

PHYS5701 Quantum Mechanics I (Fall 2020)

Class Schedule as of August 13, 2020

Reading assignments from *Modern Quantum Mechanics, 3e* (Cambridge 2020) by J.J. Sakurai and J. Napolitano

Day	Date	Topics	Reading	HW Due
Tue	25 Aug	Introductions and Course Summary; The Stern-Gerlach Experiment	1.1	—
Thu	27 Aug	States and Dirac Notation	1.2	—
Tue	1 Sep	The Matrix Representation of Quantum Mechanics	1.3	—
Thu	3 Sep	Measurements and Observables; Uncertainty in Measurements	1.4	#1
Tue	8 Sep	Unitary Transformations and the Change of Basis	1.5	—
Thu	10 Sep	Continuous Eigenvalues: Positions, Translations, and Momentum	1.6	—
Tue	15 Sep	The Wave Function: States Represented by Position or Momentum	1.7	—
Thu	17 Sep	Time Evolution, the Hamiltonian, and Schrödinger's Equation	2.1	#2
Tue	22 Sep	The Schrödinger's Picture and the Heisenberg Picture	2.2	—
Thu	24 Sep	The Simple Harmonic Oscillator in One Dimension using Operator Methods	2.3	—
Tue	29 Sep	Projection onto Position Space: The Schrödinger Wave Equation	2.4	—
Thu	1 Oct	Elementary Solutions to Schrödinger's Wave Equation	2.5	#3
Tue	6 Oct	The linear potential; The WKB approximation	2.5	—
Thu	8 Oct	Propagators and the Feynman Path Integral formalism	2.6	—
Tue	13 Oct	Gauge Transformations and the Aharonov-Bohm Effect	2.7	—
Thu	15 Oct	Rotations and Angular Momentum	3.1	#4
Tue	20 Oct	Application to Spin-1/2 systems	3.2	—
Thu	22 Oct	Continuous Groups SO(3) and SU(2); Euler Rotations	3.3	—
Tue	27 Oct	The Density Operator; Pure and Mixed Ensembles	3.4	—
Thu	29 Oct	Eigenvalues and Eigenstates of Angular Momentum	3.5	#5
Tue	3 Nov	Angular Momentum in the Position Basis; Orbital Angular Momentum	3.6	—
Thu	5 Nov	Spherical Harmonics	3.6	—
Tue	10 Nov	The Schrödinger Equation in Spherically Symmetric Potentials	3.7	—
Thu	12 Nov	Solving the One-Electron Atom	3.7.4	#6
Tue	17 Nov	The Addition of Angular Momentum; Clebsch-Gordan Coefficients	3.8	—
Thu	19 Nov	Schwinger's Oscillator Model of Angular Momentum	3.9	—
23-27 Nov Thanksgiving Break (No Classes)				
Tue	1 Dec	Hidden Variable Theories, Spin Correlations, and Bell's Inequality	3.10	—
Thu	3 Dec	Tensor Operators and the Wigner-Eckart Theorem	3.11	#7 (Dec 8)

PHYS5701 Quantum Mechanics II (Fall 2018)

Class Schedule as of August 13, 2020

Reading assignments from *Modern Quantum Mechanics, 3e* (Cambridge 2020) by J.J. Sakurai and J. Napolitano

Day	Date	Topics	Reading	HW Due
Tue	12 Jan	Symmetries, Conservation Laws, and Degeneracies	4.1	—
Thu	14 Jan	Discrete Symmetries; The Parity Transformation	4.2	—
Tue	19 Jan	Lattice Translation as a Discrete Symmetry; Bloch's Theorem	4.3	—
Thu	21 Jan	Anti-Unitary Operators; Time Reversal as a Discrete Symmetry	4.4	#1
Tue	26 Jan	Time-Independent Perturbation Theory: The Non-Degenerate Case	5.1	—
Thu	28 Jan	Time-Independent Perturbation Theory: The Degenerate Case	5.2	—
Tue	2 Feb	Applications in One-Electron Atoms: Relativistic Fine Structure	5.3	—
Thu	4 Feb	Applications in One-Electron Atoms: Effects of Static Magnetic Fields	5.3	#2
Tue	9 Feb	The Variational Principle and Simple Applications	5.4	—
Thu	11 Feb	Time-Dependent Potentials and the Interaction Picture	5.5	—
Tue	16 Feb	Adiabatic and Sudden Approximations; Berry's Phase in Quantum Mechanics	5.6	—
Thu	18 Feb	Time-Dependent Perturbation Theory	5.7	#3
Tue	23 Feb	Interactions of Atoms with the Classical Electromagnetic Field	5.8	—
Thu	25 Feb	Spontaneous Emission	5.8.4	—
1-5 March Spring Break				
Tue	9 Mar	Scattering as a Time-Dependent Perturbation	6.1	—
Thu	11 Mar	The Scattering Amplitude; The Optical Theorem	6.2	#4
Tue	16 Mar	The Born Approximation	6.3	—
Thu	18 Mar	The Partial Wave Expansion; Scattering Resonances	6.4, 6.7	—
Tue	23 Mar	Permutation Symmetry; Bosons and Fermions	7.1, 7.2	—
Thu	25 Mar	Two-Electron Systems: Application to the Helium Atom	7.3, 7.4	#5
Tue	30 Mar	Multi-particle States; Density Functional Theory	7.5, 7.6	—
Thu	1 Apr	Quantum Fields and Second Quantization Formalism	7.7	—
Tue	6 Apr	Quantization of the Electromagnetic Field; The Casimir Effect	7.8	—
Thu	8 Apr	Relativity and Schrödinger's Equation; The Klein-Gordon Equation	8.1	#6
Tue	13 Apr	Fixing the Problems: The Klein-Gordon Field	8.1.5	—
Thu	15 Apr	The Dirac Equation and a New Degree of Freedom	8.2	—
Tue	20 Apr	Symmetries of the Dirac Equation	8.3	—
Thu	22 Apr	Solving the Dirac Equation with a Central Potential; The Hydrogen Atom	8.4	#7 (Apr 27)