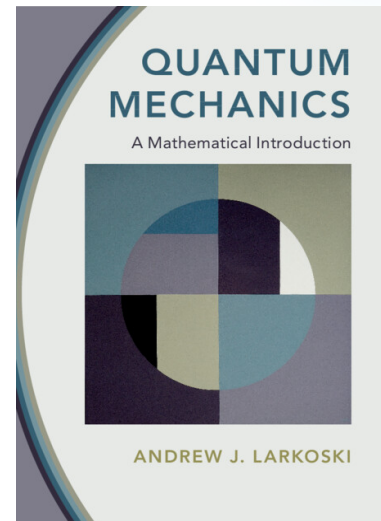# Quantum Mechanics
A Mathematical Introduction

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This original and innovative textbook takes the unique perspective of introducing and solving problems in quantum mechanics using linear algebra methods, to equip readers with a deeper and more practical understanding of this fundamental pillar of contemporary physics. Extensive motivation for the properties of quantum mechanics, Hilbert space, and the Schrödinger equation is provided through analysis of the derivative, while standard topics like the harmonic oscillator, rotations, and the hydrogen atom are covered from within the context of operator methods. Advanced topics forming the basis of modern physics research are also included, such as the density matrix, entropy, and measures of entanglement. Written for an undergraduate audience, this book offers a unique and mathematically self-contained treatment of this hugely important topic. Students are guided gently through the text by the author's engaging writing style, with an extensive glossary provided for reference and numerous homework problems to expand and develop key concepts. Online resources for instructors include a fully worked solutions manual and lecture slides.

1. Introduction; 2. Linear Algebra; 3. Hilbert Space; 4. Axioms of Quantum Mechanics and Their Consequences; 5. Quantum Mechanical Example: The Infinite Square Well; 6. Quantum Mechanical Example: The Harmonic Oscillator; 7. Quantum Mechanical Example: The Free Particle; 8. Rotations in Three Dimensions; 9. The Hydrogen Atom; 10. Approximation Techniques; 11. The Path Integral; 12. The Density Matrix; 13. Why Quantum Mechanics?; Appendix A. Mathematics Review; Appendix B. Poisson Brackets in Classical Mechanics; Appendix C. Fundamental Constants and Units; Appendix D. Quantum Mechanics Jargon Glossary; Appendix E. Bibliography.

'This book is a refreshing and innovative addition to quantum mechanics teaching. It will help students build strong mathematical skills to rely on when studying this novel subject. Larkoski demystifies the subject and provides instructors with new ways to cover even the most canonical examples in quantum mechanics. I think it will also be a very useful companion for students learning quantum field theory.'
Seyda Ipek, *Carleton University, Ottawa*