

CONTENTS

LIST OF PLATES	x
I. THE OPTICAL IMAGE	1
1. Geometrical theory	1
1.1 Introduction	1
1.2 Notation	2
1.3 The aberration function	5
1.4 Best field surface	9
1.5 Chromatism	12
1.6 Aberration functions of anastigmats	14
1.7 Image assessment and error-balancing in anastigmats	19
1.71 Introduction, 19. 1.72 Best field surface, 23. 1.73 Best spherical field surface, 25. 1.74 Aberration balancing in monochromats, 26. 1.75 Aberration balancing in presence of chromatism, 28. 1.76 Illustrative example, 31.	
2. Diffraction images	35
2.1 The aberration-free diffraction image	35
2.2 Effect of central obstruction	41
2.3 Diffraction theory of aberrations	45
2.31 The diffraction integral, 45. 2.32 Nijboer's classification of the aberrations, 48. 2.321 Physical interpretation of the classification by circle polynomials, 54. 2.33 The diffraction patterns associated with a single aberration, 58.	
3. Images of coherent or partially coherent object surfaces	67
3.1 Relevance of the ikonal function	67
3.2 Partial coherence	73
3.3 Calculation of γ_{12} from given illumination data	77
3.4 Small sources	81
3.5 Propagation of γ_{12}	82
3.6 Coherence in the image of a light source	86
3.7 Transillumination in the microscope	91
3.71 Condenser aperture and resolving power in the microscope, 94. 3.72 Images of transilluminated objects, 96. 3.73 Resolution of transilluminated object structure, 104. 3.74 Periodic objects, 108. 3.75 Imaging of periodic line structures (gratings), 112. 3.76 Resolution of fine gratings, 113.	
3.8 The phase-contrast microscope	120
REFERENCES	126
II. THE FOUCAULT TEST	128
1. Introduction	128
2. General theory of the Foucault test	129
2.1 Notation and basic approximations	129
2.2 Analytical representation of the test	133
2.3 The Reduction Theorem	136

2.4 Two special cases	138
2.5 The knife-edge test with a slit source	141
3. The true mirror under the Foucault test	143
4. Foucault properties of the astigmatic circular mirror	145
5. Circular mirror with arbitrary errors. Special cases	150
5.1 Small errors tested with knife-edge centrally set	150
5.2 Effects of varying the knife-edge setting	154
5.3 Two special cases	156
6. Zonal errors under the Foucault test	162
6.1 Introductory	162
6.2 Effect on the knife-edge shadows of a small change in figure	163
6.3 Local zonal errors	165
6.4 Interpretation of the test	168
REFERENCES	174
III. THE SCHMIDT CAMERA	176
1. Introduction and general discussion	176
2. The monochromatic aberrations of the Schmidt camera	184
3. Corrector plate profile and colour-error in the classical Schmidt camera	192
4. Aberration-balancing in Schmidt cameras	201
5. The field-flattened Schmidt camera	208
5.1 Introductory	208
5.2 Aberrations of the field-flattened Schmidt camera	209
5.3 Balancing the aberrations	219
5.4 An application	223
REFERENCES	228
IV. PLATE-DIAGRAM ANALYSIS AND ITS APPLICATIONS	229
1. Plate-diagram analysis	229
1.1 The plate-diagram	229
1.2 The Seidel error coefficients (except distortion) in terms of the plate diagram	230
1.3 Seidel distortion in terms of the plate diagram	232
1.4 Extensions	236
2. Seidel properties of the Schmidt-Cassegrain systems	240
2.1 Aplanatism and anastigmatism in Schmidt-Cassegrain systems	241
2.2 Astigmatism in Schmidt-Cassegrain aplanats	245
2.3 Distortion in the Schmidt-Cassegrain systems	246
3. Plate-mirror systems and their application to astronomical photography	247
3.1 Anastigmats from two spheres and one plate	249
3.2 The monocentric Schmidt-Cassegrain cameras	251
3.3 Anastigmats with convex primary and concave secondary mirror	251
3.4 Two-sphere aplanats	253
3.5 Schmidt-Cassegrain aplanats with spherical mirrors	254

CONTENTS

ix

3.6	Flat-fielded anastigmats	257
	3.61. The Baker camera types, <i>A, B, C, D</i>	259
3.7	Achromatized Schmidt-Cassegrain systems; two-plate systems	
	with spherical mirrors	263
3.8	Schmidt cameras with aspherized mirror	270
4.	Two-mirror systems	274
REFERENCES	283
INDEX	284