C668: Special topics in physical chemistry: Advanced Quantum Mechanics

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The course will be conducted through detailed handouts (oncourse). You are responsible for dowloading these notes before you come to class. Always check if an updated version is available.

In addition the following reference books are useful and are kept on reserve in the chemistry library.

- Modern Quantum Mechanics by J. J. Sakurai
- Quantum Mechanics in Chemistry by Schatz and Ratner
- Introduction to Quantum mechanics: A time-dependent perspective by David Tannor
- Quantum Mechanics by Cohen-Tannoudji
- Elements of Quantum Mechanics by Michael D. Fayer

Homeworks will be assigned on a regular basis. In most cases these homework problems would be burried within class notes, thus enticing you to read the notes to gauge the context.

The following list of topics represents my best intentions. I warn you that I often fail in my intentions, also with best intentions.

Broadly speaking the course will have three parts:

- Review of analytically solvable problems
- Foundations of quantum mechanics
- Time-dependent theories

Two ways of starting a discussion on Quantum Mechanics:

- historical perspective: experimental findings between 1905 to 1922
- concentrate on one of these experiments: the need for a "new physics"

I prefer to do the latter. I choose the Stern-Gerlach experiments as a starting point for our discussions. This discussion will demonstrate to us:

- the need for a "new" physical theory to explain important concepts that are especially interesting to chemistry!
- yet, the mathematical basis behind such a new physical theory is quite deep and includes things like vectors, complex numbers, and multiple dimensions.

At the end we will rationalize "complicated ideas" in quantum mechanics using physically intuitive arguments (I think), but from the perspective of vectors, complex numbers, and multiple dimensions.

Since the work can get a little mathematical, I start with a review of analytically solved problems.

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