«ETTORE MAJORANA» FOUNDATION AND CENTRE FOR SCIENTIFIC CULTURE

TO PAY A PERMANENT TRIBUTE TO GALILEO GALILEI, FOUNDER OF MODERN SCIENCE AND TO ENRICO FERMI, THE "ITALIAN NAVIGATOR", FATHER OF THE WEAK FORCES

INTERNATIONAL SCHOOL OF SUBNUCLEAR PHYSICS

SEARCHING FOR THE 'TOTALLY UNEXPECTED' IN THE LHC ERA

45th Course – ERICE-SICILY: 29 AUGUST - 7 SEPTEMBER 2007

Sponsored by the: • Italian Ministry of Education, University and Scientific Research • Sicilian Regional Government • • Academies of Sciences of Estonia, Georgia, Lithuania, Russia and Ukraine • Chinese Academy of Sciences • • Commission of the European Communities • European Physical Society • Italian National Institute for Nuclear Physics • • Weizmann Institute of Science • World Federation of Scientists • World Laboratory

PROGRAMME AND LECTURERS

OPENING LECTURE

Beyond Higgs
• W.A. BARDEEN, Fermilab, Batavia, IL, USA

HOT THEORETICAL TOPICS

Is N=8 Supergravity Ultraviolet Finite?
• Z. BERN, UCLA, Los Angeles, CA, USA

Warped Dimensions
• L. RANDALL, Harvard University, Cambridge, MA, USA

The Entropic Principle and the Landscape in SUSY Gauge Theories
• H. OOGURI, CALTECH, Pasadena, CA,USA

Physics of String Flux Compactification
• M.R. DOUGLAS, IHES, Bures-sur-Yvette, F; Rutgers University, Piscataway, NJ, USA

Extremal Black-Holes and Attractors
• S. FERRARA, CERN, Geneva, CH; UCLA, Los Angeles, CA, USA

Demystifying QM: Will There be hints from LHC?
• G. 't HOOFT, Utrecht University, NL

Can ν–Mass Be Originated from Lorentz Violation?
• S.L. GLASHOW, Boston University, MA, USA

Exotic Mesons
• L. MAIANI, University of Rome 'La Sapienza', I

QCD PROBLEMS

Physics of the Light Quarks
• H. LEUTWYLER, University of Bern, CH

AdS / QFT and QCD
• S.J. BRODSKY, SLAC, Menlo Park, CA, USA

The Color Glass Condensate and the Glasma
• L. MCLERRAN, Brookhaven National Laboratory, Upton, NY, USA

BFKL Equation and Anomalous Dimensions in N=4 SUSY
• L.N. LIPATOV, St. Petersburg Nuclear Physics Institute, RU

HIGHLIGHTS FROM LABORATORIES

BNL: *RHIC*
• T.D. LEE, Columbia University, New York, NY, USA
• B. JACAK, SUNY, Stony Brook, NY, USA

CERN:
• R. AYMAR, CERN, Geneva, CH

CERN – GRAN SASSO: *OPERA*
• Y. DECLAIS, IN2P3/CNRS, Villeurbanne, F

DESY:
• A. WAGNER, DESY, Hamburg, D

FERMILAB:
• P.J. ODDONE, Fermilab, Chicago, IL, USA

GRAN SASSO:
• E. COCCIA, LNGS, L'Aquila, and University of Rome 'La Sapienza', I

SUPERKAMIOKANDE:
• M. KOSHIBA, University of Tokyo, Kamioka, Gifu, J

SEMINARS ON SPECIALIZED TOPICS

Complexity at the Fundamental Level: Consequences for LHC
• A. ZICHICHI, CERN, Geneva, CH; INFN and University of Bologna, I

Double β Decays
• E. FIORINI, University of Milano-Bicocca, I

Rare Decays in the 3rd Family
• M. GIORGI, INFN and University of Pisa, I

Problems with the 3 Neutrinos
• A. BETTINI, INFN and University of Padua, I

Dark Matter and Dark Energy
• E.W. KOLB, University of Chicago, IL, USA

PROBLEMS OPEN FOR COMPETITION

THE FIRST GROUP: MIXINGS
- *Why Nature needs the flavour mixing mechanisms?*
- *Why this mechanism produces different results in the Quark and in the Lepton sectors?*
- *What is the origin of this mechanism which does not exist in any other fundamental interaction?*

THE SECOND GROUP: ELEMENTARY AND COMPOSITE STATES
- *Is there any reason why composite ($q\bar{q}$) or ($l\bar{l}$) scalar particles have never been clearly established?*
- *Is there a fundamental reason why elementary fermions exist (Quarks and Leptons) but not elementary scalars in the same mass range?*
- *Do we really need sterile neutrinos? If yes, why? If not, why?*

THE THIRD GROUP: SYMMETRY BREAKINGS
- *Why the various global Symmetry breakings (C, P, CP, T) are not via the SSB mechanism?*
- *To what extent can we be confident that the Supersymmetry breaking threshold is not at the Planck Scale?*
  (If this were the case it would be impossible to find at LHC any evidence for Supersymmetry).
- *Are we really sure that the E-W Symmetry breaking which occurs at the Fermi Scale is due to the existence of an imaginary mass in the Lagrangian?*
  (If this were not the case, it would not be possible to find at LHC any evidence for Higgs particles).

