Relativistic Field Theory

(Ph. D. admission syllabus)

1. Lagrange formalism in classical field theory: variational principle, Euler—Lagrange equation, Noether theorem, canonical energy-momentum tensor, energy-momentum tensor of the electromagnetic field.

2. Physical and mathematical foundations of general relativity: Equivalence principle, Riemann geometry, Einstein equation, Newtonian limit. Schwarzschild spacetime.

3. Abelian Yang—Mills field: global and local phase symmetries, covariant derivative. Lagrange density of coupled Dirac and electromagnetic fields. Chiral states of Dirac fields. Abelian Higgs model, massive vector bosons.

4. Nonabelian Yang—Mills fields: global and local U(N) and SU(N) symmetries, covariant derivative, gauge transformation, field strength tensor, field equation, Lagrangian density.

5. Yang—Mills—Higgs part of Glashow—Salam—Wienberg model, the nonabelian Higgs mechanism.

Literature

1. M. Thomson: *Modern Particle Physics*. Cambridge University Press, 2013.
2. W. Greiner, B. Müller: *Gauge Theory of Weak Interaction*. Springer, 2009.
3. L. H. Ryder: *Quantum Field Theory*. Cambridge University Press, 1996.
4. R. M. Wald: *General Relativity*. University of Chicago Press, 1984.
5. M. P. Hobson, G. Efstathiou, A. N. Lasenby: *General Relativity: An Introduction for Physicists*. Cambridge University Press, 2006.