MATH 80870, TOPICS IN MATHEMATICAL PHYSICS
INTRODUCTION TO MATHEMATICAL QUANTUM MECHANICS
FALL 2023, MWF 9:35–10:15

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Topics. The course will provide an introduction to quantum mechanics (excluding quantum field theory) in a form accessible to mathematicians. I will begin by describing some of the experiments leading to the development of quantum mechanics in the early 20th century. Then I will provide a brief review of *classical* mechanics before introducing quantum mechanics. I will then try to cover many of the basic concepts in quantum mechanics, including the free quantum particle, a particle in a square well, the quantum harmonic oscillator, angular momentum, and the hydrogen atom. In addition, I will provide an introduction to the spectral theorem—the infinite-dimensional version of the statement that every Hermitian matrix has an orthonormal basis of eigenvectors.

Prerequisites. I will assume students have a basic knowledge of Hilbert spaces and some exposure to ordinary and partial differential equations. The necessary background from functional analysis will be developed in a self-contained way.

Textbook. I will use my own textbook, Quantum Theory for Mathematicians, published by Springer and available for free in electronic form from the university's library system. In the library catalog, search for "Brian C Hall" and then click on the book. Then click on "Notre Dame Online Access," log in, and download a PDF copy of the book. You can also purchase a "MyCopy" paperback copy of the book for $40. Of course, you can always get a hardback copy of the book from Amazon.com.

Grading. Attendance is required. You are allowed to miss two classes without explanation and further classes if you have an excused absence. Beyond this, there will be a deduction from homework scores for missed classes. There will be homework approximately every two weeks, with a "take-home final exam" consisting of a last homework assignment.