SPUM 102 & 201

Course: Review of Linear Algebra & Quantum Mechanics I,II

Lecturer's Info

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Curriculum-vitae: https://runawayfancy.github.io/Curriculum-vitae/

Introduction

This course is designed for UM students with basic linear algebra and quantum physics knowledge. I combine two courses into one in order to save time from some naive questions and put on effort into important concepts that quantum mechanics gives us. The first part is linear algebra. I would like to review the eigenvalue problem and Hilbert space which lead to the following study of quantum mechanics. In the second part, I will let students understand the rules of the system evolution that quantum mechanics tells us. From 5 basic principles to quantum dynamics, angular momentum, symmetry, and application, we will cover all this knowledge with additional advanced topics. I expect you guys can read my recommended textbooks individually to comprehend your understanding.

Knowledge points

1. Eigenvalue problem, Hilbert space, Inner product.
2. Basic principles of QM, operators, measurement, decoherence, uncertainty principle, change of basis.
3. time evolution operator, Schrodinger equation, quantum harmonic oscillator, Heisenberg's picture, propagator, Feynman path integral.
4. Coherent states, squeezed states, photon state, tensor product, entangled states, Bell's states, quantum teleportation.
5. Lie group, orbital angular momentum, spherical harmonics, spin, addition of angular momentum, eigenvalue problem.
6. Time-independent perturbation theory(review, both cases), fine structure of hydrogen atom, Zeeman effect, interaction picture, adiabatic theorem and geometry phase.

Recommended textbooks

1. Sakurai, J.J. and Commins, E.D., 1995. Modern quantum mechanics, revised edition.
2. Shankar, R., 2012. Principles of quantum mechanics. Springer Science & Business Media.
3. MIT OCW, lecture notes of Quantum Physics I,II,III.