Course Information Sheet for Physics 572: Quantum Theory II

Applications of quantum mechanics: Schrödinger equation with an external electromagnetic field; addition of angular momentum; fine structure of atomic spectra; molecules; approximation methods (perturbation theory; semiclassical methods; variational principle); special topics.

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Office hours: Tuesday and Thursday, 1–2:30pm

Grading policy:

The course will be graded on a curve. The minimum cumulative score to obtain an A can be expected to be roughly 85%. The minimum cumulative score to obtain a B can be expected to be roughly 70%. The minimum cumulative score to obtain a C can be expected to be roughly 55%. The minimum cumulative score to obtain a D can be expected to be roughly 40%. Cumulative scores will be determined as follows:

Homework: 15% (lowest score dropped)
Midterm 1: 20%
Midterm 2: 20%
Term paper: 10%
Final Exam: 35%

Students registered with the Disability Resource Center must submit appropriate documentation to the instructor if requesting special accommodations.

Absence policy:

Attendance of the midterms and final exam is mandatory. Homework is due at the regular date and time, regardless of approved absences (lowest homework score dropped).

Required Text:

Introduction to Quantum Mechanics, by David J. Griffiths (2nd Ed., Pearson Prentice Hall, 2005).

Additional Reference (on reserve in the Science Library)

An introduction to Mathematical methods of physics, by Lorella M. Jones (Benjamin/Cummings, 1979).

The information contained herein, other than the grade and absence policies, is subject to change with reasonable advance notice, as deemed appropriate by the instructor.

Physics 572 Schedule

1. Charged particle in an external electromagnetic field (lecture notes)

   Aug. 26 Overview; Meissner effect; gauge invariance.
   Aug. 28, Sept. 2 Aharonov-Bohm effect.
   Sept. 4 Landau levels and the normal Zeeman effect.

2. Quantum transport (lecture notes)

   Sept. 9, 11 Resistance quantum; Quantum Hall effect.

3. Review of formalism (Griffiths, Ch. 3 + Appendix)

   Sept. 16, 18, 23 Hilbert space; bra-ket notation for states and operators
   Oct. 1 Review session (tentative)
   Oct. 2 Midterm 1

4. Addition of angular momentum (Griffiths 4.4.3 + lecture notes)

   Sept. 25, 30, Oct. 7

5. Time-independent perturbation theory (Griffiths, Ch. 6)

   Oct. 9, 14 Nondegenerate perturbation theory.
   Oct. 16 Degenerate perturbation theory.
   Oct. 21, 23 Application: Fine structure of Hydrogen.

6. Variational principle (Griffiths, Ch. 7)

   Oct. 28 Derivation.
   Oct. 30 Ground state of Helium.
   Nov. 4 The H_2^+ ion.
   Nov. 12 Review session (tentative).
   Nov. 13 Midterm 2.

7. Semiclassical (WKB) approximation (Griffiths, Ch. 8) **Nov. 6, 18**

8. Time-dependent perturbation theory (Griffiths, Ch. 9)

   Nov. 20 Fermi's golden rule.
   Nov. 25 Emission and adsorption of radiation.

9. Adiabatic approximation (Griffiths, Ch. 10)

   Dec. 2 Derivation.
   Dec. 4 Applications; Berry's phase.

10. Review and discussion **Dec. 9**

Term paper due: Wednesday, December 10.
Final Exam: Tuesday, December 16, 8–10am.