



«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 NONEQUILIBRIUM PHENOMENA

## 1st Course: *1/f* NOISE FROM CONDENSED MATTER PHYSICS TO QUANTUM TECHNOLOGIES

ERICE-SICILY: 24 – 30 APRIL 2022

Sponsored by the: • Italian Ministry of Education, University and Scientific Research • Sicilian Regional Government  
• Julian Schwinger Foundation • Aalto School of Science, Applied Physics Letters  
• Dipartimento di Fisica e Astronomia “Ettore Majorana” University of Catania • CNR • IMM • INFN-Sezione Catania

### PROGRAMME AND LECTURERS

*Low-frequency noise in graphene and other 2D materials and devices*

• A. BALANDIN, University of California, Riverside, CA, US

*Decoherence due to 1/f noise*

• J. BERGLI, University of Oslo, NW

*Loss and noise in superconducting quantum circuits: materials, device designs, quantum computing*

• J. BYLANDER, Chalmers University of Technology, Gothenburg, SE

*Dynamics of low-energy excitations in disordered non-equilibrium quantum systems*

• C. ENSS, University of Heidelberg, DE

*Challenges to the implementations of superconducting qubits posed by microscopic phenomena inherent to superconducting films*

• L. FAORO, Google AI Quantum, Santa Barbara, CA, US

*Decoherence and quantum control of multilevel artificial atoms*

• G. FALCI, University of Catania, IT

*A review of electrically gated quantum-dot qubits and related noise sources*

• M. FRIESEN, University of Wisconsin-Madison, WI, US

*Intrinsic and extrinsic low-frequency noise phenomena in 2D materials*

• P. HAKONEN, Aalto University School of Science, Espoo, FL

*1/f noise and other noise channels in superconducting qubits: Modeling and simulation*

• J. KOCH, Northwestern University, Evanston, IL, US

*Sources of decoherence in superconducting quantum devices*

• S. KUBATKIN, Chalmers University of Technology, Gothenburg, SE

*1/f noise of electrons and magnons*

• S.L. RUMYANSTEV, CENTERA Laboratories, Warsaw, PL

*1/f Flux noise in superconducting qubits*

• C.C. YU, University of California, Irvine, CA, US

*Identifying material defects in superconducting quantum circuits*

• A. USTINOV, Karlsruhe Institute of Technology, Karlsruhe, DE

### PURPOSE OF THE COURSE

The aim of the Course is to give a broad overview of the current understanding of the phenomenon of  $1/f$  noise in condensed matter physics, with emphasis on its role in nanodevices for quantum information processing, quantum communication and in material science. With the advent of quantum technologies, the  $1/f$  noise field received an outburst of theoretical progress and experimental advances. By now, the field has reached a high maturity level both in material science and in the context of quantum information hardware, where nanoscale devices also play the role of quantum detectors. Noise with  $1/f$  spectrum is a major problem for superconducting, semiconducting and hybrid qubits and a key factor for scaling up the quantum computing technology. This specific noise type is also limiting the signal-to-noise ratio of quantum sensors.

The Course will bring together renowned experimental and theoretical physicists and engineers working on  $1/f$  noise both from the material science and the quantum computing perspectives. The course targets the audience of young researchers such as Ph.D. students and post-docs. It will also provide a venue for discussion of recent developments in the field for experts in electronic and quantum information technologies.

### APPLICATIONS

Persons wishing to attend the Course are requested to write to:

Prof.ssa Elisabetta Paladino  
Dipartimento di Fisica ed Astronomia  
Università di Catania, Italia  
E-mail: [elisabetta.paladino@dfa.unict.it](mailto:elisabetta.paladino@dfa.unict.it)

### • PLEASE NOTE

Participants must arrive in Erice no later than 12 a.m. on 24th April 2022.

### 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 Anchises, by his son Aeneas, 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 «Ettore Majorana» Foundation and Centre  
for Scientific Culture can be found on the WWW at the following address:  
<http://www.ccsem.infn.it>