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**Nicolas-Louis de La Caille, James Dunlop and John Herschel**

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**An analysis of the First Three Catalogues of  
Southern Star Clusters and Nebulae**

Thesis submitted by

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in June 2008

for the degree of Doctor of Philosophy

in the Faculty of Science, Engineering and Information Technology

James Cook University

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## **STATEMENT ON THE CONTRIBUTION OF OTHERS**

The following have assisted in the production of this thesis.

My supervisor, Dr Graeme White guided and encouraged me throughout my research at the University of Western Sydney and James Cook University.

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Signature

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<sup>1</sup> Wolfgang Steinicke's *Revised NGC/IC, Historic NGC* and biographical data about NGC/IC Observers, can be found at <[http://www.klima-luft.de/steinicke/index\\_e.htm](http://www.klima-luft.de/steinicke/index_e.htm)>

<sup>2</sup> Robert Erdmann's *Historically Corrected NGC* and *Digitized Sky Survey* (DSS) Images of NGC Objects, can be found at <<http://www.ngcic.org/>>

<sup>3</sup> Digitized Sky Survey, *The Space Telescope Science Institute*, 2007, <<http://archive.stsci.edu/dss/acknowledging.html>>, accessed 20 January 2008.

## ABBREVIATIONS

AAO	Anglo-Australian Observatory
cf	cumulative frequency
Dec	Declination
DSFG	Deep Sky Field Guide
DTU	Desktop Universe
Dun	Dunlop
D*	double star
ESO (B)	European Southern Observatory, blue sensitive plates
GC	globular cluster
Gxy	galaxy
Hers	Herschel
IC	Index Catalogue
Lac	Lacaille
LMC	Large Magellanic Cloud
Mag	Magnitude
MWSC	Milky Way star clouds
Neb	Nebula
NGC	New General Catalogue
NPD	north polar distance
np	north preceding
NSW	New South Wales
OC	open cluster
PN	planetary nebula
RA	Right Ascension
RAS	Royal Astronomical Society
SEM	standard error mean
SERC (J)	Science and Engineering Research Council, green sensitive plates
sf	south following
SMC	Small Magellanic Cloud
SPD	south polar distance
V	visual
'	minutes or arc-minutes
"	seconds or arc-seconds

## ABSTRACT

“If men like [John] Herschel are to spend the best years of their lives in recording for the benefit of a remote posterity the actual state of the heavens...what a galling discovery to find amongst their own contemporaries men [James Dunlop] who ... from carelessness and culpable apathy hand down to posterity a mass of errors ...[so] that four hundred objects out of six hundred could not be identified in any manner ... with a telescope seven times more powerful than that stated to have been used!”<sup>4</sup>

The denigration of James Dunlop and his catalogue of 629 southern nebulae and clusters produced in 1826 originated with John Herschel and was continued by others of his day. Was this criticism justified? Was James Dunlop guilty of “carelessness and culpable apathy”? Were there “four hundred objects out of six hundred” which could not be identified, and if so, was there an explanation for this large shortfall?

This question led to a search within Dunlop’s 1826 catalogue to rediscover, if possible, some of the missing objects and to reinstate Dunlop, if justified, as a bona fide astronomer. In doing this, Dunlop’s personal background, education and experience became relevant, as did a comparison with the catalogue of 42 southern nebulae and clusters produced by Nicolas-Louis de La Caille in 1751-2, and the 1834-8 catalogue of 1708 southern nebulae and clusters by John Herschel, who found the Dunlop catalogue so galling.

To place the three southern catalogues in their historical context, a brief overview of these and the first three northern catalogues was made. Biographical information, descriptions of their equipment and comments on their observing techniques were included, where obtainable, for each of the authors of the three southern catalogues.

However the main objective of this thesis was to determine which of the 629 objects in the Dunlop catalogue exist and then using these objects in a revised Dunlop catalogue, to statistically analyse and compare it with the content of the Lacaille and Herschel catalogues. In order to identify and compare the catalogues, positions given for an object by each astronomer were precessed to J2000.0 coordinates. These modern positions for

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<sup>4</sup> James David Forbes, ‘Results of Astronomical Observations made during the years 1834, 5, 6, 7, 8 at the Cape of Good Hope, being a completion of a telescopic survey of the whole surface of the visible heavens commenced in 1825’, *The Quarterly Review*, 85, 1849, pp 1-31.

an object could then be plotted onto modern photographic star atlases and digital images of the sky, to determine the accuracy of the original positions.

