

CONTENTS

EXPLANATION OF PLATES

page xi

AUTHOR'S PREFACE

xiii

CHAPTER I

Introductory

1.1. The discovery of the Auger effect, p. 1. **1.2.** The Auger effect and X-ray spectra, p. 3. **1.3.** Should the Auger effect be considered as an internal conversion process or a radiationless transition? p. 4. **1.4.** Radiationless reorganization following alternative modes of inner-shell ionization, p. 5. **1.5.** Radiationless reorganization of excited atoms and molecules—auto-ionization and predissociation, p. 5. **1.6.** Radiationless nuclear transitions—internal conversion of γ -radiation, p. 8. **1.7.** Production of electron pairs by internal conversion of γ -rays, p. 9. **1.8.** Radiationless annihilation of the positron, p. 9. **1.9.** Auger processes in the capture of slow negative mesons by nuclei, p. 9.

CHAPTER II

The Theory of the Auger Effect

2.1. The non-relativistic theory of the Auger effect treated as due to the direct interaction of two electrons, p. 11. **2.2.** Theory of the Auger effect treated as an internal absorption of radiation, p. 12. **2.3.** Relativistic theory of the Auger effect, p. 13. **2.4.** The Pauli principle and the Auger effect, p. 15. **2.5.** Calculation of the fluorescence yield, p. 16. **2.6.** The theory of the internal conversion of γ -rays, p. 17. **2.7.** Internal conversion effects arising from forbidden transitions, p. 21.

CHAPTER III

The Experimental Study of the Auger Effect

3.1. The cloud-chamber method, p. 24. **3.2.** Use of proportional counters for the measurements of the fluorescence yield, p. 28. **3.3.** Use of photographic emulsion techniques for the measurement of the fluorescence yield, p. 30. **3.4.** Direct measurement of the fluorescence yield, p. 31. **3.5.** Estimation of fluorescence yield from the change of ionization by X-rays in a gas at a critical frequency, p. 37. **3.6.** Measurement of fluorescence yield using calibrated Geiger-Müller counters, p. 39. **3.7.** Results of the measurement of fluorescence yield and their comparison with calculation, p. 44: (i) The *K*-shell fluorescence yield, p. 44; (ii) The *L*-shell fluorescence yield, p. 51; (iii) The *M*-shell fluorescence yield, p. 57. **3.8.** The magnetic spectra of the Auger electrons, p. 57

CHAPTER IV

The Auger Effect and X-ray Spectra

4.1. The Auger effect and the breadths of X-ray emission lines and absorption edges, p. 64. **4.2.** The Auger effect and X-ray line intensities, p. 65. **4.3.** The Auger effect and X-ray satellite lines, p. 66. **4.4.** Radiationless transitions of the Coster-Kronig type, p. 68. **4.5.** The transition rate for Coster-Kronig transitions, p. 70. **4.6.** Possible types of Coster-Kronig transitions, p. 72. **4.7.** Interpretation of *L*- and *M*-series satellites by the Coster-Kronig theory, p. 76. **4.8.** Coster-Kronig transitions and relative intensities of *L*-series lines, p. 82. **4.9.** Coster-Kronig transitions and widths of *L* and *M* levels, p. 84. **4.10.** The influence of other Auger transitions on X-ray spectra, p. 89: (i) X-ray satellites, p. 89; (ii) Line intensities, p. 91. **4.11.** The role of the Auger effect in the interpretation of soft X-ray spectra of solids, p. 92: (i) The shape of the X-ray emission bands, p. 92; (ii) Coster-Kronig transitions in the X-ray spectra of solids, p. 95.

CHAPTER V

The Internal Conversion of γ -Rays

5.1. The internal conversion coefficient, p. 98. **5.2.** Radiation from electric and magnetic multipoles, p. 98. **5.3.** Selection rules in nuclear transitions, p. 100. **5.4.** Calculation of the type of radiation emitted, using different nuclear models, p. 102. **5.5.** The measurement of the internal conversion coefficient, p. 104. **5.6.** Internal conversion and the classification of nuclear energy levels, p. 115. **5.7.** Detailed results of internal conversion coefficient calculations, p. 117. **5.8.** The comparison of measured internal conversion coefficients with the calculated values, p. 119. **5.9.** Angular correlation between successive internal conversion electrons, p. 127. **5.10.** Influence of internal conversion on the lifetimes of nuclear isomers, p. 138. **5.11.** Internal conversion following transitions of the type $J = 0 \rightarrow J = 0$, p. 141.

CHAPTER VI

Internal Conversion Processes in the Creation
and Annihilation of Electron Pairs

6.1. Internal pair production, p. 144. **6.2.** Calculation of the coefficient of internal pair production, p. 145. **6.3.** Accuracy of the approximate calculations, p. 148. **6.4.** Energy distribution of the ejected particles, p. 149. **6.5.** The coefficient of internal pair production, p. 150. **6.6.** Angular correlation between directions of emission of electron and positron, p. 152. **6.7.** The experimental evidence about internal pair production, p. 152. **6.8.** Internal pair production associated with transitions $J = 0 \rightarrow J = 0$, p. 156. **6.9.** Homogeneous positrons from γ -ray emitters, p. 158. **6.10.** The radiationless annihilation of the positron, p. 160.

CHAPTER VII

The Auger Effect in Meson Capture

CHAPTER VIII

Radiationless Transitions in Atomic and Molecular Spectra

- 8.1. Auto-ionization, p. 171. 8.2. Perturbations in molecular spectra, p. 174.
8.3. Predissociation, p. 176. 8.4. Other radiationless transition processes, p. 178.

REFERENCES	179
------------	-----

INDEX	187
-------	-----