

Contents

Preface		V
Preface to second edition		VII
Preface to third edition		IX
Introduction		1
Ch. I. Occupation number representation		3
Ch. II. Self-consistent fields		11
Ch. III. The shell model		17
Ch. IV. Single-particle excitations and vibrations		26
1. Particle-hole excitations		26
2. A schematic model		29
3. Semiclassical picture		32
4. Applications		33
5. More realistic forces		36
Appendix		38
Ch. V. Fancier methods		41
1. Introduction		41
2. Method of linearization of the equations of motion		42
3. The extended schematic model		47
4. The time-dependent Hartree-Fock method		49
5. Spurious states		53
Appendix		59
Ch.	VI. Rotations	61
1. Hartree-Fock ground state of nonspherical nuclei		61
2. Rotationally invariant wave functions		64
3. Calculation of the moment of inertia		68
4. Excited states		75
5. Odd nuclei and single-particle and vibrational excitations		76
6. The Elliott model		79

Ch. VII. Pairing in nuclei	87
1. Introduction	87
2. The degenerate model	91
3. The quasi spin formalism	95
4. System with two unperturbed levels	97
5. Quasiparticles	99
6. Nondegenerate case	102
7. Quasiparticle excitations	105
8. Moment of inertia with pairing	107
9. Vibrations in paired nuclei	112
10. Effect of pairing on deformation	115
11. Spectra of nuclei with valence particles	117
Ch. VIII. Quasiparticles	120
1. Introduction	120
2. Magnetic and electric moments	121
3. Renormalization	125
4. Self energies and lifetimes	127
Ch. IX. The optical model	130
1. Introduction	130
2. Resonances in a potential well'	131
3. The many-body problem	138
4. Physical picture underlying the optical model	141
5. The picture of Lane, Thomas and Wigner	144
6. A simple case of scattering	153
7. Expression of the scattering in the Green's function formalism	154
8. Perturbation theory	156
9. Interference between compound and direct scattering.	167
10. When should the optical model work well?	170
Ch. X. Theory of nuclear matter	174
1. Introduction	174
2. The isobaric spin formalism	175
3. Perturbation theory calculation	176
Ch. XI. Brueckner theory	190
1. Introduction	190
2. On and off the energy shell	195
3. The Moszkowski-Scott separation method	201
4. The reference spectrum	207
5. Calculational apparatus.	213
6. Results of calculations	217
Ch. XII. Further developments in the theory of nuclear matter	218
1. Three-body clusters	218
2. Formal properties of the expansion	225

3. Many-body forces	227
4. Recent calculations	229
Ch. XIII. Effective forces in nuclei	230
1. Introduction	230
2. Wave function of relative motion in nuclei	230
3. Corrections and second-order terms	235
4. Extremely finite nuclei	239
5. Other theories of effective interactions in nuclei	246
Ch. XIV. Isobaric analogue states.	254
1. Introduction	254
2. Nuclear structure aspects	256
3. The Lane equations	263
4. The many-body problem	278
5. The Bloch formalism.	286
6. The many-body case and giant resonance theory.	288
7. Other theories, especially the projection operator technique	301
8. General discussion	304
Bibliography	309
Index	314