Honors Independent Study Proposal:
Quantum Mechanics and Partial Differential Equations

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Introduction

Physics explains the fundamental nature of the universe, and math provides the fundamental logical tools to understand that nature. Throughout the summer, I will be studying an equivalent of one college term course on partial differential equations. Through the three terms, I will be studying material equivalent to three college level term courses on quantum mechanics.

Materials

The best source are Massive Open Online Courses (MOOCs) to guide me through textbooks. I am using MIT OpenCourseWare (OCW). From experience, the lectures are intuitive, and the assignments have great added value, in addition to having full resources on videos, notes, assignments, and tests.

- Introduction to PDE Fall 2011, on MIT OCW.
- Quantum Physics I Spring 2013 on MIT OCW
- Quantum Physics II Fall 2013, on MIT OCW.
- Quantum Physics III Spring 2018, on MIT OCW.
- Feynman lectures for a second angle, or just for fun (https://www.feynmanlectures.caltech.edu/)
- Eisberg, Robert M., and Robert Resnick. Quantum Physics of Atoms, Molecules, Solids, Nuclei, and Particles. Wiley, 1985. ISBN: 9780471873730.
- Salsa, Sandro. Partial Differential Equations in Action: From Modelling to Theory. Springer, 2010. ISBN: 9788847007512.
- Griffiths, David J. Introduction to Quantum Mechanics. 2nd ed. Pearson Prentice Hall, 2004. ISBN: 9780131118928.

Goals

With the courses given above, watch all lecture videos, read all lecture notes, write-up all assignments, and test my understanding of the material using the practice tests given time constraints.

Presentation

I will present my learning experience through my notes, my write-ups, and the results of my self-testing. I will present a documentation of concepts that I have learned. For my presentation, I

will try to interpret the subject for a general audience through explaining phenomenon like the photoelectric effect and blackbody radiation as well as thought experiments like the Schrodinger's cat. I will present the Young's double slit experiment live to demonstrate a profound result which quantum mechanics attempts to explain.

Calendar

- Summer (8/22): Finish Intro to PDE, with its accompanying lecture notes and assignments. In addition, finish problem set # 5 and its accompanying lectures and readings for Quantum Physics I. This will mark half of the course.
- Fall term midterm (10/15): Problem set # 7 and its accompanying lectures and readings for Quantum Physics I. This will mark a majority of the course.
- Fall term (11/15): Finish Quantum Physics I, with all its assignments, readings, and lectures.
- Winter term midterm (1/27): Problem set # 6 and its accompanying lectures and readings for Quantum Physics II. This will mark half of the course.
- Winter term (3/6): Finish Quantum Physics II, with all its assignments, readings, and lectures.
- Spring term midterm: Through Problem Set # 5 and its accompanying readings for Quantum Physics III. This will mark half of the course.
- Spring term: Finish Quantum Physics III, with all its assignments and readings.