Quantum Mechanics II is the second of a sequence of two graduate-level courses designed to teach you both the principles and some applications of quantum mechanics. It's my firm belief that the physical theory developed in *Quantum Mechanics* I and II represents one of the high-water marks of human thought. My first encounter with this material was truly thrilling. I hope you, too, find quantum theory thrilling, and that you find the opportunity to admire and enjoy it. Moreover, you will probably find that the concepts and techniques developed in this course will become particularly important and useful tools as your physics careers progress.

At the outset I would like to stress that if, at any time during the course, you find yourself having serious difficulties of any sort, please don't hesitate to come and see me or telephone me (333-1195), either during office hours, or at any other time. You can also reach me by e-mail at: `goldbart@illinois.edu`.

I shall assume that you are familiar with the material that I covered last semester in PHYS 580: *Quantum Mechanics* I. A brief summary of the material covered in that course is given in *Handout* 2. The present course extends the principles and techniques developed in *Quantum Mechanics* I, notably to time-dependent perturbation theory, intrinsic spin, the addition of angular momenta, systems of identical particles and second quantisation, the interaction of radiation with matter, as well as introductory quantised fields and relativistic spin-0 and spin-$\frac{1}{2}$ systems. A more thorough course syllabus is given in *Handout* 3.

There is a course web site, reachable via `http://webusers.physics.illinois.edu /∼goldbart/`. From it you can obtain my lecture notes, homework handouts *etc.* Occasionally the lecture notes will be upgraded or augmented; sometimes they will contain peripheral topics or technical details that we do not have time to cover in class. From the course web site you can also reach a useful page, *Course News*, on which I shall post various matters pertaining to the course (*e.g.*, contact information for teaching assistants, times and locations of office hours and make-up lectures, typographical errors in homeworks). Do bookmark this page and get into the habit of checking it from time to time.

I plan to teach this course in the following way. Lectures will take place from 1:00 p.m. to 2:20 p.m. on Mondays and Wednesdays in 144 Loomis. During the lectures I shall develop the theoretical concepts of quantum mechanics and try to illustrate them using examples drawn from a variety of physical situations. Please don't hesitate to ask questions or raise points in class. It may be that you are clarifying a point for others, too, and you may be helping me judge whether I'm being understood.

There will be a weekly set of assigned problems, usually due the week after they are issued.

I don't think quantum mechanics can be mastered without *getting your hands dirty*, and correspondingly the question sets will count significantly towards your final grade. Generally speaking, my hoped-for plan is that homework will be issued, due and returned on a weekly cycle: issued on Wednesdays; due on Thursdays (eight days later), and returned graded on Wednesdays (six more days later). Tackling the homework with friends is often instructive, but beware: written exams will be closed-book, as will be any necessary oral exams.

Grading is a difficult issue, especially in graduate school. We may have a midterm examination and we will have a final examination. Together with your homework, this (or these) examinations will generate your final grade. *Very roughly indeed*, you may assume that the relative weight given to your work will be: homework 60% and examination(s) 40%, although these figures are liable to substantial adjustment.

I shall hold an office hour once per week, at a mutually convenient time; the Teaching Assistant will hold office hours, too. I urge you to come to these sessions; it's a part of our teaching commitment and we expect to devote these periods to this class. In my experience, informal discussions in small groups can be extraordinarily rewarding.

We now come to the difficult subject of text books. Your having one of the following three books might be a good idea but is by no means required: *Lectures on Quantum Mechanics* by Baym, *Principles of Quantum Mechanics* by Shankar, and *Modern Quantum Mechanics* by Sakurai. I particularly welcome your comments on this subject. *Handout 3* contains a list of books that will be on reserve in Grainger Engineering Library. Among them, *Quantum Mechanics Volumes* I and II by Cohen-Tannoudji *et al.*, Gottfried's *Quantum Mechanics* I (or it's update with Yan), and Merzbacher's *Quantum Mechanics* are very suitable. It's a good idea to spend some time browsing through a selection of the reserved books (and any other relevant ones that you find). The time spent finding a book that you are comfortable with is a worthwhile investment. You may also find it extremely profitable to spend some time reading the books by Dirac, and Landau and Lifshitz. These books are not easy to digest but, once you feel comfortable with a topic, their insight can help you to gain a more sophisticated understanding.

Parenthetically, I remark that as you proceed through graduate school I strongly encourage you to spend some time browsing in the library (at books and journals) and in the Campus bookstores. In particular, try to get into the habit of reading the remarkable series of books by Landau and Lifshitz entitled *A Course in Theoretical Physics*. Initially, you may find this series prohibitively terse, but you will gradually get used to (and, I hope, learn to appreciate) this minimal style. Additionally, don't be afraid to return to *The Feynman Lectures on Physics*, from time to time, for Feynman's individual and stimulating view of physics. Also very highly recommended indeed is Feynman's little book *QED*, which should be required reading for everyone planning to study quantum mechanics. And don't hesitate to ask people to recommend interesting books and articles.

Finally, we are fortunate to have a large number of high-calibre seminar and colloquium series here on Campus, and you should try to attend at least some of them regularly. Especially while you are in the process of making the crucial decision of which research field to enter it is very important to hear something about a broad range of fields. You can find out about most relevant seminars and colloquia from the Physics Department web site or (on the day) from the Physics Department notice board. Additionally, I shall try to remember to announce interesting seminars *etc.*, in class. You may wish to make a note of the following regular events:

Institute for Condensed Matter Theory	Monday	190 ESB	12:00 noon
Theoretical Biophysics	Monday	3269 2269 Beckman	3:00 p.m.
High Energy Physics	Monday	144 LLP	4:00 p.m.
Astronomy Colloquium	Tuesday	134 Astron.	4:00 p.m.
Quantum Materials at the Nanoscale	T.B.A.	T.B.A.	
Quantum Information & AMO Physics	Wednesday	280 MRL	12:00 noon
Theor. Astrophysics & Gen. Relativity	Wednesday	464 LLP	12:00 noon
Medium Energy Physics	Wednesday	464 LLP	4:00 p.m.
Mathematical & Theoretical Physics	Thursday	464 LLP	12:00 noon
Physics Colloquium	Thursday	141 LLP	4:00 p.m.
Condensed Matter Physics	Friday	190 ESB	1:00 p.m.
Physics of Living Cells	Friday	144 Loomis	2:00 p.m.

You may be pleasantly surprised by how much you can follow, especially after you have attended several talks, and have got used to the style of presentation. However, don't be afraid to sit near the back and leave if you have more important things to do.