

## Physics 4410: Quantum Mechanics and Atomic Physics II, Spring 2010

**Classes:** MWF 2-2:50 PM in Duane G2B47

**Instructor:** Prof. Andreas Becker (Email: Andreas.Becker at Colorado.edu)  
Office: JILA A-903 (9th floor, JILA tower) Phone: (303) 492-7825

**Office hours:** After class (up front) for "quick questions"  
(tentative) Thursday, 2-4 PM (Room: TBA), I will be available for questions and help concerning the lecture and the homework.

Administrative type office hours: Friday after class in my office.

*And, any other times by appointment, or "electronic office hours" by Email*

**Course Web Site:** <http://www.colorado.edu/physics/phys4410>

**Goals and Prerequisites:** In this course you will learn how to apply the ideas and the formalism of quantum mechanics to understand the electronic structure of atom and molecules as well as the interaction of such quantum objects with light and particles. To this end, you will learn methods to approximately solve the Schrödinger equation. The prerequisite for this course is PHYS3220 (Quantum Mechanics I). Mathematically, the course involves complex numbers, linear algebra, integrals and partial differential equations. A prior exposure to these topics is assumed.

**Text:** **David J. Griffiths: *Introduction to Quantum Mechanics* (2<sup>nd</sup> Edition, Prentice Hall)**

Textbook errata can be found under

<http://academic.reed.edu/physics/faculty/QMIIErrata2.pdf>

The course covers the topics in the Chapters 4 (4.3 and 4.4), 5 (5.1 and 5.2), 6-9 and 11. If time permits topics of Chapter 12 will be discussed as well. Some of the topics will be presented in more detail, as covered in the book by Griffiths. Additional material will be made available on CULearn during the course.

There will be a copy of Griffiths and other text books on reserve at the Math/Physics Library. I encourage you to read and study different books. Reading different explanations of a new subject is a great way to aid your physics learning.

If you have difficulties to understand Griffiths or would like to consult another text, here are some suggestions:

B.H. Bransden and C.J. Joachain: *Introduction to Quantum Mechanics*

S. Gasiorowicz: *Quantum Physics*

R.L. Liboff: *Introductory Quantum Mechanics*

N. Zettili: *Quantum Mechanics. Concepts and Applications*

*Any information in this syllabus is as accurate as possible at the time of writing. Announcements about changes of any kind will be made in class, and posted on the web, and will take precedence over this syllabus. You are responsible for what is said in class, whether or not you are in attendance.*

**Participation and Clickers:** I will use clickers during lectures, to help you learn the material. You need to purchase an "iClicker" from the bookstore. Get the correct type! (iClicker - Radio Frequency Classroom Response System). Your iClicker responses count only as *bonus* (extra credit) points (see below). Clickers start counting the 2nd week of class. I also give you full clicker credit for the 3 days with your lowest scores, to accommodate dead batteries, sore throats, broken alarm clocks etc. Please register your iClicker at [www.colorado.edu/its/cuclickers/students/register.html](http://www.colorado.edu/its/cuclickers/students/register.html)

**Grading:** The grade weighting will be as follows:

2 Midterms (each): 20%

Final exam: 30%

Written homework: 30%

Two extra credit opportunities:

(a) I will use iClicker during the lectures. Your iClicker responses count as bonus points. They reduce the midterm exam weight by up to a maximum of 12.5% of the midterm exam total (i.e. 5% of your course grade).

(b) I will do some in-class quizzes (10-15 min). The results count as bonus points as well. They reduce the midterm exam weight by up to a maximum of 12.5% of the midterm exam total (i.e. 5% of your course grade).

**Exams:** There will be two midterms and a final:

Midterm 1: To be determined in class, location TBA

Midterm 2: To be determined in class, location TBA

Final: Time and location TBA

You may bring a single side of 8.5 in. x 11 in. paper with your own handwritten notes. Calculators with scientific notation are allowed and sometimes needed. (Of course, no phones, internet access, "electronic crib sheets", etc!)

The dates of the two midterms will be determined in the first week of class. If you have a conflict, you should retake Physics 4410 in a semester when you can make it to all the exams. If you are absent for a serious medical reason, or with prior approval from Prof. Becker, you may be excused from 1 midterm. Medical excuses must be submitted no later than 1 week following the exam. *There are no makeup exams. If you miss the final, you cannot pass the course.*

Students with disabilities, including non-visible disabilities, please let Prof. Becker know early in the semester (first two weeks) so that your academic needs may be appropriately met. Students with religious obligations that conflict with the exam dates should contact us early in the semester so that accommodations can be made.