INVITED SCIENTISTS

- R. ARNOWITT, Texas A&M University, College Station, TX, USA
- R. BALBINOT, INFN and University of Bologna, I
- L. CIFARELLI, INFN and University of Bologna, I
- D. HAIDT, DESY, Hamburg, D
- P.W. HIGGS, University of Edinburgh, Scotland, UK
- R.D. KENWAY, University of Edinburgh, Scotland, UK
- P. NATH, Northeastern University, Boston, MA, USA
- L. SUSSKIND, Stanford University, CA, USA
- H. WENNINGER, CERN, Geneva, CH

DISCUSSION SESSIONS ORGANIZERS
• A. ZICHICHI, CERN, Geneva, CH; INFN and University of Bologna, I
• S. ARCELLI, INFN and University of Bologna, I
• C. ZAMPOLLI, INFN, Bologna, and Enrico Fermi Centre, Rome, I

NEW TALENT'S SESSIONS ORGANIZERS
• G. 't HOOFT, Utrecht University, NL
• D. HAIDT, DESY, Hamburg, D
• R. BALBINOT, INFN and University of Bologna, I

POSTER SESSIONS ORGANIZERS
• L. CIFARELLI, INFN and University of Bologna, I
• F. NOFERINI, INFN, Bologna, and Enrico Fermi Centre, Rome, I

Board of Lecturers and Invited Scientists: In addition to the Lecturers, a group of distinguished physicists is invited to contribute to the lively intellectual atmosphere of the School by participating in the discussions following the Lectures. Lecturers and Invited Scientists will take part in the selection of the **New Talents** to be admitted at the School and in the award of the various scholarships and grants open for competition.

A worldwide competition is open to select **New Talents**. The competition starts with the participation to this year School. Young fellows who think they have the ability to compete for the **New Talents** are invited to apply at this year's School. There are **fifty places available** and those selected will be offered the fees of the School plus full board and lodging in Erice for the period of the School. Applications for the **fifty places available** should be sent as soon as possible to the Director of the School. A Permanent Committee (**PC**) composed by the Lecturers and the Invited Scientists will take decisions in real time, i.e. not later than two weeks after the arrival of the letter of application. At the end of the School the **Best Student** will be selected and twenty-one Diplomas awarded to the **Best New Talents** from the fifty admitted. The same **PC** will decide on the winners of the competition open for the nine problems and on the special Prizes to be awarded for each solution. The solutions must be presented at the Special Sessions of the School.

Special Sessions for New Talents: One of the aims of the School is to encourage and promote young physicists to achieve recognition at an international level. There will be poster sessions whereby each student will have the privilege of presenting the results of current studies and interacting with other participants to their mutual benefit. Each student may also propose a contribution for open presentation. The Board of Lecturers and Invited Scientists will select the best proposals. Priority will be given to the new material of either experimental or theoretical nature, especially if the candidate has made an important contribution to the results to be presented. A review paper has lower priority and, as before, will only be selected if the candidate can point out some new features in the field reviewed. Due to the large number of students and the limited time available, it is obvious that only selected 'New Talents' can be given the possibility of making themselves known. The selection will be based solely on 'scientific excellence', without favour to geographical distribution, the Laboratory or the University of origin.

PURPOSE OF THE SCHOOL

Waiting for the LHC first results, the present status of Subnuclear Physics is characterized by an intense theoretical work on fascinating topics which, unfortunately, are not easily amenable to experimental verification. Meanwhile, the highlights from all Labs will be presented and fully discussed with all participants – invited scientists, lecturers, students – in the most exciting sessions of the School. We must really consider the possibility that, from the existing facilities at CERN and in other laboratories, a totally unexpected discovery could finally show up; this should indeed be the case if Complexity exists at the fundamental level.

APPLICATIONS

Interested candidates should send a letter to the Director of the School:

Professor Antonino ZICHICHI
CERN
CH-1211 GENEVA 23, Switzerland

Needed:
i) date of birth and present activity;
ii) nationality;
iii) letter of recommendation from a senior physicist.

To honour the memory of Victor Weisskopf, the *WORLD FEDERATION OF SCIENTISTS* (WFS) has established a commemorative fund to support needy students. Students in need of financial support should apply for this fund, specifying their needs (i.e. participation fee only or also travel expenses) at the time of the application to the School.

- *PLEASE NOTE*

Participants must arrive in Erice on August 29, not later than 5 p.m.

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

G. 'T HOOFT – A. ZICHICHI
CO-DIRECTORS OF THE COURSE

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.

DIPLOMAS for the Best Students

The following Diplomas have been established in honour of, and named after, the late physicists:

JOHN S. BELL	ROBERT HOFSTADTER	GIULIO RACAH
PATRICK M.S. BLACKETT	GUNNAR KÄLLEN	BRUNO ROSSI
JAMES CHADWICK	YUVAL NEEMAN	ANDREIJ D. SAKHAROV
RICHARD H. DALITZ	GIUSEPPE P.S. OCCHIALINI	VICTOR F. WEISSKOPF
PAUL A.M. DIRAC	BRUNO PONTECORVO	EUGENE P. WIGNER
SERGIO FUBINI	ORESTE PICCIONI	BJORN H. WIIK
VLADIMIR N. GRIBOV	ISIDOR I. RABI	CHIEN SHIUNG WU

These Diplomas will be awarded at the end of the Course by the Board composed of the Lecturers and the Invited Scientists.

A. ZICHICHI
DIRECTOR OF THE SCHOOL