

MATH431 — Introduction to Modern Particle Theory

(Dr Thomas Teubner)

Content:

1. Lagrange and Hamilton formalism. Classical Field Theory
2. Klein Gordon equation. Solutions
3. Quantization
4. Interactions. Feynman diagrams
5. Lorentz and Poincare group
6. Local phase transformations. Electrodynamics
7. Dirac equation. Solutions
8. Classification of elementary particles: mass, spin, charge, iso-spin
9. Unitary groups
10. Global and local symmetries
11. Hadrons. Quark model. Strong interactions.
12. Weak interactions
13. Electro-Weak Standard Model. Higgs Mechanism
14. Unified Theories. Supersymmetry

Useful references:

1. M. Maggiore: ‘A Modern Introduction to Quantum Field Theory’ (Oxford Univ. Press, 2005) (comprehensive but still compact; more advanced than e.g. H+M)
2. F. Halzen and A.D. Martin: ‘Quarks and Leptons’ (Wiley, New York, 1984) (compact but complete, rather easy and not very formal)
3. P. Ramond: ‘Journeys beyond the Standard Model’ (Frontiers in Physics) (Westview Press, Perseus Books Group, 2003)
4. O. Nachtmann: ‘Elementary particle physics: concepts and phenomena’ (Springer) (more difficult but also more complete and more formalism)
5. T.-P. Cheng and L.-F. Li: ‘Gauge theory of elementary particle physics’ (Oxford) (more specific)
6. S. Weinberg: ‘The Quantum Theory of Fields’ (Cambridge) (more difficult; very comprehensive)
7. **Script** (your own notes from the lectures)