CONTENTS

		PAGE
PR	EFACE	vii
NO'	FATION	ix
	I. SYMMETRY TRANSFORMATIONS	
1.	The uses of symmetry properties	1
2.	Expressing symmetry operations mathematically	3
3.	Symmetry transformations of the Hamiltonian	6
4.	Groups of symmetry transformations	12
5.	Group representations	24
6.	Applications to quantum mechanics	41
	II. THE QUANTUM THEORY OF A FREE ATOM	
7.	Some simple groups and representations	48
8.	The irreducible representations of the full rotation group	52
9.	Reduction of the product representation $D^{(j)} \times D^{(j')}$	67
10.	Quantum mechanics of a free atom; orbital degeneracy	73
11. 12.	Quantum mechanics of a free atom including spin	78
13.	The effect of the exclusion principle Calculating matrix elements and selection rules	89 99
10.	Oalculating matrix elements and selection riles	99
	III. THE REPRESENTATIONS OF FINITE GROUPS	
14.	Group characters	113
15.	Product groups	125
16.	Point-groups	128
17.	The relationship between group theory and the Dirac method	143
	IV. FURTHER ASPECTS OF THE THEORY OF FREE ATOMS AND IONS	
18.	Paramagnetic ions in crystalline fields	148
19.	Time-reversal and Kramers' theorem	164
20.	Wigner and Racah coefficients	176
21.	Hyperfine structure	189
	V. THE STRUCTURE AND VIBRATIONS OF MOLECULES	
22.	Valence bond orbitals and molecular orbitals	206
23.	Molecular vibrations	229
24.	Infra-red and Raman spectra	245
	VI. SOLID STATE PHYSICS	
25.	Brillouin zone theory of simple structures	265
26.	Further aspects of Brillouin zone theory	284
27.	Tensor properties of crystals	304

CONTENTS

	VII. NUCLEAR PHYSICS	PAGE
28.	The isotopic spin formalism	313
29.	Nuclear forces	321
30.	Reactions	334
	VIII. RELATIVISTIC QUANTUM MECHANICS	,
31.	The representations of the Lorentz group	351
32.	The Dirac equation	363
33.	Beta decay	384
34.	Positronium	397
	APPENDICES	
A.	Matrix algebra	404
в.	Homomorphism and isomorphism	410
C.	Theorems on vector spaces and group representations	412
D.	Schur's lemma	418
E.	Irreducible representations of Abelian groups	420
F.	Momenta and infinitesimal transformations	422
G.	The simple harmonic oscillator	424
H.	The irreducible representations of the complete Lorentz group	428
I.	Table of Wigner coefficients $(jj' mm' JM)$	432
J.	Notation for the thirty-two crystal point-groups	446
K.	Character tables for the crystal point-groups	448
L.	Character tables for the axial rotation group and derived groups	455
LIS	T OF GENERAL REFERENCES, WITH REVIEWS	457
BIBLIOGRAPHY		459
SUBJECT INDEX		464