



«ETTORE MAJORANA» FOUNDATION AND CENTRE FOR SCIENTIFIC CULTURE
TO PAY A PERMANENT TRIBUTE TO ARCHIMEDES AND GALILEO GALILEI, FOUNDERS OF MODERN SCIENCE
AND TO ENRICO FERMI, THE "ITALIAN NAVIGATOR", FATHER OF THE WEAK FORCES



INTERNATIONAL SCHOOL OF COMPLEXITY

16th Course: *NONEXTENSIVE STATISTICAL MECHANICS, SUPERSTATISTICS AND BEYOND: THEORY AND APPLICATIONS IN ASTROPHYSICAL AND OTHER COMPLEX SYSTEMS*

ERICE-SICILY: 2 – 8 JULY 2019

Sponsored by the: Italian Ministry of Education, University and Scientific Research · Sicilian Regional Government · Museo Storico della Fisica e Centro Studi e Ricerche "Enrico Fermi"

PROGRAMME AND LECTURERS

Nonlinear Fokker-Planck equation and nonextensive statistical mechanics

• E.M.F. CURADO, CBPF, Rio de Janeiro, BR

q-statistics and random walks

• H.J. JENSEN, Imperial College, London, UK and CSH, Vienna AT

Kappa distributions in space plasmas out of equilibrium

• D.J. MCCOMAS, Princeton University, Princeton, NJ, US

Non-Gaussianity, heterogeneity and superdiffusion

• R. METZLER, University of Potsdam, DE

Nonlinear q-generalizations of quantum equations

• F.D. NOBRE, CBPF, Rio de Janeiro, BR

Non-thermal velocity distributions in the solar wind

• V. PIERRARD, Université Catholique de Louvain, BE

Constrained entropic functional variational problems

• A.R. PLASTINO, Universidad Nacional de la Provincia de Buenos Aires, AR

Non-Gaussian power grid frequency fluctuations and superstatistics

• B. SCHAEFER, Max Planck Institute, Goettingen, DE

Generalised entropies

• P. TEMPESTA, Universidad Complutense, Madrid, ES

Entropies for complex systems

• S. THURNER, Medical University of Wien and CSH Vienna, AT

Nonlinear wave-particle interaction and electron kappa distribution

• P. YOON, University of Maryland, College Park, MD, US

PURPOSE OF THE COURSE

After more than 140 years of impressive success there is no reasonable doubt that the Boltzmann-Gibbs (BG) entropy is the correct one to be used for a wide and important class of physical systems, basically those whose (nonlinear) dynamics is strongly chaotic i.e., for classical systems with positive maximal Lyapunov exponent, which are mixing and ergodic. However, a plethora of physical complex systems exists for which such simplifying dynamical hypotheses are violated; typical examples are those for which the maximal Lyapunov exponent vanishes, leading to sub-exponential sensitivity to the initial conditions, which can of course occur in a variety of mathematical ways. Corresponding anomalies are found in a variety of quantum systems as well. In order to statistically describe the dynamics of such systems, various generalised forms of statistical mechanics have been proposed such as those using the nonadditive entropies S_q (where q is a real number which, for $q=1$, recovers the BG entropy), kappa distributions (also known as q -Gaussians, where kappa is simply related to q), superstatistical approaches, among various others. In the last decades, these new generalised statistical mechanical formalisms have found a large variety of very successful applications, even beyond the realm of physics. This course aims to cover the most recent analytical, experimental, observational and computational aspects and examples where these new extended formalisms have found fruitful applications.

Topics include, but are not limited to: Generalised Central Limit theorems; Generalised Large Deviation theory; Low-dimensional nonlinear conservative and dissipative dynamical systems near the edge of chaos; Long-range-interacting many-body classical Hamiltonian systems; Complex networks; Area-law-like quantum systems; Applications in astrophysics, space and other plasma physics, geophysics, high energy physics, cosmology, granular matter, cold atoms, econophysics, theoretical and structural chemistry, biophysics, social systems, power grids, image and time series processing, among others.

APPLICATIONS

Persons wishing to attend the Course should apply writing to:

Professor Andrea Rapisarda
University of Catania and Infn, Italy, CSH Vienna, Austria
E-mail: andrea.rapisarda@ct.infn.it
E-mail: complexityerice2019@gmail.com

POETIC TOUCH

According to legend, Erice, son of Venus and Neptune, founded a small town on top of a mountain (750 metres above sea level) more than three thousand years ago. The founder of modern history — i.e. the recording of events in a methodic and chronological sequence as they really happened without reference to mythical causes — the great Thucydides (~500 B.C.), writing about events connected with the conquest of Troy (1183 B.C.) said: «After the fall of Troy some Trojans on their escape from the Achaei arrived in Sicily by boat and as they settled near the border with the Sicilians all together they were named Elymi: their towns were Segesta and Erice.» This inspired Virgil to describe the arrival of the Trojan royal family in Erice and the burial of Anchise, by his son Enea, on the coast below Erice. Homer (~1000 B.C.), Theocritus (~300 B.C.), Polybius (~200 B.C.), Virgil (~50 B.C.), Horace (~20 B.C.), and others have celebrated this magnificent spot in Sicily in their poems. During seven centuries (XIII-XIX) the town of Erice was under the leadership of a local oligarchy, whose wisdom assured a long period of cultural development and economic prosperity which in turn gave rise to the many churches, monasteries and private palaces which you see today. In Erice you can admire the Castle of Venus, the Cyclopean Walls (~800 B.C.) and the Gothic Cathedral (~1300 A.D.). Erice is at present a mixture of ancient and medieval architecture. Other masterpieces of ancient civilization are to be found in the neighbourhood: at Motya (Phoenician), Segesta (Elymian), and Selinunte (Greek). On the Aegadian Islands — theatre of the decisive naval battle of the first Punic War (264-241 B.C.) — suggestive neolithic and paleolithic vestiges are still visible: the grottoes of Favignana, the carvings and murals of Levanzo.

Splendid beaches are to be found at San Vito Lo Capo, Scopello, and Cornino, and a wild and rocky coast around Monte Cofano: all at less than one hour's drive from Erice.

More information about the other activities of the «ETTORE MAJORANA» FOUNDATION AND CENTRE FOR SCIENTIFIC CULTURE can be found on the WWW at the following address:
<http://www.ecsem.infn.it>

PLEASE NOTE

Participants are expected to arrive in Erice on July 2, no later than 5 p.m.

C. BECK – G. BENEDEK – G. LIVADIOTIS
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