

CONTENTS

	PAGE
FOREWORD.....	vii
PREFACE.....	ix

SERIES I

THE STRUCTURE OF THE ATOM

LECTURE 1.....	1
Comparison between the classical continuum theory and the quantum theory — Chief experimental results on the structure of the atom — General principles of the quantum theory — Examples.	
LECTURE 2.....	12
General introduction to mechanics — Canonical equations and canonical transformations.	
LECTURE 3.....	21
The Hamilton-Jacobi partial differential equation — Action and angle variables — The quantum conditions.	
LECTURE 4.....	25
Adiabatic invariants — The principle of correspondence.	
LECTURE 5.....	32
Degenerate systems — Secular perturbations — The quantum integrals.	
LECTURE 6.....	38
Bohr's theory of the hydrogen atom — Relativity effect and fine structure — Stark and Zeeman effects.	
LECTURE 7.....	47
Attempts towards a theory of the helium atom and reasons for their failure — Bohr's semi-empirical theory of the struc-	

	PAGE
ture of higher atoms — The optical electron and the Rydberg-Ritz formula for spectral series — The classification of series — The main quantum numbers of the alkali atoms in the unexcited state.	
LECTURE 8	54
Bohr's principle of successive building of atoms — Arc and spark spectra — X-ray spectra — Bohr's table of the completed numbers of electrons in the stationary states.	
LECTURE 9	60
Sommerfeld's inner quantum numbers — Attempts toward their interpretation by means of the atomic angular momentum — Breakdown of the classical theory — Formal interpretation of spectral regularities — Stoner's definition of subgroups in the periodic system — Pauli's introduction of four quantum numbers for the electron — Pauli's principle of unequal quantum numbers — Report on the development of the formal theory.	
LECTURE 10	68
Introduction to the new quantum theory — Representation of a coordinate by a matrix — The elementary rules of matrix calculus.	
LECTURE 11	75
The commutation rule and its justification by a correspondence consideration — Matrix functions and their differentiation with respect to matrix arguments.	
LECTURE 12	79
The canonical equations of mechanics — Proof of the conservation of energy and of the "frequency condition" — Canonical transformations — The analogue of the Hamilton-Jacobi differential equation.	
LECTURE 13	83
The example of the harmonic oscillator — Perturbation theory.	
LECTURE 14	89
The meaning of external forces in the quantum theory and corresponding perturbation formulas — Their application to the theory of dispersion.	

CONTENTS

xvii

	PAGE
LECTURE 15	94
Systems of more than one degree of freedom — The commutation rules — The analogue of the Hamilton-Jacobi theory — Degenerate systems.	
LECTURE 16	99
Conservation of angular momentum — Axial symmetrical systems and the quantization of the axial component of angular momentum.	
LECTURE 17	106
Free systems as limiting cases of axially symmetrical systems — Quantization of the total angular momentum — Comparison with the theory of directional quantization — Intensities of the Zeeman components of a spectral line — Remarks on the theory of Zeeman separation.	
LECTURE 18	113
Pauli's theory of the hydrogen atom.	
LECTURE 19	119
Connection with the theory of Hermitian forms — Aperiodic motions and continuous spectra.	
LECTURE 20	125
Substitution of the matrix calculus by the general operational calculus for improved treatment of aperiodic motions — Concluding remarks.	

SERIES II

THE LATTICE THEORY OF RIGID BODIES

LECTURE 1	133
Classification of crystal properties — Continuum and lattice theories — Geometry of lattices.	
LECTURE 2	139
Molecular forces — Polarizability of atoms — Potential energy and inner forces — Homogeneous displacements — The conditions of equilibrium — Examples of regular lattices.	

	PAGE
LECTURE 3	146
Elimination of inner motions — Compressibility — Elasticity and Hooke's law — Cauchy's relations — Dielectric displacement and piezoelectricity — Residual-ray frequencies.	
LECTURE 4	155
Ionic lattices — Kossel's and Lewis' theory — Calculation of the lattice energy according to Madelung and Ewald.	
LECTURE 5	163
The energy of the rock-salt lattice — Repulsive forces — Derivation of the properties of salt crystals from the properties of inert gases.	
LECTURE 6	168
Experimental determination of the lattice energy by means of cyclic processes — The electron affinity of halogens — Heat of dissociation of salt molecules — Theory of molecular structure.	
LECTURE 7	176
Chemical crystallography — Coördination lattices — Hund's theory of lattice types — Molecule, radical and layer lattices.	
LECTURE 8	183
Physical mineralogy — The parameters of asymmetrical lattices — The molecule lattice of hydrochloric acid — Bragg's calculation of the rhombohedral angle of calcite — Rutile and anatase — Influence of the polarizability on elastic and electric constants — The breaking stress of rock salt.	
LECTURE 9	189
Crystal optics — Refraction and double refraction — Optical activity — Thermodynamics — Quantum theory of specific heats — Distribution of frequencies in phase space.	
LECTURE 10	196
Thermal expansion and pyroelectricity — Concluding remarks.	