Particle Physics (15 Lectures, 45 hours)
By Merab Gogberashvili (TSU)

1. Review of Classical Physics (Some Concepts; Relativistically Invariant Field Equations; Particles and Forces).
2. Elements of Scattering Theory (Kinematics of Minkowski Spacetime; Golden Rules for Decays and Scatterings; Examples of calculation in QED).
3. Quantum Field Theory (Primary Quantization; Secondary Quantization; Path Integrals).
4. Introduction to Group Theory (Mathematical Descriptions of Groups; Lie Groups; Examples of Lie Groups).
5. Introduction to Group Theory (Mathematical Descriptions of Groups; Lie Groups; Examples of Lie Groups).
6. Spontaneous Symmetry Breaking (SSB in Condensed Matter; SSB in Field Theory; Higgs Mechanism in SM).
7. Predictions of the Standard Model (The SM Lagrangian; Predictions of the SM; Free Parameters in the SM).
8. Experimental Aspects of the Standard Model (Anatomy of an Experiment; Precision Testing of SM; Limitations of Particle Accelerators).
9. Introduction to QCD (Main Ingredients; Symmetry Breaking Patterns in QCD; Nonlinear σ-model).
10. Beyond the Standard Model (Problems with SM; Neutrino Masses; New Ingredients).
11. Supersymmetry (Supersymmetry Basics; The SUSY SM; SUSY Serches on LHC).
12. Flavor and CP Violation (Flavor physics in the SM; Effective QFT and Flavor Transitions; Flavor at High Energy).
13. Introduction to Renomalizations (Renormalization Schemes; BPH Renormalization; Power Counting and Renormalizability).
14. Grand Unification Models (GUT Idea; The Georgi-Glashow Model; SO(10) GUT).
15. Overview of the Course.