Analysis of the three non-stellar catalogues included the determination of the radial distance of each object from its “correct” position and diagrams of both difference in Right Ascension and difference in Declination against Right Ascension and Declination, in order to identify any trends. Each catalogue contained some copy or printing errors, but these were omitted from the statistical calculations performed. The results for the three catalogues, from the astrometric perspective, showed that the Herschel catalogue contained the most accurate positions, followed closely by the Lacaille catalogue with no obvious or systematic trends in their inaccuracies. In contrast, the Dunlop catalogue showed some clear trends in the positional inaccuracies which, regardless of mitigating circumstances, to some extent warranted John Herschel’s criticism.

Finally an examination of the completeness of each catalogue was undertaken to determine the thoroughness of each astronomer. Firstly the effective aperture and theoretical magnitude limit for each telescope was calculated. Next the non-stellar objects were grouped into five types, open clusters, globular clusters, diffuse nebulae, planetary nebulae and galaxies, and a single working magnitude limit<sup>5</sup> was found for each catalogue. A number of indicators were used to determine the working magnitude limit.

The number of faint objects of each type which were seen, and the number of bright objects which were missed by the three astronomers, was assessed. In both the Dunlop and Herschel catalogues galaxies gave the best indicator of the working magnitude limit. Globular clusters provided the best working magnitude limit for Lacaille.

In answer to the question, ‘Was the Dunlop catalogue as bad as John Herschel claimed?’ the reply must surely be that although there are definite problems within the catalogue, chiefly missing objects and positional inaccuracies, generally this catalogue achieved much of what Dunlop intended, that is, a comprehensive list of bright nebulae and clusters in the southern sky. Although partially justified, John Herschel and others have not granted to James Dunlop the recognition he deserves.

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<sup>5</sup> The working magnitude limit is the magnitude at which the observer starts to miss more than half the objects in the best available reference catalogue.

## TABLE OF CONTENTS

ACKNOWLEDGEMENTS .....	v
ABBREVIATIONS .....	vii
ABSTRACT.....	viii
TABLE OF CONTENTS .....	x
LIST OF TABLES .....	xiii
LIST OF FIGURES .....	xvi
LIST OF PLATES .....	xviii
<b>CHAPTER 1 - A BRIEF SURVEY OF THE CATALOGUES OF SIX EARLY OBSERVERS OF CLUSTERS AND NEBULAE.....</b>	<b>1</b>
1.1 LACAILLE .....	4
1.2 MESSIER.....	5
1.3 MECHAIN .....	6
1.4 WILLIAM HERSCHEL .....	7
1.5 JAMES DUNLOP.....	9
1.6 JOHN HERSCHEL.....	10
1.7 SUMMARY .....	12
<b>CHAPTER 2 – NICOLAS-LOUIS de La CAILLE, a Precursor to the Work of Dunlop.....</b>	<b>14</b>
2.1 LIFE SKETCH OF LACAILLE (1713-1762) .....	14
2.2 LACAILLE'S WORK IN THE SOUTHERN HEMISPHERE .....	17
2.3 LACAILLE'S WORK BACK IN FRANCE .....	27
<b>CHAPTER 3 - JAMES DUNLOP, Messier of the Southern Hemisphere .....</b>	<b>28</b>
3.1 LIFE SKETCH OF DUNLOP (1793 – 1848).....	28
3.2 HISTORY OF THE PARRAMATTA OBSERVATORY.....	45
3.3 THE INTER-RELATIONSHIP BETWEEN DUNLOP, RÜMKER AND BRISBANE.....	56

