



«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 STATISTICAL PHYSICS

20th Course: NEW TRENDS IN NONEQUILIBRIUM STOCHASTIC MULTISTABLE SYSTEMS AND MEMRISTORS

ERICE-SICILY: 18 – 21 OCTOBER 2019

Sponsored by the: Italian Ministry of Education, University and Scientific Research • Sicilian Regional Government • University of Palermo
• N.I. Lobachevsky State University of Nizhny Novgorod, Russia • Office of Naval Research (ONR)

PROGRAMME AND LECTURERS

Nonequilibrium distributions and relaxation times in a stochastic model of memristor

• N. AGUDOV, N.I. Lobachevsky State University of Nizhny Novgorod, RU

Noise and variability in oxide-based filamentary resistance switching devices

• S. BRIVIO, CNR-IMM, Agrate (MI), IT

Memcomputing: Leveraging memory and physics to compute efficiently

• M. DI VENTRA, University of California, San Diego, US

Organic memristive devices for neuromorphic applications

• V. EROKHIN, CNR-IMEM and University of Parma, IT

Noise-induced resistive switching studied by conductive atomic force microscopy

• D. FILATOV, N.I. Lobachevsky State University of Nizhny Novgorod, RU

Resistive multi-level NVM devices for high capacity storage and neuromorphic system applications

• S. KOVESHNIKOV, Institute of Microelectronics Technology, Russian Academy of Sciences, Moscow, RU

Towards experimental realization of collective dynamics of stochastic memristor-coupled artificial neurons

• A. MIKHAYLOV, N.I. Lobachevsky State University of Nizhny Novgorod, RU

Syntheses of metal oxide-based hybrid nanomaterials and their perspectives in neuromorphic applications

• G. TSELIKOV, Moscow Institute of Physics and Technology, Moscow, RU

Optoelectronic dynamic memristor systems based on two-dimensional crystals

• G. PANIN, Institute of Microelectronics Technology and High-Purity Materials, Russian Academy of Sciences, IMT RAS, Chernogolovka, RU

Dynamical aspects of resistance switching: Attractors, bifurcations, and ideal behaviour

• Y. PERSHIN, University of South Carolina, US

Quantum memristors and quantum neurons

• M. SANZ, University of Basque Country UPV/EHU, Bilbao, ES

Comparing biological and artificial memristive neurons

• S. SAVELEV, Loughborough University, UK

Real-time computing by memristor cellular nonlinear networks (M-CNN)

• R. TETZLAFF, Technische Universitaet Dresden, Dresden, DE

PURPOSE OF THE COURSE

Despite the impressive scenario of promising applications of memristors, nanomaterials and devices, there is still a serious fundamental problem to be solved before any further development in this scientific area and related technology, due to the role of multistability and noise affecting memristive system. The resistive switching, or “memristive effect”, has indeed a pronounced stochastic nature and, as revealed experimentally, resistive switching devices show multiple memory states. Therefore, the memristor appears as a multistable system, whose switching dynamics occurs in the presence of noise with intensity comparable to the height of energy barriers separating the stable and metastable states of the system. To use memristors as memory elements in resistive random-access memory (RRAM) and neuromorphic systems one needs to significantly extend the understanding of the resistive state switching process, while taking into account the multistability and the role of internal and external noise sources in the transient dynamics of such nonlinear systems.

While fitting the general context of complex system, metastability and the constructive role of noise in nonlinear systems, the aim of this meeting is to focus on memristor. The Conference indeed brings together leading experts and research groups, working on the development of memristors as building blocks for quantum and neuromorphic computing, but it is also addressed to scientists interested in the challenging problems connected with the dynamics of nonequilibrium multistable systems and memristor devices, from both theoretical and experimental point of view. The Conference will be a discussion forum to promote new ideas in this promising research field, concerning stochastic nonlinear models, phase transitions phenomena in memristive devices, control of memory lifetime, and memcomputing.

APPLICATIONS

Person wishing to attend the Course should apply via e-mail to:
Professor Bernardo Spagnolo – University of Palermo & INFN Catania, IT
E-mail: bernardo.spagnolo@unipa

PLEASE NOTE

Participants must arrive in Erice on October 18, no later than 13:00 p.m.

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.ccsen.infn.it>