

Phys 501: Quantum Mechanics II

Lecturer: Fei Zhou

Time: MW 1230PM-200PM

Location: Hennings 302 Office Hrs: Tues 3-4pm, Hennings Room 345

<http://www.phas.ubc.ca/~feizhou/phys501,2019/>

I: Scattering theory

- 1) Basics Concepts and phenomenology
- 2) Partial wave expansion and phase shifts
- 3) The idea of transfer matrix
- 4) Born Approximation and beyond
- 5) Resonance scattering: scale and conformal symmetries
- 6) More contemporary stuff: Feshbach resonance in atomic gases

II: Dirac equations

- 1) Relativistic physics: General
- 2) Dirac equations and Dirac fermions
- 3) Massless limit of Dirac equations and Weyl fermions
- 4) Particles and anti-particles, and Majorana fermions
- 5) Non-relativistic limit of Dirac equations: Interactions with EM fields

III: Path Integrals I

- 1) Feynman's idea and general formulation
- 2) Transition amplitudes
- 3) Application I: understand the unitary evolution
- 4) Application II: to get spectrum
- 5) Applications III: quantum tunneling phenomena

IV: Path Integrals II

- 1) Coherent states;
- 2) Coherent state representation and paths;
- 3) Quantum spin coherent states;
- 4) Spin coherent representation and spin paths;
- 5) Bosonic path integrals and many-body stuff (Optional)
- 6) Fermionic path integrals and Grassman algebras (optional)

IV: Density matrices and entanglement entropy

Textbook: *Principles of quantum mechanics* (second edition), R Shankar (Springer).
UBC bookstore offers copies customized for Phys501.

More references will be added.