3.4 A DESCRIPTION OF THE PARRAMATTA OBSERVATORY, ITS INSTRUMENTS, EQUIPMENT AND THE TELESCOPES USED FOR THE DUNLOP CATALOGUES .....	63
3.5 CRITICISMS OF THE DUNLOP CATALOGUES.....	81
<b>CHAPTER 4 – SIR JOHN FREDERICK WILLIAM HERSCHEL, The follow-on from Dunlop.....</b>	<b>86</b>
4.1 LIFE SKETCH OF JOHN HERSCHEL (1792-1871).....	86
4.2 JOHN HERSCHEL’S TELESCOPES .....	104
4.3 THE OBSERVING TECHNIQUE USED BY HERSCHEL COMPARED TO THAT USED BY DUNLOP .....	106
<b>CHAPTER 5 – AN ANALYSIS OF THE THREE EARLY CATALOGUES OF NEBULAE AND CLUSTERS.....</b>	<b>113</b>
5.1 IDENTIFICATION METHODOLOGY .....	113
5.2 ASTROMETRY, UNCERTAINTY IN POSITIONS.....	133
5.3 MAGNITUDE LIMITS AND COMPLETENESS .....	169
<b>CHAPTER 6 – CONCLUSION .....</b>	<b>209</b>
6.1 THE LACAILLE CATALOGUE .....	209
6.2 THE DUNLOP CATALOGUE .....	210
6.3 THE HERSCHEL CATALOGUE.....	211
6.4 COMBINED CATALOGUE .....	212
<b>BIBLIOGRAPHY .....</b>	<b>215</b>
<b>APPENDICES .....</b>	<b>228</b>
APPENDIX A – THE ORIGINAL LACAILLE CATALOGUE .....	228
APPENDIX B – THE LACAILLE CATALOGUE in English with Images.....	233
APPENDIX C – THE ORIGINAL DUNLOP CATALOGUE.....	248
APPENDIX D – J2000 COORDINATES FOR THE DUNLOP CATALOGUE .....	292
APPENDIX E – INTRODUCTION TO THE DUNLOP DOUBLE STAR CATALOGUE ...	293
APPENDIX F – THE REVISED DUNLOP CATALOGUE.....	294
APPENDIX G – THE ORIGINAL HERSCHEL CATALOGUE .....	354

APPENDIX H – J2000 COORDINATES FOR THE HERSCHEL CATALOGUE .....	360
APPENDIX I – IMAGES OF OBJECTS FOUND BY HERSCHEL.....	361
APPENDIX J – TABLE OF OBJECTS CATALOGUED BY LACAILLE, DUNLOP AND HERSCHEL .....	362

## LIST OF TABLES

Table 1.1: The number of NGC objects found by 1838.....	1
Table 1.2: All clusters and nebulae found by 1782.....	3
Table 1.3: Number of Each Type of Object Found by William Herschel.....	8
Table 1.4: Number of non-stellar objects catalogued by six early observers.....	12
Table 1.5: NGC objects found before 1838 south of Declination $-30^{\circ}$ .....	13
Table 3.1: Parramatta's Average Rainfall in mm from 1832 to 1838.....	39
Table 3.2: Instruments sold by Brisbane to the NSW Government.....	66
Table 3.3: The magnitudes and separations for some close double stars, according to Dunlop.....	79
Table 3.4: Comparisons between distances (in arc-seconds) and magnitudes of some double stars from the Dunlop double star catalogue.....	80
Table 4.1: A William Herschel record, sweep number 729.....	108
Table 4.2: Comparison of the positions of the two southern observatories.....	112
Table 5.1: Comparison of plates from ESO (B) and SERC (J) surveys.....	117
Table 5.2: Summary of the microfilm of Dunlop's notes.....	126
Table 5.3: Dates when Dunlop studied the Large Magellanic Cloud.....	128
Table 5.4: Dunlop objects in the LMC showing drift number and arranged by date.....	128
Table 5.5: Dunlop's third drift through the LMC on 27 September 1826.....	130
Table 5.6: Dates when Dunlop studied the Small Magellanic Cloud.....	131
Table 5.7: Objects found in the SMC sorted by date.....	132
Table 5.8: Dates when Dunlop observed in 1826.....	134
Table 5.9: Typing errors in Dunlop's published catalogue.....	135
Table 5.10: A Comparison of the number of objects with large uncertainty in radial position.....	161
Table 5.11: Dunlop objects with large uncertainty in radial position.....	161
Table 5.12: Summary of differences in RA and Declination for 18 Dunlop objects with radial positions greater than 30 arc-minutes from the ESO (B) position.....	163
Table 5.13: Herschel objects with large uncertainty in radial position.....	164
Table 5.14: Summary of differences in RA and Declination for 20 Herschel objects with radial distance greater than 30 arc-minutes from the ESO (B) position.....	166
Table 5.15: Comparison of radial distance discrepancies in position for the 3 catalogues..	167
Table 5.16: Comparison of mean, standard error mean and standard deviation for the radial distance, difference in RA and difference in Declination for the 3 non-stellar catalogues.....	168

