

CONTENTS

PREFACE

page vii

I Introduction

II General Theory of Rays and Waves in Space-time

| | | |
|------|---|----|
| 2.1 | Rays in space-time | 6 |
| 2.2 | Waves in space-time | 16 |
| 2.3 | Gauge transformations | 19 |
| 2.4 | Geometrical and kinematical descriptions of the unit 3-wave | 22 |
| 2.5 | Wave velocity and ray velocity | 25 |
| 2.6 | Wave packets and group velocity | 30 |
| 2.7 | Laws of reflexion and refraction | 34 |
| 2.8 | Hamilton's T -function | 40 |
| 2.9 | Focal properties | 48 |
| 2.10 | Special types of medium-functions | 51 |

III Geometrical Mechanics for a Particle, Free or in a Given Field

| | | |
|-----|--|----|
| 3.1 | Basic formulae for a free particle | 60 |
| 3.2 | Refraction through a hole | 70 |
| 3.3 | Refraction at a potential-jump | 74 |
| 3.4 | Rays and waves for a charged particle in a given electromagnetic field | 88 |
| 3.5 | De Broglie waves from a source-event in a uniform electrostatic field | 94 |
| 3.6 | De Broglie waves for a particle in a central field of force | 97 |

IV Primitive Quantization

| | | |
|-----|--|-----------------|
| 4.1 | Quantization for plane waves for a free particle | <i>page</i> 105 |
| 4.2 | Quantization for waves from a source-event | 108 |
| 4.3 | Primitive quantization | 112 |
| 4.4 | Primitive quantization for a central field of force and for the hydrogenic atom | 115 |
| 4.5 | The Zeeman effect | 124 |
| 4.6 | Interference for a single free particle and two holes | 129 |

V Some Generalizations

| | | |
|-----|---|-----|
| 5.1 | Rays and waves in a Hamiltonian space | 136 |
| 5.2 | The two-body problem | 144 |
| 5.3 | Two free particles in empty space-time | 147 |
| 5.4 | Interference of two particles passing through two holes | 152 |
| 5.5 | The optical method and the dynamical method | 160 |

| | |
|------------|-----|
| REFERENCES | 164 |
|------------|-----|

| | |
|-------|-----|
| INDEX | 165 |
|-------|-----|