Physics 425/625: Quantum Theory, Fall 2010

Location and lecture times: Room 1311 HN, Tu and Th, 4:10 – 5:25PM

Instructor: János Bergou

email: jbergou@hunter.cuny.edu

phone: 212-772-5254

office: 1205 HN

Note: email is the best way to reach me

Office hours: Tu and Th: 3:15pm - 4pm, or by appointment.

Text: *Introduction to Quantum Mechanics*, by D. J. Griffiths (2nd Ed.), (Prentice-Hall Pearson, 2004). Supplementary reading will be suggested occasionally.

Grading:

Homework	25%
Midterm Exams	40%
Final Exam	35%

Homework: Will be assigned about every two weeks, and due about a week later. Collaboration with your peers is encouraged, but independent solutions must be handed in for credit. Homeworks will be either assigned in class or posted here.

Midterms: Two in-class exams: Thu October 7 and Thu November 17 (or around).

Last class: Th, December 9.

Final Exam: Tues December 21, 1:45pm – 3:45pm.

In compliance with the American Disability Act of 1990 (ADA) and with Section 504 of the Rehabilitation Act of 1973, Hunter College is committed to ensuring educational parity and accommodations for all students with documented disabilities and/or medical conditions. It is recommended that all students with documented disabilities (Emotional, Medical, Physical and/ or Learning) consult the Office of AccessABILITY located in Room E1124 to secure necessary academic accommodations. For further information and assistance please call (212-772-4857)/TTY (212-650-3230).

Hunter College regards acts of academic dishonesty (e.g., plagiarism, cheating on examinations, obtaining unfair advantage, and falsification of records and official documents) as serious offenses against the values of intellectual honesty. The college is committed to enforcing the CUNY Policy on Academic Integrity and will pursue cases of

academic dishonesty according to the Hunter College Academic Integrity Procedures.

Syllabus:

Topic	Book chapter
The wave function The Schrödinger equation, probabilities, statistical interpretation, expectation values, Heisenberg's uncertainty principle	1
Time-independent Schrödinger equation Stationary states, square well potentials, the harmonic oscillator, free particle, the delta-function potential	2
Formalism and axioms of quantum mechanics The Hilbert space, Dirac notation, observables as operators, eigenfunctions, commuting observables and compatibility, relation with uncertainty principle, unitary transformations, matrix representations, Schrödinger vs. Heisenberg pictures	3
Quantum mechanics in three-dimension The 3D Schrödinger equation in Cartesian and spherical polar coordinates, the hydrogen atom, angular momentum and spin	4
Identical particles Two-particle systems, Pauli exclusion principle, atoms, solids, quantum statistics	5
Time-independent perturbation theory Non-degenerate and degenerate perturbation theory, atomic fine structure, Zeeman effect, hyperfine splitting	6
The variational method Principles, ground state of He, the H_2^- ion	7
The WKB approximation The classical region, tunneling, turning points and connection formulas	8
Time-dependent perturbation theory Two-level systems, emission and absorption of radiation, spontaneous emission	9
The adiabatic approximation Adiabatic theorem, Berry's phase	10
Scattering Scattering cross section, partial waves, phase shifts, Born approximation	11
Paradoxes The EPR paradox and Bell's theorem, no-cloning, Schrödinger's cat, Zeno effect	12