

Quantum Mechanics 2

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Lectures: Th 11:30-13:00 MS 3.2, Fr 9:45-11:15 MS 3.1

Exercises: We 15:00-16:30 MS 3.3

Chap. 1: Approximation Methods for the Stationary Schrödinger Equation

- 1.1 Perturbation of a Non-degenerate Level
- 1.2 Example: Ground State of the Helium Atom
- 1.3 Perturbation of a Degenerate Level
- 1.4 Example: The Stark Effect
- 1.5 Variational Method

Chap. 2: Approximation Methods for the Time-Dependent Schrödinger Equation

- 2.1 Interaction Picture
- 2.2 Transition Probability
- 2.3 Example: Forced Harmonic Oscillator
- 2.4 Example: Periodic Perturbations
- 2.5 Sudden Approximation
- 2.6 Adiabatic Approximation
- 2.7 Example: Stimulated Raman Adiabatic Passage (STIRAP)

Chap. 3: Particles in an Electromagnetic Field

- 3.1 Minimal Coupling
- 3.2 Atom coupled to an electromagnetic wave
- 3.3 Rabi Oscillations
- 3.4 Zeeman effect and Stern-Gerlach Experiment
- 3.5 Pauli Equation

Chap. 4: Relativistic Quantum Mechanics

- 4.1 Notations and Reminders
- 4.2 Klein-Gordon Equation
- 4.3 Derivation of the Dirac Equation
- 4.4 Nonrelativistic Correspondence
- 4.5 Lorentz Covariance of the Dirac Equation
- 4.6 Space Reflection, Time Reversal and Charge Conjugation
- 4.7 Plane-Wave Solutions of the Free Dirac Equation

Chap. 5: Second Quantization

- 5.1 Identical Particles
- 5.2 Occupation-Number Representation
- 5.3 Creation and Annihilation Operators
- 5.4 Coherent Bosonic States
- 5.5 Field Operators

References: A. Galindo/P. Pascual: Quantum Mechanics II
A. Messiah: Quantum Mechanics II
J. D. Bjorken/S. D. Drell: Relativistic Quantum Mechanics