

Quantum Theory

Part I

1. Physics and Quantum Theory
 - 1.1 Quantum effects
 - 1.2 Particle-Wave Dualism
 - 1.3 Measurement uncertainties

2. Wave Mechanics
 - 2.1 Wave packets
 - 2.2 *Schrödinger* wave equation
 - 2.3 The Harmonic Oscillator
 - 2.4 One-dimensional motion
 - 2.5 Motion in spherical potentials
 - 2.6 Rutherford-Bohr model of hydrogen atom
 - 2.7 Free particle in spherical waves
 - 2.8 Scattering amplitude and partial waves
 - 2.9 Perturbative methods

3. Principles of Quantum Theory
 - 3.1 States of a Quantum System
 - 3.2 Measurement and Preparation of Quantum States
 - 3.3 Unitarity and Time Evolution
 - 3.4 Quantization
 - 3.5 Prototypes of Quantum Systems
 - 3.6 Density matrix

4. Symmetries of quantum systems I
 - 4.1 Symmetries and their implication, examples
 - 4.2 *Lie* groups, examples
 - 4.3 More on angular momentum
 - 4.4 Identical particles and *Pauli* principle

Textbooks

Standard texts

L.D. Landau and E.M. Lifschitz, *Quantum Mechanics - Non-Relativistic Theory*, Pergamon Press, Oxford 1965

A. Messiah, *Mechanique Quantique*, (2 volumes), Dunod, Paris 1959, Engl. transl. Wiley 1958 or Dover publ. 2000, German transl. W. de Gruyter, 1985.

L.I. Schiff, *Quantum Mechanics*, McGraw Hill, New York 1968

A. Galindo, P. Pascual, *Quantum Mechanics*, Springer, Berlin 1990

F. Schwabl, *Quantum Mechanics*, Springer, 2002.

Ashok Das, A.C. Melissinos, *QM- a modern introduction*, Gordon and Breach, 1990

B.-G. Englert, *Lectures on QM*, 3 volumes World Scientific, Singapore, 2006.

Exercises

S. Flügge, *Practical Quantum Mechanics*, (2 volumes), Springer, Berlin 1971, 1991

H.A. Mavromatos, *Exercises in QM*, Reidel, Dordrecht, 1986,

V.I. Kogan, V.M. Galitsky, *Problems in QM*, Prentice Hall, New Jersey, 1963.

Classical texts and mathematical basis

H. Weyl, *Gruppentheorie und Quantenmechanik*, Leipzig 1931

P.A.M. Dirac, *The principles of Quantum Mechanics*, Clarendon Press, London 1958

J. von Neumann, *Mathematische Grundlagen der Quantenmechanik*, Springer, Berlin 1932, 1968.

E.P. Wigner, *Group Theory and Its Application to the Quantum Mechanics of Atomic Spectra*, Academic Press, New York 1959.

Further recommendations

R.P. Feynman, R.B. Leighton and M. Sands, *The Feynman Lectures on Physics*, Addison-Wesley, Reading, Mass. 1966

R.P. Feynman and A.R. Hibbs, *Quantum Mechanics and Path Integrals*, McGraw Hill, New York, 1965.

M. Hammermesh, *Groups Theory*, Adison Wesley, Reading 1962.

A.R. Edmonds, *Angular momentum in QM*, Princeton Univ. Press, 1957.

History

M. Born, *Atomic Physics*, Blackie and Son, London 1963

M. Planck, *A Survey of Physical Theory*, Dover Publ., New York 1960.

G. Ludwig, *Wellenmechanik. Einführung und Originaltexte*, Akademie-Verlag, Berlin 1970.

D. ter Haar, *Quantentheorie. Einführung und Originaltexte*, Akademie-Verlag, Berlin 1969.

L.C. Biedenharn, J.D. Louck, *Angular momentum in QM*, Adison Wesley, Reading 1979