systems. Scientist working mainly on physics, but also in chemistry, biology, economy, sociology, mathematics, have meet, interacted and contributed with their different points of view and approaches to have an updated vision of the state of the art as well as to have a cross-fertilization of ideas.

An extremely relevant objective for the meeting was, as the participants were researchers in statistical physics and complex systems from both Europe and Latin America, that it should contribute, through the building of communication bridges, to the foundation of new and strong relations between the scientific communities from both sides of the Atlantic.

SCIENTIFIC CONTENT:

As it was originally pointed out in the application form, the general area of complex systems is at the forefront of interdisciplinary research, with networks already operating at European level. The interest on this area of research is due to several aspects, but particularly to its interdisciplinary character, where scientist coming from physics, chemistry, biology, economy, sociology, engineering, interact and contribute with their different approaches and views to the understanding of very complex issues involving from nanotechnology, through biological problems, up to economical and sociological problems.

It is well known that the European scientific community has been pioneer in favoring the organization of interdisciplinary research projects. Some of the earlier proposals in bridging the gap among different disciplines have its origin in worldwide recognized European “schools”. Even some of the leading experimental groups on pattern formation and other aspects of research on complex systems are in Europe. Regarding this latter point of view, patterns, one of the aims of the workshop was to contribute to the understanding of the arising of spatial or temporal patterns

in many relevant biological, chemical, and even sociological situations.

It is also known that fluctuations or noise have played a changing role in the history of science, from being a nuisance in the past to the recent realization that noise can actually play a central role in inducing or triggering new phenomena. Examples where noise leads to organized behaviour include: stochastic resonance, noise induced phase transitions, noise induced patterns, noise induced transport. Many of these fluctuation-induced phenomena involve temporal fluctuations, but spatial fluctuations (disorder) can also play a similar role. It is also well known and largely discussed the relation of such noise induced phenomena to some physical, biological, and chemical problems. Clearly, all these aspects are of relevance to the European policies for technological and scientific development and could contribute to increase the European competitiveness.

With the previous framework in mind, the aim of the workshop on *COMPLEX SYSTEMS: NEW TRENDS AND EXPECTATIONS* was twofold:

1. in one hand the organization of a workshop with the main objective of gathering together experts on the different aspects of complex systems, that included noise induced phenomena, synchronization, pattern formation, and particularly applications of statistical physics to social, economic and biological problems. The original idea, part of a *Marie Curie Chair* project, was to have an updated view of the state of the art as well as a cross-fertilization of ideas,

2. on the other hand, the gathering of experts from European and Latin American countries, in order to contribute to tighten the relations between researchers from both sides of the Atlantic, and in such a way emphasizing the relations between Europe and Latin America, as well as to establish the basis for future, solid, collaborations among those same scientists.

Both objectives were largely reached. The final group of participants involved researchers and students of several European (Belgium, England, France, Germany, Italy, Poland, Portugal, Spain, Swiss) and Latin American (Argentina, Brazil, Chile, Mexico, Venezuela) countries. The programme of the meeting, that was held in Santander, Spain, from June 5

to 9 2006, included the following aspects (that were approved by the scientific committee):

a) 45 selected invited talks, half an hour each, offering an overview of the different aspects of complex systems that are currently investigated in the different groups to which the participants belong, all of which are well established and internationally recognized groups;
b) Poster sessions, that took place together with the coffe-breaks, where the young participants presented their work;
c) Long coffee-breaks, allowing the participants to look at the posters, as well as to have discussions about them, about the talks, and also about all subjects of common interest. These long breaks, with the chance of deep discussions, were the adequate place to generate the possibility of fruitful contacts and collaborations.

It is worth to comment that after the end of the first day session's, as several of the participants were also members of the *Board of the Statistical and Nonlinear Physics Division* (SNP) of the *European Physical Society* (EPS), there was a meeting of that Board. In that meeting, diverse problems of the division were discussed, as well as the possibility of official and more strong contacts between the SNP-EPS and similar divisions of Latin American physical societies. This later aspect was analyzed together with representatives of the Latin American countries presents in the event.

