

# **Phys 402: Applications of Quantum Mechanics (Winter, 2016)**

Lecturer: Fei Zhou

Time: Tu, Th 930-1100AM

Location: Hebb 12

## **I: Perturbation theory (time-independent)**

- 1) Non-degenerate and degenerate perturbation theory;
- 2) Applications in atomic systems (see also Part V):  
Spin-orbit coupling; Lamb-Shift; Hyperfine coupling;
- 3) Applications in solid states, Rashba Model;
- 4) Applications to ultra-cold atomic matter: a brief introduction.

## **II: Variational principle and method**

- 1) Variational Principle;
- 2) Feynman-Hellmann Theorem;
- 3) Applications to molecule physics;
- 4) Born-Oppenheimer Approximation.

## **III: WKB method**

- 1) Basic ideas of semi-classical expansion;
- 2) Various applications.

## **IV: Time-dependent perturbations**

- 1) Basic concepts;
- 2) Rabi oscillations as coherent perturbations;
- 3) Resonance dynamics;
- 4) Emission and absorption;
- 5) Geometric Berry's phases in adiabatic evolution.

## **V: Spin and angular momentum algebras**