

1. Record Nr.	UNINA9910633920803321
Autore	Reed Bruce Cameron
Titolo	Quantum mechanics : an enhanced primer / / Bruce Cameron Reed
Pubbl/distr/stampa	Cham, Switzerland : , : Springer, , [2022] ©2022
ISBN	9783031140204 9783031140198
Edizione	[Second edition.]
Descrizione fisica	1 online resource (407 pages)
Disciplina	530.12
Soggetti	Quantum theory
Lingua di pubblicazione	Inglese
Formato	Materiale a stampa
Livello bibliografico	Monografia
Nota di bibliografia	Includes bibliographical references and index.
Nota di contenuto	<p>Intro -- Preface -- Contents -- About the Author -- 1 Foundations --</p> <p>1.1 Faraday, Thomson, and Electrons -- 1.2 Spectra, Radiation, and Planck -- 1.3 The Rutherford-Bohr Atom -- 1.4 de Broglie Matter Waves -- 1.5 The Radiative Collapse Problem (Optional) -- References</p> <p>-- 2 Schrödinger's Equation -- 2.1 The Classical Wave Equation -- 2.2 The Time-Independent Schrödinger Equation -- 2.3 The Time-Dependent Schrödinger Equation -- 2.4 Interpretation of :</p> <p>Probabilities and Boundary Conditions -- References -- 3 Solutions of Schrödinger's Equation in One Dimension -- 3.1 Concept of a Potential Well -- 3.2 The Infinite Potential Well -- 3.3 The Finite Potential Well --</p> <p>3.3.1 A Matrix Approach to the Finite Potential Well -- 3.4 Finite Potential Well-Even Solutions -- 3.5 Number of Bound States in a Finite Potential Well -- 3.6 Sketching Wavefunctions -- 3.7 Potential Barriers and Scattering -- 3.8 Penetration of Arbitrarily-Shaped Barriers -- 3.9 Alpha-Decay as a Barrier Penetration Effect -- 3.10 Scattering by One-Dimensional Potential Wells -- References -- 4 Operators, Expectation Values, and Various Quantum Theories -- 4.1 Properties of Operators -- 4.2 Expectation Values -- 4.3 The Uncertainty Principle -- 4.4 Commutators and Uncertainty Relations -- 4.5 Ehrenfest's Theorem -- 4.6 The Orthogonality Theorem -- 4.7 The Superposition Theorem -- 4.8 Constructing a Time-Dependent Wave Packet -- 4.9 The Virial Theorem -- 4.10 Momentum-Space Wavefunctions -- References -- 5</p>

The Harmonic Oscillator -- 5.1 A Lesson in Dimensional Analysis --
5.2 The Asymptotic Solution -- 5.3 The Series Solution -- 5.4 Hermite
Polynomials and Harmonic Oscillator Wavefunctions -- 5.5 Comparing
the Classical and Quantum Harmonic Oscillators -- 5.6 Raising and
Lowering Operators -- Reference.

6 Schrödinger's Equation in Three Dimensions and the Quantum Theory
of Angular Momentum -- 6.1 Separation of Variables: Cartesian
Coordinates -- 6.2 Spherical Coordinates -- 6.3 Angular Momentum
Operators -- 6.4 Separation of Variables in Spherical Coordinates:
Central Potentials -- 6.5 Angular Wavefunctions and Spherical
Harmonics -- 6.5.1 Solution of the Equation -- 6.5.2 Solution of the
Equation -- 6.5.3 Spherical Harmonics -- References -- 7 Central
Potentials -- 7.1 Introduction -- 7.2 The Infinite Spherical Well -- 7.3
The Finite Spherical Well -- 7.4 The Coulomb Potential -- 7.5 Hydrogen
Atom Probability Distributions -- 7.5.1 The (1, 0, 0) State of Hydrogen
-- 7.5.2 The (2, 0, 0) and Other States of Hydrogen -- 7.6 The Effective
Potential -- 7.7 Some Philosophical Remarks -- References -- 8
Further Developments with Angular Momentum and Multiparticle
Systems -- 8.1 Angular Momentum Raising and Lowering Operators --
8.2 The Stern-Gerlach Experiment: Evidence for Quantized Angular ...
-- 8.3 Diatomic Molecules and Angular Momentum -- 8.4 Identical
Particles, Indistinguishability, and the Pauli Exclusion Principle --
References -- 9 Approximation Methods -- 9.1 The WKB Method --
9.2 The Superposition Theorem Revisited -- 9.3 Perturbation Theory --
9.4 The Variational Method -- 9.5 Improving the Variational Method --
References -- 10 Numerical Solution of Schrödinger's Equation -- 10.1
Atomic Units -- 10.2 A Straightforward Numerical Integration Method
-- References -- 11 A Few Results from Time-Dependent Quantum
Mechanics: Transition Rates and Probabilities -- 11.1 Transition
Frequencies -- 11.2 Transition Rules -- 11.3 The Sudden
Approximation -- References -- Appendix A Miscellaneous Derivations
-- A.1 Heisenberg's Uncertainty Principle -- A.2 Normalization of
Hermite Polynomials.
A.3 Explicit Series Form for Associated Legendre Functions -- A.4
Proof That upper Y Subscript script l comma negative m Baseline equals
left parenthesis negative 1 right parenthesis Superscript m Baseline
upper Y Subscript script l comma m Superscript asteriskYell,-m = (-1)
 $mYell,m^*$ -- A.5 Radial Nodes in Hydrogen Wavefunctions --
Appendix B Answers to Selected Odd-Numbered Problems -- Appendix
C Integrals and Trigonometric Identities -- Appendix D Physical
Constants -- Index.
