

Quantum Physics

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August 8, 2022

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Part I

Quantum mechanics

Chapter 1

Quantization

1.1 Wave-particle duality

Black body radiation(1901) Photoelectric effect(1905) Compton scattering(1923)

Bohr atom model(1913) Rutherford scattering(1911) Franck-Hertz experiment(1914) De Broglie waves(1924) Electron diffraction Davisson-Germer(1927) George Pagit Thompson(1928)

1.2 Interpretations of quantum mechanics

Pictures Hilbert space, wave functions, Dirac notation Copenhagen interpretation observables and self-adjoint operators EPR paradox, Bell's inequality, CHSH inequality

1.3 Canonical commutation relation

canonical quantization fourier transform Stone-von Neumann theorem

Chapter 2

Schrödinger equation

2.1 Time-independent potentials

Infinite well Harmonic oscillator Free particle Hydrogen atom

2.2 Approximation methods

WKB approximation

2.3 Atoms

2.4 Scattering theory

Chapter 3

Spin

3.1

3.2 Dirac equation

Pair production(1941)

3.3 Wigner classification

Part II

Quantum statistical physics

Chapter 4

Quantum statistics

4.1 Fermions and Bosons

Two statistics Fermi sea Bose-Einstein condensation

Chapter 5

Condensed matter physics

5.1 Solid state physics

phonon

5.2 Quantum Hall effect

Chapter 6

Renormalization group

6.1 Phase transition

Magnetic models Ginzburg Landau theory

Part III

Quantum field theory

Chapter 7

Particle physics

7.1 Path integral formulation

7.2 Field equations

7.3 Interacting fields

Feynman diagram

Chapter 8

Non-perturbative field theory

8.1 Algebraic quantum field theory

Chapter 9

Nonabelian gauge theory

Part IV

Chapter 10

Supersymmetry