Table 5.17: Content of the Lacaille, Dunlop and Herschel catalogues by object type, not including the Magellanic Clouds .....	170
Table 5.18: Content of the Lacaille, Dunlop and Herschel catalogues by object type, south of Declination $-30^{\circ}$ and not including the Magellanic Clouds. ....	170
Table 5.19: Reflectivity and magnitude limit for 45% tin speculum mirror telescopes.....	173
Table 5.20: Magnitude of the faintest stars in the Dunlop catalogue of nebulae and clusters. ....	174
Table 5.21: The closest doubles in the Dunlop double star catalogue. ....	175
Table 5.22: Number of non-stellar objects south of $-30^{\circ}$ Declination in the modern catalogues outside the Magellanic Clouds. ....	178
Table 5.23: Magnitudes of the faintest open cluster, globular cluster, planetary nebulae and galaxy catalogued by Lacaille, Dunlop and Herschel. ....	184
Table 5.24: Cumulative frequency percentages of galaxies catalogued by Herschel and the PGC, south of Declination $-30^{\circ}$ . ....	185
Table 5.25: Cumulative frequency percentages of open clusters, globular clusters and planetary nebulae catalogued by Herschel. ....	189
Table 5.26: Peak or modal magnitudes for open clusters, globular clusters and planetary nebulae in the Herschel catalogue compared to the reference catalogues. ....	190
Table 5.27: Number of open clusters, globular clusters, planetary nebulae and galaxies included and missed in the Herschel catalogue compared to the working magnitude limit of 12.7. ....	190
Table 5.28: Cumulative frequency percentages of open clusters, globular clusters and planetary nebulae catalogued by Dunlop. ....	195
Table 5.29: Peak or modal magnitudes for open clusters, globular clusters and planetary nebulae in the Dunlop catalogue compared to the reference catalogues.....	196
Table 5.30: Number of open clusters, globular clusters, planetary nebulae and galaxies included and missed in the Dunlop catalogue compared to the working magnitude limit of 10.9.....	197
Table 5.31: Cumulative frequency percentages of open clusters and globular clusters catalogued by Lacaille. ....	198
Table 5.32: Number of open clusters, globular clusters, planetary nebulae and galaxies included and missed in the Lacaille catalogue compared to the working magnitude limit of 6.4. ....	199
Table 5.33: A sample of bright galaxies missed by Dunlop and Herschel to magnitude 11.0.....	200
Table 5.34: Faint galaxies seen by Dunlop and a sample of faint galaxies seen by Herschel to magnitude 15.0.....	201

Table 5.35: Globular clusters found or missed by Lacaille, Dunlop and Herschel to magnitude 12.4.....	203
Table 5.36: Open clusters missed by Lacaille or Dunlop or Herschel.....	203
Table 5.37: Open clusters fainter than the working magnitude limits found by Lacaille, Dunlop and Herschel.....	205
Table 5.38: All planetary nebulae found or missed by Dunlop and Herschel compared to their working magnitude limits.....	205
Table 5.39: Summary of the telescopes, the magnitude limits and faintest object seen for the three historical catalogues.....	207
Table 5.40: Number of missed objects brighter than working magnitude limit and objects seen fainter than working magnitude limit, by type of object.....	208
Table 6.1: Number of southern objects, by type, originally discovered by each observer ..	213

