# Quantum Mechanics II
## FIZ415E

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**Office Hours:** Drop by when you want to ask a question at my office or send me an email.

**Course Description:** This course is the direct continuation of Quantum Mechanics I. The main aim of the course is to use the knowledge acquired in the previous lecture and use it on diverse real applications. The first part of the lecture will cover angular momentum and the Schrödinger equation in three dimensions, the addition of angular momenta. Next the concept of identical particles will be introduced along, simple solid models such as the free electron gas and periodic potential will be covered. Afterwards we will study the approximation methods. First time independent perturbation theory, and apply it to study the fine structure of hydrogen, hyperfine structure, Zeeman and Stark effects. Next the variational method will be covered, and finally time dependent perturbation theory.

**References:**

- D. J. Griffiths, *Introduction to Quantum Mechanics*, Cambridge University Press, 2nd Ed. 2016
- B.H. Bransden and C.J. Joachain, *Quantum Mechanics*, Prentice Hall, 2nd Ed. 2000

**Quizzes:** Short exams will be given after each recitation.

**Examinations:** There will be two midterm examinations covering each half of the course. The final examination will cover the entire course.

**Minimum points:** You need to have at least 15 points out of 60 from the two midterms and in class examinations in order to attend the final exam.

**Grading:** Your final grade will be calculated according to the following table:

| Activity | Percent of Total Grade |
|---|---|
| Quizzes | 10 % |
| Midterms | 25 %+25 % |
| Final exam | 40 % |

| COURSE SCHEDULE | |
|---|---|
| **Weeks** | **Topics** |
| 1 | Postulates of QM, Schrödinger equation in cartesian coordinates — Recitation 1 |
| 2 | The Schrödinger equation in spherical coordinates, Angular momentum — Recitation 2 |
| 3 | The Hydrogen atom — Recitation 3 |
| 4-5 | Spin, electron in a magnetic field, addition of angular momenta — Recitation 4 |
| 6 | **Midterm I** — Bosons and Fermions, Atoms, Periodic table |
| 7 | Solids, free electron gas, band structure — Recitation 5 |
| 8-9 | Time independent perturbation theory, degenerate perturbation theory — Recitation 6 |
| 10-11 | Fine structure of H, Zeeman effect, Hyperfine structure, Stark effect — Recitation 7 |
| 12 | **Midterm II** — Variational principle |
| 13 | Ground state of He, $H_2$ ion — Recitation 8 |
| 14 | Time dependent perturbation theory, emission and absorption— Recitation 9 |