HE395 August 3:0

Quantum Field Theory I

Instructor

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Teaching Assistant

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Department: CHEP

Course Time: MWF 9-10

Lecture venue: LH3

Detailed Course Page:

Announcements

Brief description of the course

First course on field theory, combining special theory of relativity with quantum mechanics. Foundational for research in particle physics. Core for those wanting to work with CHEP faculty.

Prerequisites

QM-I, II

Syllabus

Scalar, spinor and vec

tor fields. Canonical quantisation, propagators.

Symmetries and Noether

theorem. Path integrals for bosonic and

fermionic fields, generating functionals. Feynman diagrams.

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matrix, LSZ reduction formula. Interacting scalar and Yukawa theories.

Covariant d

erivatives and

gauge theories. Quantum electrodynamics.

Gauge invariance, massless photons, Ward identity.

Elementary processes.

Scattering cross

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sections, optical theorem, decay rates. Loop diagrams,

power counting, divergences. Renormalization, fixed poi

nt classification.

One loop calculations in

QED. Callan

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Symanzik equations, beta functions.

Effective field theory

Course outcomes

Students are equipped to start research in particle physics. More material would be taught in QFT-II.

Grading policy

20% HW, 30% mid-tem, 50% final exam

Assignments

Several problem sets given to coach students in problem solving towards research work.

Resources

Zee A., Quantum Field Theory in a Nutshell (Second edition), Princeton University Press, 2010.,Srednicki M., Quantum Field

Theory, Cambridge University Press, 2007.,Ryder L.H., Quantum Field Theory (Second edition), Cambrid ge University Press,

1996.,Ramond P., Field Theory: A Modern Primer (Second edition), Levant Books, 2007