## LIST OF FIGURES

Figure 2.1: Plan of Lacaille's 1751 observatory on Strand St, Cape Town, showing the location of the instruments.....	18
Figure 2.2: A diagram of the large reticle, one of four used to make the star catalogue. Different reticles were used for different Declination zones of the sky.....	20
Figure 2.3: Lacaille's arc of the meridian triangles.....	24
Figure 3.1: The Parramatta Observatory, showing the position of the instruments.....	65
Figure 5.1: Radius from Guide 8 position to Lacaille position.....	137
Figure 5.2: The Lacaille Target diagram (in the sense Guide – Lacaille).....	138
Figure 5.3: The distribution of the differences in Right Ascension (in the sense Guide – Lacaille) as a function of Right Ascension.....	139
Figure 5.4: The distribution of the differences in Declination (in the sense Guide – Lacaille) as a function of Right Ascension.....	140
Figure 5.5: The distribution of the differences in RA (in the sense Guide – Lacaille) as a function of Declination.....	141
Figure 5.6: The distribution of the differences in Declination (in the sense Guide – Lacaille) as a function of Declination.....	142
Figure 5.7: Radial distances of 354 objects from the modern ESO (B) positions. ....	144
Figure 5.8: The Dunlop Target Diagram (in the sense ESO – Dunlop).....	145
Figure 5.9: The distribution of the differences in Right Ascension (in the sense ESO – Dunlop) as a function of Right Ascension.....	146
Figure 5.10: The distribution of the differences in Declination (in the sense ESO – Dunlop) as a function of Right Ascension.....	147
Figure 5.11: The distribution of the differences in RA (in the sense ESO – Dunlop) as a function of Declination.....	148
Figure 5.12: The distribution of the differences in Declination (in the sense ESO – Dunlop) as a function of Declination.....	149
Figure 5.13: Difference in RA as a function of the observation date in 1826.....	150
Figure 5.14: Difference in Declination as a function of observation date in 1826. ....	151
Figure 5.15: Plot of the range in daily difference in RA, for the 61 nights of observations.	152
Figure 5.16: Plot of the range in daily difference in Declination, for the 61 nights of observations. ....	153
Figure 5.17: The Herschel Target diagram (in the sense ESO – Herschel). ....	155
Figure 5.18: Histogram of the radial differences in position. ....	156
Figure 5.19: Histogram of positional differences in RA (ESO – Herschel).....	156
Figure 5.20: Histogram of positional differences in Declination (ESO – Herschel).....	157

Figure 5.21: The distribution of the differences in Right Ascension (in the sense ESO – Herschel) as a function of Right Ascension.....	158
Figure 5.22: The distribution of the differences in Declination (in the sense ESO – Herschel) as a function of Right Ascension.....	159
Figure 5.23: The distribution of the differences in RA (in the sense ESO – Herschel) as a function of Declination.....	159
Figure 5.24: The distribution of the differences in Declination (in the sense ESO – Herschel) as a function of Declination.....	160
Figure 5.25: Histogram of the number of open clusters by half magnitude for the Lynga Catalogue.....	179
Figure 5.26: Histogram of the number of globular clusters by half magnitude for the Harris catalogue.....	180
Figure 5.27: Histogram of the number of planetary nebulae by half magnitude in the Strasbourg-ESO Catalogue.....	181
Figure 5.28: Cumulative frequency as a function of magnitude for galaxies recorded by Dunlop, Herschel and the Catalogue of Principal Galaxies.....	183
Figure 5.29: Histogram of the number of galaxies by magnitude for the PGC.....	183
Figure 5.30: Histogram of the number of galaxies by half magnitude for the Herschel catalogue.....	186
Figure 5.31: Distribution of log of the cumulative frequency with Poisson upper and lower limits as a function of V magnitude for Herschel galaxies.....	187
Figure 5.32: Distribution of log of the cumulative frequency as a function of V magnitude for the Herschel and PGC galaxies.....	188
Figure 5.33: Histogram of the number of galaxies by half magnitude for the Dunlop catalogue.....	192
Figure 5.34: Distribution of log of the cumulative frequency with Poisson upper and lower limits as a function of V magnitude for the Dunlop galaxies.....	193
Figure 5.35: Distribution of log of the cumulative frequency as a function of V magnitude for the Dunlop and LEDA galaxies.....	194

