

---

# Contents

<b>Chapter 1</b>	<b>The Formalism of Quantum Mechanics</b>	<b>1</b>
	Hilbert Space, 1	
	Operators in Hilbert Space, 3	
	Eigenvectors and Eigenvalues, 4	
	Unitary Transformations, 8	
	Direct Product Space, 8	
	The Axioms of Quantum Mechanics, 9	
	A Useful Theorem, 12	
	Spin $\frac{1}{2}$ Particle in a Magnetic Field, 13	
	The Free Particle, 15	
	The One-Dimensional Harmonic Oscillator, 19	
	Perturbation Theory, 22	
<b>Chapter 2</b>	<b>Quantum Theory of the Free Electromagnetic Field</b>	<b>25</b>
	Coherent States of the Radiation Field, 29	
<b>Chapter 3</b>	<b>Interaction of Radiation and Matter</b>	<b>32</b>
	Emission of Light by an Excited Atom, 33	
	Absorption of Light, 37	
	Black Body Spectrum, 38	
	Scattering of Light by a Free Electron, 39	
	Čerenkov Radiation, 42	
	Natural Line Width, 44	
<b>Chapter 4</b>	<b>Second Quantization</b>	<b>47</b>
	The Connection with Elementary Quantum Mechanics, 50	

<b>Chapter 5</b>	<b>Interaction of Quantized Fields</b>	<b>54</b>
	Nonrelativistic Bremsstrahlung, 56	
<b>Chapter 6</b>	<b>Quantum Electrodynamics</b>	<b>61</b>
	Dirac's Hole Theory, 64	
	Čerenkov Radiation by a Dirac Electron, 66	
	Compton Scattering, 69	
	Pair Production, 74	
	Electron-Positron Annihilation, 75	
<b>Chapter 7</b>	<b>The Theory of Beta Decay</b>	<b>78</b>
<b>Chapter 8</b>	<b>Particles that Interact Among Themselves</b>	<b>87</b>
	The Boltzmann Equation for Quantum Gases Bose-Einstein and Fermi-Dirac Distributions, 88	
	The Degenerate Nearly Perfect Bose-Einstein Gas, 91	
	Superfluidity, 94	
<b>Chapter 9</b>	<b>Quasi Particles in Plasmas and Metals</b>	<b>96</b>
	Plasmons and Phonons, 101	
	Landau Damping in Plasmas and Characteristic Energy Losses in Solids, 103	
<b>Chapter 10</b>	<b>The Problem of Infinities in Quantum Electrodynamics</b>	<b>107</b>
	Attraction of Parallel Conductors Due to Quantum Fluctuations of the Field, 107	
	Self Energy of the Vacuum, 110	
	Renormalization of the Mass of the Electron, 111	
	The Lamb Shift, 113	
	Anomalous Magnetic Moment of the Electron, 116	
<b>Appendix A</b>	<b>Relativistic Wave Equations</b>	<b>121</b>
<b>Appendix B</b>	<b>Details of the Calculation of the Klein-Nishina Cross Section</b>	<b>131</b>
<b>Appendix C</b>	<b>Answers and Solutions to the Problems</b>	<b>135</b>
	<b>Notes and References</b>	<b>157</b>
	<b>Index</b>	<b>163</b>