

PHYS5701 Quantum Mechanics I (Spring 2018)

Class Schedule as of March 22, 2018

Reading assignments from *Modern Quantum Mechanics, 2e* (Cambridge 2017) by J.J. Sakurai and J. Napolitano

| Day | Date | Topics | Reading | HW Due |
|-------------------------------|--------|--|----------|------------|
| Tue | 16 Jan | The Stern-Gerlach Experiment; States and Dirac Notation | 1.1, 1.2 | — |
| Thu | 18 Jan | The Matrix Representation of Quantum Mechanics | 1.3 | — |
| Tue | 23 Jan | Measurements and Observables; Uncertainty in Measurements | 1.4 | — |
| Thu | 25 Jan | Unitary Transformations and the Change of Basis | 1.5 | #1 |
| Tue | 30 Jan | Continuous Eigenvalues: Positions, Translations, and Momentum | 1.6 | — |
| Thu | 1 Feb | The Wave Function: States Represented by Position or Momentum | 1.7 | — |
| Tue | 6 Feb | Time Evolution, the Hamiltonian, and Schrödinger's Equation | 2.1 | — |
| Thu | 8 Feb | The Schrödinger's Picture and the Heisenberg Picture | 2.2 | #2 |
| Tue | 13 Feb | The Simple Harmonic Oscillator in One Dimension using Operator Methods | 2.3 | — |
| Thu | 15 Feb | Projection onto Position Space: The Schrödinger Wave Equation | 2.4 | — |
| Tue | 20 Feb | Elementary Solutions to Schrödinger's Wave Equation | 2.5 | — |
| Thu | 22 Feb | The linear potential; The WKB approximation | 2.5 | #3 |
| Wed | 28 Feb | Propagators and the Feynman Path Integral formalism | 2.6 | — |
| Thu | 1 Mar | Gauge Transformations and the Aharonov-Bohm Effect | 2.7 | — |
| March 5-9 Spring Break | | | | |
| Tue | 13 Mar | Rotations, Angular Momentum, and Application to Spin-1/2 | 3.1, 3.2 | — |
| Thu | 15 Mar | Finite Rotations and Continuous Groups SO(3) and SU(2) | 3.2, 3.3 | #4 |
| Tue | 20 Mar | The Density Operator; Pure and Mixed Ensembles | 3.4 | — |
| Thu | 22 Mar | No class - Snowstorm | | — |
| Tue | 27 Mar | Eigenvalues and Eigenstates of Angular Momentum | 3.5 | — |
| Thu | 29 Mar | Angular Momentum in the Position Basis; Orbital Angular Momentum | 3.6 | #5 |
| Tue | 3 Apr | The Schrödinger Equation in Spherically Symmetric Potentials | 3.7 | — |
| Thu | 5 Apr | The Addition of Angular Momentum; Clebsch-Gordan Coefficients | 3.8 | — |
| Tue | 10 Apr | Hidden Variable Theories, Spin Correlations, and Bell's Inequality | 3.10 | — |
| Thu | 12 Apr | Tensor Operators and the Wigner-Eckart Theorem | 3.11 | #6 |
| Tue | 17 Apr | Symmetries, Conservation Laws, and Degeneracies | 4.1 | — |
| Thu | 19 Apr | Discrete Symmetries; The Parity Transformation | 4.2 | — |
| Tue | 24 Apr | Lattice Translation as a Discrete Symmetry; Bloch's Theorem | 4.3 | — |
| Thu | 26 Apr | Anti-Unitary Operators; Time Reversal as a Discrete Symmetry | 4.4 | #7 (May 2) |

PHYS5701 Quantum Mechanics II (Fall 2018)

Class Schedule as of March 22, 2018

Reading assignments from *Modern Quantum Mechanics, 2e* (Cambridge 2017) by J.J. Sakurai and J. Napolitano

| Day | Date | Topics | Reading | HW Due |
|--|--------|---|----------|-------------|
| Tue | 28 Aug | Time-Independent Perturbation Theory: The Non-Degenerate Case | 5.1 | — |
| Thu | 30 Aug | Time-Independent Perturbation Theory: The Degenerate Case | 5.2 | — |
| Tue | 4 Sep | Applications in One-Electron Atoms: Relativistic Fine Structure | 5.3 | — |
| Thu | 6 Sep | Applications in One-Electron Atoms: Effects of Static Magnetic Fields | 5.3 | #1 |
| Tue | 11 Sep | The Variational Principle and Simple Applications | 5.4 | — |
| Thu | 13 Sep | Time-Dependent Potentials and the Interaction Picture | 5.5 | — |
| Tue | 18 Sep | Adiabatic and Sudden Approximations; Berry's Phase in Quantum Mechanics | 5.6 | — |
| Thu | 20 Sep | Time-Dependent Perturbation Theory | 5.7 | #2 |
| Tue | 25 Sep | Interactions of Atoms with the Classical Electromagnetic Field | 5.8 | — |
| Thu | 27 Sep | Energy Shift and Decay Width | 5.9 | — |
| Tue | 2 Oct | Scattering as a Time-Dependent Perturbation: The Scattering Amplitude | 6.1, 6.2 | — |
| Thu | 4 Oct | Scattering in the Born Approximation | 6.2, 6.3 | #3 |
| Tue | 9 Oct | Phase Shifts and Partial Waves | 6.4 | — |
| Thu | 11 Oct | The Eikonal Approximation | 6.5 | — |
| Tue | 16 Oct | Low Energy Scattering and Phase Shifts | 6.6 | — |
| Thu | 18 Oct | Bound States and Scattering Resonances | 6.6, 6.7 | #4 |
| Tue | 23 Oct | Symmetries in Scattering; Inelastic Scattering | 6.8, 6.9 | — |
| Thu | 25 Oct | Permutation Symmetry; Bosons and Fermions | 7.1, 7.2 | — |
| Tue | 30 Oct | Two-Electron Systems: Application to the Helium Atom | 7.3, 7.4 | — |
| Thu | 1 Nov | Multi-particle States and Second Quantization Formalism | 7.5 | #5 |
| Tue | 6 Nov | Introduction to Density Functional Theory | Notes | — |
| Thu | 8 Nov | Quantization of the Electromagnetic Field: The Casimir Effect | 7.6 | — |
| Tue | 13 Nov | Relativity and Schrödinger's Equation; The Klein-Gordon Equation | 8.1 | — |
| Thu | 15 Nov | Fixing the Problems: The Klein-Gordon Field | Notes | #6 |
| November 19-23 Thanksgiving Break | | | | |
| Tue | 27 Nov | The Dirac Equation and a New Degree of Freedom | 8.2 | — |
| Thu | 29 Nov | Symmetries of the Dirac Equation | 8.3 | — |
| Tue | 4 Dec | Solving the Dirac Equation with a Central Potential; The Hydrogen Atom | 8.4 | — |
| Thu | 6 Dec | The Path Forward: Relativistic Quantum Field Theory | 8.5 | #7 (Dec 12) |