



«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

ETTORE MAJORANA CENTENARY



INTERNATIONAL SCHOOL OF SUBNUCLEAR PHYSICS

44th Course: HOMAGE TO RICHARD H. DALITZ

THE LOGIC OF NATURE,
COMPLEXITY AND NEW PHYSICS:
FROM QUARK-GLUON PLASMA TO SUPERSTRINGS,
QUANTUM GRAVITY AND BEYOND

ERICE-SICILY: 29 August - 7 September 2006

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 • Weizmann Institute of Science • World Federation of Scientists • World Laboratory

PROGRAMME

A. ZICHICHI
DIRECTOR OF THE SCHOOL AND PRESIDENT EMFCSC

INTERNATIONAL SCHOOL OF SUBNUCLEAR PHYSICS

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PROGRAMME AND LECTURERS

HOMAGE TO RICHARD H. DALITZ

Wednesday, 30 August

CHAIR: A. ZICHICHI

OPENING LECTURE

Complexity at the Fundamental Level

- A. ZICHICHI, CERN, Geneva, CH; INFN & University of Bologna, I

The Landscape and its Physics Foundations

- L. SUSSKIND, Stanford University, CA, USA

Complexity and Landscape in String Theory – I

- F. DENEFF, Katholieke Universiteit Leuven, B & Rutgers University, NJ, USA
- M.R. DOUGLAS, IHES, Bures-sur-Yvette, F & Rutgers University, NJ, USA

The Status of Lattice QCD – I

- R.D. KENWAY, University of Edinburgh, Scotland, UK

Complexity and Nonextensive Statistical Mechanics - Theory, Experiments, Observations, and Computer Simulations – I

- M. GELL-MANN, Institute for Complexity, Santa Fe Institute, NM, USA
- C. TSALLIS, Institute for Complexity, Santa Fe Institute, NM, USA

PROBLEMS OPEN FOR COMPETITION

THE FIRST GROUP: MIXINGS

- *Why Nature needs the flavour mixings mechanism?*
- *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?*

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Thursday, 31 August

CHAIR: G. 't HOOFT

THE FIRST BEST STUDENT CELEBRATING THE FIRST MAJORANA CENTENARY

Neutrino Masses, Leptogenesis and Beyond:

The Incredible Foresight of Ettore Majorana – I

- H. HARARI, Weizmann Institute of Science, Rehovot, IL

How String Theory Generates the Landscape – II

- L. SUSSKIND, Stanford University, CA, USA

Complexity and Landscape in String Theory – II

- F. DENEFF, Katholieke Universiteit Leuven, B & Rutgers University, NJ, USA
- M.R. DOUGLAS, IHES, Bures-sur-Yvette, F & Rutgers University, NJ, USA

The Status of Lattice QCD – II

- R.D. KENWAY, University of Edinburgh, Scotland, UK

Complexity and Nonextensive Statistical Mechanics - Theory, Experiments, Observations, and Computer Simulations – II

- M. GELL-MANN, Institute for Complexity, Santa Fe Institute, NM, USA
- C. TSALLIS, Institute for Complexity, Santa Fe Institute, NM, USA

PROBLEMS OPEN FOR COMPETITION

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?*

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Friday, 1 September

CHAIR: A. ZICHICHI

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Neutrino Masses, Leptogenesis and Beyond:

The Incredible Foresight of Ettore Majorana – II

- H. HARARI, Weizmann Institute of Science, Rehovot, IL

How String Theory Generates the Landscape – III

- L. SUSSKIND, Stanford University, CA, USA

Complexity and Landscape in String Theory – III

- F. DENEFF, Katholieke Universiteit Leuven, B & Rutgers University, NJ, USA
- M.R. DOUGLAS, IHES, Bures-sur-Yvette, F & Rutgers University, NJ, USA

SLAC: *Towards New Physics with Rare Processes in CP Violation*

- M. GIORGI, University of Pisa, I

Complexity and Nonextensive Statistical Mechanics - Theory, Experiments, Observations, and Computer Simulations – III

- M. GELL-MANN, Institute for Complexity, Santa Fe Institute, NM, USA
- C. TSALLIS, Institute for Complexity, Santa Fe Institute, NM, USA

PROBLEMS OPEN FOR COMPETITION

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 at LHC to find 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 at LHC to find any evidence for Higgs particles).*

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Saturday, 2 September

CHAIR: G. 't HOOFT

QCD at Low Energy: The Simplicity of Complex non-Perturbative Phenomena – I

• G. COLANGELO, University of Bern, CH

How String Theory Generates the Landscape – IV

• L. SUSSKIND, Stanford University, CA, USA

GRAN SASSO: *Neutrino Beams from CERN*

• E. COCCIA, LNGS, L'Aquila, I

FERMILAB: *Tevatron Physics – I*

• N. LOCKYER, University of Pennsylvania, Philadelphia, PA, USA

BNL: *Evidence for a Quark-Gluon Plasma at RHIC – I*

• J.W. HARRIS, Yale University, New Haven, CT, USA

PROBLEMS OPEN FOR COMPETITION

OTHER PROBLEMS

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Sunday, 3 September

CHAIR: A. ZICHICHI

QCD at Low Energy: The Simplicity of Complex non-Perturbative Phenomena – II

• G. COLANGELO, University of Bern, CH

Complexity in Stochastically Quantized Field Theories and Standard Model Parameters – I

• C. BECK, University of London, UK

FERMILAB: Tevatron Physics – II

• N. LOCKYER, University of Pennsylvania, Philadelphia, PA, USA

DISCUSSION

INTERNATIONAL SCHOOL OF SUBNUCLEAR PHYSICS

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Monday, 4 September

CHAIR: G. 't HOOFT

Black Holes, Attractors and Quantum Information – I

- M.J. DUFF, Blackett Laboratory, Imperial College London, UK

Complexity in Stochastically Quantized Field Theories and Standard Model Parameters – II

- C. BECK, University of London, UK

DESY: Diffraction at the Scale of Quarks and Gluons

- B. LOEHR, DESY, Hamburg, D

BNL: Evidence for a Quark-Gluon Plasma at RHIC – II

- J.W. HARRIS, Yale University, New Haven, CT, USA

Dick Dalitz. Examples of His Contributions to Particle Physics

- G.R. GOLDSTEIN, Tufts University, Medford, MA, USA

PROBLEMS OPEN FOR COMPETITION

OTHER PROBLEMS

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Tuesday, 5 September

CHAIR: A. ZICHICHI

Black Holes, Attractors and Quantum Information – II

- M.J. DUFF, Blackett Laboratory, Imperial College London, UK

The Future of Supercomputers

- R. PETRONZIO, University of Rome II & INFN, Rome, I

How to Detect Extradimensions

- I. ANTONIADIS, CERN, Geneva, CH

CERN: LHC upgrade

- H. WENNINGER, CERN, Geneva, CH

PROBLEMS OPEN FOR COMPETITION

OTHER PROBLEMS

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Wednesday, 6 September

CHAIR: G. 't HOOFT

Black Holes, Attractors and Quantum Information – III

- M.J. DUFF, Blackett Laboratory, Imperial College London, UK

About Quantum Mechanics

- G. 't HOOFT, Utrecht University, NL

Conclusions

- A. ZICHICHI, CERN, Geneva, CH; INFN & University of Bologna, I

CELEBRATION of the 60th ANNIVERSARY
of the 1st NEW TALENT of the ISSP