Modern Physics I (Physics 0479): Basic Relativity and Quantum Theory

Course Summary, Requirements, and References

Fall, 2009

1 Course Summary

1. A Brief History of Light : Optics versus Mechanics.

2. Death of the Aether: Einstein's Special Theory of Relativity, Relativistic kinematics

3. Dynamical applications :Relativistic mechanics (Mass, Momentum and Energy).

4. Brief Review of Statistical Thermodynamics.

5. From the Arrow of Time to Planck: Birth of Quantum Theory.

6. Wave-Particle Duality in Early Quantum Theory.

7. The Old Quantum Theory: the Bohr atom.

8. Basics of wave mechanics: the Schrödinger Equation.

9. Complementarity: the Uncertainty Principle and Indeterminism in Quantum Theory.

10. Applications of Quantum Mechanics: Tunneling Phenomena, Bound States.

11. The Hydrogen Atom according to Schrödinger.

2 Course Requirements

The course text will be "Modern Physics", by Jeremy Bernstein, Paul Fishbane and Stephen Gasiorowicz, (publisher Cummings, April 2000). The grade will be based on problem sets (25%), a midterm exam (25%) and a final exam (50%).

3 Writing Option (Phys 0679)

In addition to the requirements stated above, students enrolled for the writing option (Physics 0679) will be required to write a short (≈10-15 pages) paper due on the last class of the term. The topic should be decided by mutual consultation with the instructor by the time of the midterm exam (late October: exact date later), *and a preliminary draft is due the end of the week before the Thanksgiving break.* The instructor will then suggest changes, improvements etc for the final version. A separate grade will be awarded for this paper.

4 References

The following texts may be consulted for supplementary material, and are on reserve in the Engineering Library, Benedum Hall:

1. R. Resnick and D. Halliday, "Basic Concepts in Relativity and Early Quantum Theory".
2. E.F. Taylor and J.A. Wheeler, "Spacetime Physics" (W.H. Freeman, 1966).
3. E.H. Wichmann, "Quantum Physics", vol. 4, Berkeley Physics Course (McGraw-Hill, 1971).
4. R. Eisberg and R. Resnick, "Quantum Physics of Atoms, Molecules, Solids, Nuclei and Particles", (Wiley 1985).