The funds for the organization of this meeting came originally through a *Marie Curie Chair* project, but we have received further support from the European Science Foundation (through the program *Stochastic Dynamics: fundamentals and applications (STOCHDYN)*), and Spanish institutions like the Consejo Superior de Investigaciones Científicas, the Instituto de Física de Cantabria and the Universidad de Cantabria, as well as the Ayuntamiento de Santander and Government of Cantabria. Those funds were devoted to support the participation of European and Latin American scientists, to cover the hotel expenses for all invited speakers, lunch and coffee-breaks for all participants, transport from the hotel to the conference place, etc. Part of the funds helped to cover (total or partially) the travel expenses of some Latin American and European researchers. It is worth to comment that the total number of participants from Latin

America were 32, while we have had 44 from Europe. From these total of 76 participants, 45 were invited speakers.

Finally, we have reached an arrangement with Springer for publishing the proceedings of the meeting as a special issue of the *European Physical Journal*, in the new "Special Topics" section. The results of the meeting have clearly matched some of the objectives of European research as it complemented other projects that are currently under way within the framework of already existing European networks on complex systems. It has certainly contributed to build communication bridges and to the foundations of new and strong relations between the scientific communities of researchers in statistical physics and complex systems in Europe and Latin America. According to the comments of several participants, the discussions they have had during the meeting, have been the seeds for such new collaborations and common projects.

FINAL PROGRAMM

Invited Speakers and Titles:

Albano E., Universidad de La Plata, Argentina
Short-time critical dynamics of complex systems

Ausloos M., University Liege, Belgium
The Southern Oscillation Index characterizing El Niño: a complex signal adequately described through a Beck-like Turbulence Model & Tsallis non-extensive statistics

Boon J.P., Universitaet Libre Bruxelles, Belgium
Generalized diffusion and precursors to fingering processes

Cabrera J.L., IVIC, Caracas, Venezuela
Time scales and scaling in human stick balancing

Condat C., Universidad de Córdoba, Argentina
A Multilevel Approach to Cancer Growth

Cordero P., Universidad de Chile, Santiago, Chile
Dense granular systems: phase transitions

Corvera E., UNAM, Mexico
Fronts in microfluidics

Cosenza M., Universidad de los Andes, Mérida, Venezuela
Mass media effects in cultural dynamics

Delsanto P.P., Politechnico di Torino, Torino, Italy
Phenomenological universalities as a cross-fertilization tool for the investigations of growth laws in different disciplines

Deza R., Universidad de Mar del Plata, Mar del Plata, Argentina
Controlled replication of noise-sustained structures induced by synchronization

Díaz Guilera A., Universidad de Barcelona, Barcelona, Spain
Synchronization Reveals Topological Scales in Complex Networks

Gonze D., Universitaet Libre Bruxelles, Belgium

Molecular noise and circadian rhythms: factors de influencing the robustness of oscillations

Gudowska-Nowak E., Jagellonian University, Krakow, Poland

Anomalous diffusion driven by Levy white noises: the effect of boundaries and the first passage time statistics

Hänggi P., Universitaet Augsburg, Augsburg, Germany

Chiral separation in microflows

Hermann H., ETH, Zurich, Swiss

Transport of particles by fluids

Hernández-Machado A., Universidad de Barcelona, Barcelona, Spain

Dynamic instabilities in biological membranes

Iglesias J.R., UFRGS, Porto Alegre, Brazil

Inequalities and wealth distribution in Artificial Societies

Jensen H.J., Imperial College, London, England

Biological Evolution as a Paradigm for Dynamics in Complex Systems

Kuperman M., Centro Atómico Bariloche, Bariloche, Argentina

Models of cultural propagation

Kurths J., Universitaet Postdam, Postdam, Germany

Synchronization in Complex Networks

López, J.M., IFCA, Santander, Spain

Scaling concepts in spatially extended chaotic systems

Luczka J., Silesian University, Katowice, Poland

Inertial Brownian motors

Martínez-Mekler G., UNAM, Cuernavaca, México

Ecological Succession and Volcanism Circa 2000000 B.C.