**Written Homework:** There will be a homework assignment due on every Friday at start of class (2 PM). The homework will be graded and handed back during the classes. *You are encouraged to work together on the homework, but in the end, you are responsible for generating your own solutions and understanding.* Do not fall into the trap of working with a group where others routinely provide solutions; you will have tremendous difficulty on the exams which you must take alone.

**Lecture Notes and Solutions:** Lecture Notes and solutions of the in-class concept tests, written homeworks, in-class quizzes and exams will generally be posted on CULearn and/or the course web site.

**Etiquette:** Please turn off all phones when entering the class. It is perfectly OK to interrupt the lecture by yelling "Question!", questions are always good! We encourage collaboration in this course, an essential skill in all professions. Social interactions are critical to scientists' success - most good ideas grow out of discussions with colleagues. As you study together, help your partners get over confusions, ask each other questions, constructively critique ideas. You learn the most from *teaching* others! Remember that this is about *learning*, not about passing a class - for all assignments, *the work you turn in must be your own: in your own words, reflecting your own understanding.*

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### **And, the fine print:**

**Incompletes:** Rules of the University require that grades of incomplete (IF) may be assigned only if "*for reasons beyond the student's control, the student is unable to complete the course requirements.*" IF requests must be made in person to Prof. Becker.

**Disabilities:** Students with disabilities, including non-visible disabilities, please let Prof. Becker know early in the semester (first two weeks) so that your academic needs may be appropriately met. You will need to provide documentation from the Disability Services Office in Willard 322 (phone 303-492-8671), or [www.colorado.edu/disabilityservices](http://www.colorado.edu/disabilityservices).

**Religious Holidays:** We will make a strong effort to reasonably and fairly deal with all students who, because of religious obligations, have conflicts with exams, assignments or required attendance. Please send an e-mail to Prof. Becker in the *first week of classes* if you anticipate a conflict. See [www.colorado.edu/policies/fac\\_relig.html](http://www.colorado.edu/policies/fac_relig.html)

**CU Behavior Policy:** Students and faculty each have responsibility for maintaining an appropriate learning environment. *We* have the professional responsibility to treat all students with understanding, dignity and respect, to guide classroom discussion and to set reasonable limits on the manner in which they and their students express opinions. Professional courtesy and sensitivity are always important. Class rosters are provided to us with your legal name. We will gladly honor your request to address you by an alternate name or gender pronoun. Please advise us of this preference early in the semester. See [www.colorado.edu/policies/classbehavior.html](http://www.colorado.edu/policies/classbehavior.html) and [www.colorado.edu/studentaffairs/judicialaffairs/code.html#student\\_code](http://www.colorado.edu/studentaffairs/judicialaffairs/code.html#student_code)

**Honor Code:** I trust every individual in this class to understand and follow the CU honor code. Please respect that trust! I'll do my best to make the class valuable and worthy of your honorable behavior! The honor code at CU is very cool, although the CU official wording about it is a little tough. Violations of the honor code may include: cheating, plagiarism, aid of academic dishonesty, fabrication, lying, bribery, and threatening behavior. All incidents of academic misconduct shall be reported to the Honor Code Council (303-725-2273). Students who are found to be in violation of the academic

integrity policy will be subject to both academic sanctions and non-academic sanctions (including but not limited to university probation, suspension, or expulsion). Other information on the Honor Code can be found at [www.colorado.edu/policies/honor.html](http://www.colorado.edu/policies/honor.html) and at [www.colorado.edu/academics/honorcode](http://www.colorado.edu/academics/honorcode).

**Discrimination:** CU policies on Discrimination and Harassment, Sexual Harassment, or Amorous Relationships apply to all students, staff and faculty. Anyone who believes s/he has been the subject of discrimination or harassment based upon race, color, national origin, sex, age, disability, religion, sexual orientation, or veteran status should contact the Office of Discrimination and Harassment (ODH) at 303-492-2127 or the Office of Judicial Affairs at 303-492-5550. ([www.colorado.edu/policies/discrimination.html](http://www.colorado.edu/policies/discrimination.html)), Information about the ODH and the campus resources available to assist individuals regarding discrimination or harassment can be obtained at [www.colorado.edu/odh](http://www.colorado.edu/odh).