

Description of the Program

Sept 4- November 20th

Pre-School: Review of QM and SR

Lecturer: Mishaal Hai

Lecture 0a: Group Theory Basics, Lorentz Group (Scalars, vectors and tensors under Lorentz)

Lecture 0b: $SU(N)$ and its Lie algebra

Lecture 0c: Crash course on basic Quantum Mechanics (Harmonic Oscillators, Ladder operators).

Phase 1: Foundations of Quantum Field Theory

Lecture 1-6 : Arpit Das

Lecture 1: Brief intro, Classical Field Theory, Noether's Theorem

Lecture 2: Representations of Lorentz group, massless and massive representations

Lecture 3: Klein-Gordon Field and its canonical quantisation

Lecture 4: Different types of Green's function and discussions on causality

Lecture 5: Spinors and the Dirac equation

Lecture 6: Quantisation of the Dirac field

Phase 2: Path Integrals

Lecture 7-9: Nafiz Ishtiaque

Lecture 7: Path integral formulation of Quantum Field Theory.

Lecture 8: Scalar Field Theory in Path Integral formalism and generating functionals

Lecture 9: Grassman Variables and Fermionic Path Integrals

Lecture 10-13: Subhroneel Chakrabarti

Lecture 10 & 11: Maxwell field (electromagnetic field), local gauge invariance and Path quantisation of the electromagnetic field.

Lecture 12, 13: Interaction pictures (QED) and Feynman diagrams.

Lecture 14-15 Nafiz Ishtiaque

Lecture 14: YM theory and Fadeev-Poppov Quantisation

Lecture 15: Feynman Propagator for non-abelian gauge theories, Ghost propagator, BRST symmetry

Phase 3: The Standard Model

Lecture 16-19 : Ahmed Rakin Kamal

Lecture 16-19 : Spontaneous Symmetry Breaking, Electroweak Interactions and Basics of QCD

Lecture 16: Spontaneous Symmetry Breaking and Goldstone's Theorem

Lecture 17: Higgs Mechanism and Electroweak Interactions

Lecture 18: Electroweak Interactions and QCD

Lecture 19: Basics of QCD

Phase 4: Seminars

1. Edward Witten (IAS, Princeton, USA) - An Introduction to black hole Thermodynamics.
2. John McGreevy (University of California, San Diego, USA) - TBD
3. Nabil Iqbal (Durham University, UK and University of Amsterdam, Netherlands) - TBD

Date and time (Bangladesh Standard Time)	Lecture	Lecturer/Speaker
13/09/2025, 7pm-9pm	Lecture 1	Arpit Das
15/09/2025, 7pm-9pm	Lecture 2	Arpit Das

19/09/2025, 7pm-9pm	Lecture 3	Arpit Das
20/09/2025, 7pm-9pm	Lecture 4	Arpit Das
26/09/2025, 7pm-9pm	Lecture 5	Arpit Das
27/09/2025, 7pm-9pm	Lecture 6	Arpit Das
03/10/2025, 7pm-9pm	Lecture 7	Nafiz Ishtiaque
04/10/2025, 7pm-9pm	Lecture 8	Nafiz Ishtiaque
10/10/2025, 7pm-9pm	Lecture 9	Nafiz Ishtiaque
11/10/2025, 7pm-9pm	Lecture 10	Subhroneel Chakrabarti
17/10/2025, 7pm-9pm	Lecture 11	Subhroneel Chakrabarti
18/10/2025, 7pm-9pm	Lecture 12	Subhroneel Chakrabarti
24/10/2025, 7pm-9pm	Lecture 13	Subhroneel Chakrabarti
25/10/2025, 7pm-9pm	Lecture 14	Nafiz Ishtiaque
31/10/2025, 7pm-9pm	Lecture 15	Nafiz Ishtiaque
01/11/2025, 7pm-9pm	Lecture 16	Ahmed Rakin Kamal
07/11/2025, 7pm-9pm	Lecture 17	Ahmed Rakin Kamal
08/11/2025, 7pm-9pm	Lecture 18	Ahmed Rakin Kamal
14/11/2025, 7pm-9pm	Lecture 19	Ahmed Rakin Kamal
15-25/11/2025	Seminars	Edward Witten, John McGreevy, Nabil Iqbal.