

International Workshop at the ECT* on
FUNDAMENTAL INTERACTIONS

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Organized by:

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Scientific Motivation

In spite of the astounding success the Standard Model enjoys in describing the strong and electroweak forces, the existence of new fundamental interactions is expected, for several compelling theoretical reasons and especially because of the recent observations of neutrino oscillations. More experimental clues are urgently needed to distinguish among the many proposed speculative extensions of the Standard Model and to guide new model building.

The big accelerator centers of particle physics are not the only arena in which the search for new interactions is being conducted. In fact, nuclear physics facilities, low and intermediate energy, offer unique opportunities to contribute to this quest. NuPECC recognized this by the formation of a working group on Fundamental Interactions which participated in the formulation of the long-range plan for nuclear physics within Europe.

Some of the most central and intriguing questions that face the field in the near future, and that are within the realm of nuclear physics, are the following:

- In order to learn about the nature of the neutrinos the mixing parameters must be determined and precise measurements of the absolute masses are needed. Double β -decay experiments should be pursued to settle the question of neutrinos being Dirac or Majorana particles.
- Searches for electric dipole moments in different systems (neutron, nuclei, atoms, molecules) have a very high potential to discover new sources of CP violation which are required by baryo/leptogenesis models.
- Processes that violate baryon or lepton number or lepton flavor are extremely suited to constrain speculative extensions of the Standard Model.
- Correlation measurements in β -decay can reveal non-V–A contributions to weak processes.
- Parity nonconservation in atoms and in electron-nucleon scattering.
- Speculations about violation of CPT and Lorentz invariance.
- Possible time dependence of fundamental “constants”, such as the fine-structure constant.

The workshop has the goal to pursue in depth these physics issues, and to identify where well-founded input from theory is needed. The program foresees ample time for discussion.

Program:

	Monday	Tuesday	Wednesday	Thursday	Friday
		β -decay Wilschut	Simple atoms Simons	β -decay Severijns	EDM Liu
	Registration	Herczeg	Pachucki	Naviliat	Semertzidis
Coffee					
	Opening Parity Corradi	Double- β Klapdor Giuliani	Prec. expt's Semertzidis Glück	Neutrino's Lindner Vissani	Final discussion
Lunch					
	Parity/EDM Sapirstein Khriplovich	Neutron/EDM Abele Pilaftsis	Free	T-violation Beyer Eversheim	
Coffee					
	EDM/CP-viol. Onderwater Bernreuther	Fund.const. Murphy Karshenboim	Free	EDM Kirch Willmann	
Dinner					

Titles of the talks:

- Hartmut Abele: The neutron and the Standard Model.
- Werner Bernreuther: Baryogenesis: a mini-review.
- Michael Beyer: Test of T-symmetry in proton-deuteron forward scattering.
- Lorenzo Corradi: Atomic parity nonconservation experiments with radioactive beams.
- Dieter Eversheim: TRIC - a Time Reversal Invariance test at the Cooler synchrotron COSY at Juelich.
- Andrea Giuliani: The bolometric technique as a powerful tool to study neutrinoless double beta decay.
- Ferenc Glück: Absolute neutrino mass determination with the KATRIN experiment.
- Peter Herczeg: Beta decay beyond the Standard Model.
- Savely Karshenboim: Precision tests of QED and the fine-structure constant.
- Yosif Khriplovich: Electric dipole moments: Nuclei and ions.
- Klaus Kirch: Towards a source of ultracold neutrons and a neutron EDM measurement at PSI.
- Hans Klapdor-Kleingrothaus: Evidence for neutrinoless double beta decay - and consequences.
- Manfred Lindner: The path to leptonic CP violation.
- Cheng-Pang Liu: P- and T-odd NN interaction and the deuteron EDM.

- Michael Murphy: The search for varying fundamental constants with quasar spectra.
- Oscar Naviliat-Cuncic: Measurements of P and T violating correlations in beta and muon decays.
- Gerco Onderwater: Deuteron EDM: Experimental aspects.
- Krzysztof Pachucki: NRQED of light atoms.
- Apostolos Pilaftsis: Electric dipole moment constraints on baryogenesis.
- Jonathan Sapirstein: Calculation of radiative corrections in cesium.
- Yannis Semertzidis: Theoretical and experimental considerations of past and future muon $g - 2$ measurements.
- Yannis Semertzidis: Electric dipole moments in storage rings.
- Nathal Severijns: Weak interaction studies in beta-decay: unitarity and exotic weak currents.
- Leo Simons: Determination of the pion-nucleon coupling constant from pionic hydrogen experiments.
- Francesco Vissani: Some questions about neutrinos of fundamental interest (or fundamentally interesting).
- Lorenz Willmann: Search for EDMs of radioactive atoms.
- Hans Wilschut: Atomic trapping and recoil spectroscopy in beta-decay (and other) studies.

Other participants:

- Lex Dieperink
- Klaus Jungmann
- Gisbert zu Putlitz
- Rob Timmermans
- Christian Weinheimer