

Physics 335**MODERN PHYSICS**

Fall 2009

Instructor

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home phone - 722-4581 (no calls after 10 p.m. please)
office hours: Tue 4-5 pm, Thur 9:30-10:30 am & 4-5 pm, or by
appointment
Course information can be found at <http://homepages.dordt.edu/~zwart/>

TextBeiser Concepts of Modern Physics**References**

Blatt Modern Physics
Arya Elementary Modern Physics
Brandt
& Dahmen The Picture Book of Quantum Mechanics
Isenberg
& Chomet Physics Experiments and Projects for Students Vol 1&2
Kanare Writing the Laboratory Notebook
Lyons A Practical Guide to Data Analysis for Physical Science
Students
McGervey Introduction to Modern Physics 2nd edition
Moore, Davis,
Coplan Building Scientific Apparatus 2nd edition
Mark & Olson Experiments in Modern Physics
Melissonos Experiments in Modern Physics
Preston
& Dietz The Art of Experimental Physics
Rae Quantum Mechanics
Young Statistical Treatment of Experimental Data

Course Description

Physics 335 is the first semester of a two semester course. Topics include: atomic nature of matter and electricity, wave and particle aspects of electrons and light, and quantum theory. Prerequisites: Physics 203, Math 201, 204.

Course Objectives

To develop an intuitive and calculational familiarity with the concepts of modern physics. Also, to learn experiment design and data analysis techniques.
To explore worldview shifts associated with the paradigm shift from classical to modern physics.

Grading System

Problem Sets	25%
Laboratory	25%
Midterm Tests	30%
Final Exam	20%

Laboratory

The lab component of the course will consist of the performance of four experiments, no more than two of which can be from the "Physics Constants" category. All lab information should be recorded in a laboratory notebook following the usual rules. Of the four experiments, two will be reported to the class via a presentation (oral/powerpoint), one will be a poster presentation, and the fourth report will be a written formal report using the formal report structure used in Physics 203. At least two of the experiments will be done individually, with the formal report being one of the individual efforts. The other experiments can be done in a group of up to three and only one report per group is necessary.

List of Experiments for Physics 335

Physics Constants

- 1) G (Cavendish experiment)
- 2) ϵ_0 and μ_0 (current and capacitance bridges)
- 3) e (Millikan oil drop experiment)
- 4) e/m (electron beam deflection)
- 5) h (Planck's constant from LED characteristics)
- 6) Find/design your own experiment to measure c,...

Other experiments

- 1) "X-Ray" crystallography (scaled exp with microwaves)
- 2) Rutherford Scattering (measuring the size of the gold nucleus)
- 3) Nuclear decay statistics & Absorption of radiation
- 4) Half life determination (of a short half life isotope)
- 5) Superconducting transition temperature
- 6) Beta ray spectroscopy
- 7) Gamma ray spectroscopy
- 8) Holography
- 9) Visible light spectroscopy (esp. Hydrogen)
- 10) The Zeeman Effect
- 11) The Photoelectric Effect
- 12) Critical Potentials
- 13) Franck-Hertz Experiment
- 14) Specific heat ratios (may not be done if done in another course)
- 15) Temperature dependence of resistance
- 16) Find/design your own experiment or theoretical project in modern physics

Important Dates

- 29 September Exam #1
- 20 October Lab presentation session #1
- 10 November Exam #2
- 3 December Lab presentation session #2
- 15 December Take Home Final Exam Due 3:15 pm (at the latest: 1 point per minute will be deducted for exams handed in after this time.)