Editorial

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Statistical Physics and Mathematics for Complex Systems

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Preface

The second international workshop on the Statistical Physics and Mathematics for Complex Systems (SPMCS) was held in the Center for Complexity Science at Central China Normal University in Wuhan, China, from 23–27 October 2010; the first workshop, held in 2008 in Le Mans, France, was convened by the Laboratoire de Physique Statistique et Systèmes Complexes of ISMANS, an engineering college in France.

As announced in the Aims and Scope, this conference series is intended to bring together senior and junior scientists, as well as Ph.D. students, to present the state of the art, to exchange recent results, new ideas, and different points of view on questions in the vanguard of statistical physics, thermodynamics, and mathematics for complex systems. The topics of interest include:

(1) Applications of methods from statistical physics and thermodynamics to complex systems and networks, and mathematical modeling of complexity;

(2) Statistical physics and thermodynamics for finite-size and nonextensive systems; fluctuation theorems and equalities, superstatistics, and quantum thermodynamics;

(3) Fractal geometry, and fractional calculus.

Each of the above topics is or is becoming sufficiently large to be the focus of specialized workshops. We decided to include all since these topics reflect the most important current concerns of many physicists and mathematicians, working within the areas of statistical physics and thermodynamics, who want to get involved in the study of complex systems with their own approaches and questions on fundamental concepts of statistical mechanics and its kinship with thermodynamics.

One important characteristic of complex systems whether these be small, social, economic, biological systems or networks to list but a few, is the ubiquitous uncertainties or fluctuations in their dynamics usually out of and far from equilibrium. This highlights one reason why there is a role for statistical physics, which, in spite of its own deep fundamental concerns in regard to the second law of thermodynamics, the arrow of time, and nonequilibrium processes, is an example of a successful application of statistical methods to the microscopic mechanical world (that perhaps is much more complicated than to date we have been considering). It is essentially for this reason that this workshop series is open to all matters related to the above listed topics, and to the fundamental questions which have spilt much ink over the past 150 years.

In this issue, we selected 22 papers from the numerous contributions. I will not comment on these selected papers and let the reader find the works of his interest. I would like here to underline in a few words the spirit or the philosophy of this workshop series. Since statistical physics is one of the few fields in physics in which there are open questions about almost all the basic concepts and laws (there is a joke that says that there are as many viewpoints as researchers), and since it is just such a physics which is widely used for complex systems, we encourage innovational, revolutionary ideas and methodologies on fundamental matters and novel problems related to statistical physics and complex systems. We encourage scientists, especially young researchers, to inquire and be wary of every basic notion in these fields, from its original definitions to its new applications. Do not fear awakening and startling from their graves Maxwell, Boltzmann, Poincaré, or other founders of statistical mechanics and thermodynamics. With this philosophy, new ideas and methodologies, be these naive or described as naive or absurd by some well-informed colleagues, are much more useful and valuable in the progression of knowledge than any improvement of, for example, a mathematical solution of Boltzmann's equation or any complement and extension of old models. I hope that this workshop is an incubator for those new ideas needing careful, considerate, and delicate criticism instead of rapid censure and sarcastic verdict. I also hope that, in the future, this workshop series can include metaphysics as a topic to encourage more reflection to deepening our understanding of the foundation of statistical physics as well as its application to complex systems.

I am deeply indebted to the Center for Complexity Science of Central China Normal University for hosting and sponsoring the SPMCS workshop. The great job and excellent cooperation of Professors Xu Cai and Wei Li for the organization are sincerely acknowledged. I thank all the members of the organizing committee and scientific committee for their help in the preparation and organization of the event. I would like to express thanks to *Chinese Science Bulletin* for publishing this pro-

ceedings, to Professor Guilu Long and Mr. Shujun Sun for their editing work, and to all the participants for their interesting presentations and discussions. Last but not least, I would like to thank Professor Dmitrii Tayurskii from Kazan Federal University in Russia for proposing to host the next SPMCS workshop at his University in August 2012.

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