PHYS-817 **Supersymmetry**

Vecchi Luca

Cursus	Sem.	Type
Physics		Opt.

Language of teaching	English
Credits	1
Session	
Exam	Oral presentation
Workload	30h
Hours	**18**
Courses	18
Number of positions	

Frequency

Only this year

Remark

Introductory course on Supersymmetry, the unique quantum extension of the symmetry principles of Relativity. Standard Model and non-perturbative phenomena in quantum field theory. Oct. 8th-Nov. 12th

Summary

Supersymmetry is the unique quantum extension of the symmetry principles of relativity. This course offers a first but broad introduction covering the role of Supersymmetry in our understanding of both physics beyond the Standard Model and non-perturbative phenomena in quantum field theory.

Content

Introduction
-- Motivations (Coleman-Mandula, Unification with Gravity, Naturalness, non-perturbative QFT)
-- Weyl spinors
-- The Wess-Zumino model and SUSY transformations

N=1 Supersymmetry algebra
-- Action of SUSY algebra on 1-particle states
-- Action of SUSY algebra on fields (off-shell and on-shell formulations)
-- Comments on extended Supersymmetry

Supersymmetric field theory
-- Superspace
-- General SUSY Lagrangians of chiral superfields
-- SUSY Gauge symmetry, Super-Higgs Mechanism

Minimal Supersymmetric Standard Model (MSSM)
-- motivations for low scale SUSY
-- soft SUSY terms
-- electro-weak symmetry breaking
-- R-parity
-- mu-term
-- collider bounds and Higgs mass
-- unification
-- the flavor problem.

Introduction to non-perturbative aspects of N=1 Supersymmetry
-- non-renormalization of superpotential in the Wess-Zumino model
-- all-order beta function of Super Yang-Mills

-- Affleck-Dine-Seiberg superpotential
-- notions of Seiberg duality.

Note

https://moodle.epfl.ch/course/view.php?id=16400?

Keywords

Supersymmetry, Minimal Supersymmetric Standard Model, the Hierarchy Problem

Learning Prerequisites

Required courses

Quantum Field Theory

Learning Outcomes

- build Supersymmetric particle physics models
- understand their phenomenological implications

Resources

Bibliography

"Introducing Supersymmetry" (Sohnius), "Supersymmetry and Supergravity" (Bagger-Wess), "A Supersymmetry Primer" (Martin), "Superspace, or One thousand and one lessons in supersymmetry" (Gates et al.), "Advanced Topics in Quantum Field Theory" (Shifman)

Ressources en bibliothèque

- Introducing supersymmetry (Sohnius)
- Supersymmetry and Supergravity (Bagger-Wess)
- A Supersymmetry Primer (Martin)
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- Advanced Topics in Quantum Field Theory (Shifman)