Course title:

Standard Model of Fundamental Interactions

Duration [number of hours]: 12

PhD Program [MERC/MPS/SPACE]: SPACE

Name and Contact Details of Unit Organizer:

Prof. Francesco Sannino
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Course Description [max 150 words]:

The course introduces the student to the fascinating world of fundamental interactions. The students will learn how to fuse quantum field theory, group theory and other deep mathematical tools to bridg the gap between theory and experiments in particle physics. We will arrive at the frontier of our understanding of the ultimate laws of nature.

Syllabus [itemized list of course topics]:

Topics coverd in the course:

- Introduction to Fundamental Interactions
- Scales of Nature
- The Quark Model
- Elements of Group Theory
- Classical Symmetries and Asymptotic Freedom
- Effective Theories I: From the isospin Symmetry to the Goldstone Theorem
- Effective Theories II: From the sigma model to non-linear realisations
- Standard Model and Origin of Mass
- What comes next?
- From SUSY to Composite Dynamics
- Grand Unified Theories

Assessment [form of assessment, e.g. final written/oral exam, solutions of problems during the course, final project to be handed-in etc.]:

Oral exam

Suggested reading and online resources:

References:

Fundamental Interactions, Francesco Sannino's Notes
Gauge Theory of elementary particle physics, Cheng and Li, Oxford press
An Introduction to Quantum Field Theory, Peskin and Schroeder, Addison Wesley press.
Dynamics of the Standard Model, Donoghue, Golowich, Holstein, Cambridge press.
Particle Physics and Introduction to Field Theory, T.D.Lee. Columbia Univ. Contemporary Concepts in Physics, Volume 1.

Quantum Chromodynamics, Greiner and Schäfer, Springer.

Fundamental Composite Dynamics: A Review. Giacomo Cacciapaglia, Claudio Pica and Francesco Sannino. Physics Reports, Elsevier