«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 COSMIC RAY ASTROPHYSICS «MAURICE M. SHAPIRO»

21st Course: *ASTROPARTICLE PHYSICS: YESTERDAY, TODAY, AND TOMORROW*

ERICE-SICILY: 1 – 7 AUGUST 2018

Sponsored by the: • Italian Ministry of Education, University and Scientific Research • Sicilian Regional Government • U.S. National Science Foundation • Radboud University Nijmegen • NWO • APPEC • KIT • Springer • Nikhef • DESY Zeuthen • University of Delaware

PROGRAMME AND LECTURERS

Gravitational waves and detectors
Detections of gravitational waves
• G. GONZALEZ, Louisiana State University, Baton Rouge, LA, US

Historical introduction - basic properties of cosmic rays
Cosmic rays from the knee up to 10^17 eV
Radio detection of cosmic rays
• J. HÖRANDEL, Radboud University Nijmegen, Nijmegen, NL

IceCube: Opening a new window on the Universe from the South Pole
• F. HALZEN, UW-Madison, Madison, WI, US

Cosmic-ray direct detection
• P.S. MARROCCHESI, University of Siena, Siena, IT

Dark matter: astrophysical evidence
Beyond the cosmological standard model
Cosmic ray acceleration in the laboratory
• S. SARKAR, University of Oxford, UK & Niels Bohr Institute Copenhagen, DK

Introduction, key observations, electromagnetic acceleration processes and their rigidity ordering
Test uctuation approach, classical electromagnetic uctuation theory of linear waves, eigenmodes in unmagnetized and magnetized plasmas, MHD waves
Test particle approach, from the Boltzmann to leaky-box transport equations, diusive shock acceleration, stochastic acceleration, generation of power law particle spectra
• R. SCHLICKEISER, Ruhr-University Bochum, Bochum, DE

Propagation of cosmic rays in the Galaxy and Intergalactic Space
Air shower detection and the cosmic ray spectrum at high energy
• T. STANEV, University of Delaware, Newark, DE, US

Very-high-energy gamma-ray astronomy
• C. STEGMANN, DESY, Zeuthen, DE

What are extensive air showers and why are they useful?
Experimental data on the highest-energy cosmic rays and prospects for the future
• A. WATSON, University of Leeds, Leeds, UK

PURPOSE OF THE COURSE

Our understanding of the high energy universe has increased exponentially since the founding of ISCRA forty years ago. Since then, research on cosmic rays and high-energy astrophysics has made great progress towards understanding the high-energy Universe. The field, currently known as Astroparticle Physics, combines observation and theory across all accessible high energy observables (including, now, Gravitational Waves). In this 21st course we will review the progress made in the last four decades, look at today's developments, review gravitational wave physics and assess likely directions of tomorrow's research challenges. Astroparticle Physics encompasses a number of sub-disciplines and it is often difficult for young researchers to develop an overview and perspective of the whole field and how the field has affected our understanding of the cosmos and generated new questions yet to be resolved. This course will provide an overview from both lectures and discussions with experts in the field who have been chosen, in the ISCRA tradition, not only for their scientific work but also for their communication skills. It will also provide a perspective on the history of the sub-disciplines over the past 40 years and project to what might be learned from observatories/instruments in the future. The lunch, dinner, and Marsala room discussions provide a unique perspective of the experts' view the field, and many anecdotes that never enter scientific papers, but which influenced the scientists and their careers. Topics include: Neutrino astronomy, gravitational waves astronomy, the highest energy particles, acceleration and interactions of high energy radiation, balloon, satellite and ground based measurements of cosmic rays and gamma rays, propagation of high-energy radiation through the Universe, and the new space- or ground-based experiments of the near future.

APPLICATIONS

Persons wishing to attend the Course should apply writing to:

Professor Todor Stanev and Professor Jörg Hörandel
Louisiana State University, Baton Rouge, LA 70803, USA
E-mail: *wefel@phunds.phys.lsu.edu – wefel@Lsu.edu*

PLEASE NOTE

Participants are expected to arrive in Erice on August 1, no later than 5 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 Sicanians 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.ccsem.infn.it

J.R. HÖRANDEL – T.S. STANEV – J.P. WEFEL
DIRECTORS OF THE COURSE

A. ZICHICHI
PRESIDENT EMFCSC