Mateos J.L., UNAM, Mexico D.F., México

Levy-walk foraging of primates induced by complex environment

Maza D., Universidad de Navarra, Pamplona, Spain

Anomalous behaviors in silo discharge granular flows

Moukarzel C., CINESTAV, Mérida, Mexico

Condensation and Pareto Law in Multiplicative Asset Exchange Models

Oshanin G., Universite P. et M. Curie, Paris, France

Random Walks and Surfaces Generated by Random Permutations of Natural Series

Parrondo J.M., Universidad Complutense, Madrid, Spain

Heating without heat

Pietronero L., Universita La Sapienza, Rome, Italy

Complex Correlations in Astrophysics and Geophysics

Reimann P., Uiversitaet Bielefeld, Bielefeld, Germany

Paradoxical Brownian Motion in a Microfluidic Device: Absolute Negative Mobility

Rosso O., Universidad de la Plata, La Plata, Argentina

Entropy and statistical complexity changes in brain electrical activity

Sagues F., Universidad de Barcelona, Barcelona, Spain

Langmuir monolayers: where self-organization and self-assembly meet

Sánchez A., Universidad Carlos III, Madrid, Spain

The importance of time scales for the evolution of cooperation

San Miguel M., IMEDEA-UIB, P.Mallorca, Spain
Models of social consensus

Santos M.A., Universida de Porto, Porto, Portugal
Wealth distribution in modern and medieval societies

Sherrington D., Oxford University, Oxford, England
The minority game: statistical physics of collective behaviour of competitive agents in a market

Tamarit F., Universidad de Córdoba, Córdoba, Argentina
The relaxation dynamics of the XY Mean Field Hamiltonian model

Tirapegui E., Universidad de Chile, Santiago, Chile
Front propagation induced by additive noise

Tsallis C., CBPF, Rio de Janeiro, Brazil
Nonextensive statistical mechanics –Introduction, foundations, and recent applications in complex systems

Toral R., IMEDEA-UIB, P.Mallorca, Spain
Diversity induced effects in the dynamics of coupled oscillators

Van den Broeck Ch., Hasselt University, Diepenbeek, Belgium
Fluctuation and work theorem: three case studies

Voituriez R., Universite P. et M. Curie, Parie, France
Optimal Search Strategies for Hidden Targets

Vulpiani A., Universita La Sapienza, Rome, Italy
Boltzmann entropy and chaos in a large assembly of weakly interacting systems

Zorzenon R., UFRGN, Pernambuco, Brazil
Malaria: from modeling to data analysis

	MONDAY 5	**TUESDAY 6**	**WEDNESDAY 7**	**THUERSDAY 8**	**FRIDAY 9**
8:45-9:00	***OPENING***	----------	----------	----------	----------
9:00-9:30	Sagués	San Miguel	Hänggi	Maza	Ramasco
9:30-10:00	Iglesias	Sherrington	Mulet	Kuperman	Deza
10:00-11:00	***COFFEE***	***BREAK***	***COFFEE***	***BREAK***	***COFFEE***
11:00-11:30	Kurths	Pietronero	Tsallis	Jensen	Tirapegui
11:30-12:00	Cosenza	Zorzenón	Oshanin	Boon	Luczka
12:00-12:30	Gonze	Delsanto	Gudowska-N	Balankin	Mateos
12:30-14:30	***LUNCH***	***LUNCH***	***LUNCH***	***LUNCH***	***LUNCH***
14:30-15:00	Tamarit	Sánchez	----------	López	Albano
15:00-15:30	Vulpiani	Vd Broeck	***F***	Voituriez	Corvera
15:30-16:30	***COFFEE***	***BREAK***	***R***	***COFFEE***	***BREAK***
16:30-17:00	Herrmann	Hernánd-M	***E***	Díaz Guilera	Rosso
17:00-17:30	Parrondo	Cabrera	***E***	Reimann	Santos
17:30-18:00	Martínez-M	Toral	----------	Condat	Moukarzel
18:00-18:30		Cordero	----------	Ausloos	***CLOSING***
	SNP-EPS Meeting				
		DINER			