## Contents

LIST OF TABLES	vii
LIST OF FIGURES	vii
Preface	ix
CHAPTER J. DEFINITIONS AND BASIC CONCEPTS IN RADIATIVE TRANSFER	1
1. Introduction	1
2. The Radiation Field	1
3. Interaction of the Radiation Field with Matter	5
CHAPTER II. THE EQUATION OF TRANSFER	10
1. Introduction	10
2. The Equation of Transfer-An Eulerian Derivation	10
3. The Equation of Transfer-A Lagrangian Derivation	13
4. The Boundary Conditions on the Equation of Transfer	15
5. The Equation of Transfer in Various Coordinate Systems	16
6. The Equation of Transfer in Integral Form	27
7. Peierls' Equation 8. A Variational Characterization of the Equation of Transfer	31 39
9. Induced Processes and Local Thermodynamic Equilibrium	39 44
10. The Validity of the Equation of Transfer	47
CHAPTER III. APPROXIMATE DESCRIPTIONS OF RADIATIVE TRANSFER	50
1. Introduction	50
2. The Eddington or Diffusion Approximation	51
3. Asymptotic Diffusion Theory	55
4. A New Diffusion Theory	64
5. The P-N (Spherical Harmonic) Approximation	71
6. The S-N (Discrete Ordinate) Approximation	84
7. Equilibrium Diffusion Theory	86
8. The Multigroup Method—The Planck and Rosseland Means	88
9. A New Multigroup Method	93
Chapter IV. The Representation of Polarized Light in the Equation of Transfer	106
1. Introduction	106
2. Elliptically Polarized Light	107
3. Arbitrarily (Partially) Polarized Light	113
4. The Equation of Transfer for (Partially) Polarized Light	1 <b>21</b>
5. The Special Case of Thomson (Rayleigh) Scattering	131
CHAPTER V. RADIATIVE TRANSFER IN REFRACTIVE AND DISPERSIVE MEDIA	144
1. Introduction	144
2. Hamilton's Equations for Photons	144
3. The Equation of Transfer for a General Dispersion Relation	149

v

## Contents

CHAPTER VI. THE EFFECTS OF FLUED MOTION ON THE EQUATION OF TRANSFER	154
1. Introduction	154
2. Application of the Lorentz Transformation	155
CHAPTER VII. THE INTERACTION OF THE RADIATION FIELD WITH MATTER	157
1. Introduction	157
2. General Remarks	157
3. The Einstein Coefficients	160
4. The Absorption Coefficient	164
5. The Scattering Coefficient	177
Chapter VIII. Compton and Inverse Compton Scattering	183
1. Introduction	183
2. The Scattering Kernel	183
3. The Fokker–Planck Treatment of Scattering	191
4. The Eigenvalue Problem—The Eigenvalues for No Absorption	197
5. The Eigenvalues in the Presence of Absorption	201
CHAPTER IX. RELATIVISTIC HYDRODYNAMICS IN THE PRESENCE OF A RADIATION FIELD	211
1. Introduction	211
2. Kinetic Theory Considerations	212
3. Eulerian Hydrodynamics	219
4. The Eulerian Equations in Various Coordinate Systems	222
5. Modified Eulerian Hydrodynamics	232
6. The Modified Eulerian Equations in Various Coordinate Systems	236
7. Lagrangian Hydrodynamics	245
8. The Lagrangian Equations in Various Coordinate Systems	252
Appendix. The Lorentz Transformation of the Equation of Transfer	267
References	275
BIBLIOGRAPHY	279
INDEX	281
OTHER TITLES IN THE SERIES IN NATURAL PHILOSOPHY	287