

# Field-theoretical Methods in the theory of condensed matter

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## Outline

1. Feynman's Path integral as alternative to the Schrödinger equation
2. Path-integral formulation of statistical mechanics
3. Langevin and Fokker-Planck equation
4. Path-integral formulation of polymer theory
5. Functional-integral treatment of quenched disorder: Replica theory
6. 2<sup>nd</sup> order phase transitions: From discrete models to field theories
7. Renormalization of  $\phi^4$  theory and Renormalization Group
8. Planar Heisenberg model and nonlinear  $\sigma$  model
9. Electrons in a random potential, localization and nonlinear  $\sigma$  model
10. Disordered phonons: Classical field theory and phonon localization
11. Anharmonic disordered phonons treated by finite-temperature quantum field theory

## Literature

- P. M. Chaikin, T. C. Lubensky, *Principles of condensed-matter physics*, Cambridge University Press 1995
- A. Altland, B. Simons *Condensed-matter field theory*, Cambridge University Press 2006
- H. Kleinert *Path integrals in quantum mechanics, polymer physics and financial markets* World Scientific NJ, USA, 2004