## LIST OF PLATES

Plate 1.1: Giovanni Hodierna discovered non-stellar objects before 1654.....	2
Plate 1.2: Abbé Nicolas-Louis de La Caille was the first to catalogue southern non-stellar objects.....	4
Plate 1.3: Charles Joseph Messier began a catalogue of non-stellar objects six years after Lacaille completed his catalogue.....	5
Plate 1.4: Pierre Francois André Méchain discovered some objects in the Messier catalogue.....	6
Plate 1.5: William Herschel compiled a catalogue of more than 2000 non-stellar objects with help from his sister, Caroline Herschel.....	7
Plate 1.6: James Dunlop produced the first major catalogue of southern non-stellar objects in 1826.....	9
Plate 1.7: John Frederick William Herschel was the first to catalogue more than 1000 southern non-stellar objects.....	10
Plate 2.1: Monument to Lacaille at his birthplace in Rumigny, France.....	14
Plate 2.2: Location of Lacaille's house at Rumigny. The current building was erected in 1825.....	15
Plate 2.3: Collège Mazarin, now the Institut de France, where Lacaille studied and later taught, and a satellite image showing its location across the Seine River from the Louvre..	16
Plate 2.4: The plaque and its wording, on Strand St, Cape Town, near the site of Lacaille's observatory.....	18
Plate 2.5: Satellite photographs of the vertices of the meridian triangles.....	25
Plate 3.1: James Dunlop (1793-1848).....	28
Plate 3.2: Map showing the area south-west of Glasgow including Largs where Brisbane built his observatory, Dalry where Dunlop was born and Beith where Dunlop worked.....	29
Plate 3.3: Remains of Brisbane's first observatory at Largs.....	30
Plate 3.4: Old Government House Parramatta, from the transit mounting stones.....	31
Plate 3.5: The obelisk marks the alleged position of the original transit instrument in the observatory, with a transit mounting in the foreground.....	32
Plate 3.6: Satellite image of Parramatta showing the location of Brisbane's observatory, Government House, the site of Dunlop's house and observatory and St John's Church.....	32
Plate 3.7: Map showing Sydney and Parramatta (top left) 24 km to the west.....	33
Plate 3.8: A Catalogue of 7385 Stars, chiefly in the Southern Hemisphere. This catalogue was produced by Brisbane from observations made by Dunlop and Rümker. ....	33
Plate 3.9: Dunlop catalogued clusters, nebulae and double stars with his 9-inch reflecting telescope from the back yard of this house, in 1826.....	34

Plate 3.10: The white multi-storey building behind St John's Church was built on the site of Dunlop's house.....	35
Plate 3.11: Brisbane built his third observatory at Makerstoun, Scotland, on the Tweed River, 6 km west of Kelso.....	36
Plate 3.12: Brisbane's third observatory, according to the owner Lady Mary Biddulph, and his house on the Tweed River at Makerstoun, Scotland. ....	37
Plate 3.13: Dunlop retired to Kincumber on Brisbane Water, 11 km south east of Gosford, NSW.....	41
Plate 3.14: Satellite image of Kincumber showing Dunlop's house on Brisbane Water and St Paul's Anglican Church where he is buried.....	42
Plate 3.15: John Dunlop Heuston, a relative of James Dunlop now lives at Boora Boora, the site of Dunlop's original house.....	42
Plate 3.16: Head stone on James Dunlop's grave (1793 – 1848) at St Paul's Church, Kincumber, NSW.....	43
Plate 3.17: Sir Thomas Brisbane (1773-1860) established the Parramatta Observatory in 1822 with Charles Rümker as his astronomer and James Dunlop as an assistant.....	45
Plate 3.18: The German Charles Luis Rümker (1788-1862) was Brisbane's astronomer until June 1823.....	47
Plate 3.19: Encke's comet was near M35 and Mercury when recovered, according to modern astronomy software.....	48
Plate 3.20: The Scotsman James Dunlop (1793-1848) became the astronomer at the Parramatta Observatory when Rümker left in June 1823. ....	50
Plate 3.21: The 46-inch equatorial telescope and two Parramatta clocks: local time (left) and sidereal time (right); now at the Sydney Observatory.....	50
Plate 3.22: The obelisk in Parramatta Park marks the alleged site of the transit instrument.	54
Plate 3.23: The author at Rümker's grave at St George English Church, Estrella, Lisbon, Portugal. ....	61
Plate 3.24: The northern and eastern walls of the Parramatta Observatory. ....	64
Plate 3.25: The 5.5-foot Transit Instrument and Brisbane's celestial globe are at the Sydney Observatory.....	67
Plate 3.26: Part of the 2-foot diameter mural circle and an enlargement of the circle showing 1 degree = 6 divisions.....	69
Plate 3.27: The 3.25-inch aperture, 46-inch focal length, Banks equatorial achromatic telescope, and mounting detail, now located at the Sydney Observatory.....	71
Plate 3.28: The 16-inch repeating circle by Reichenbach now located at the Sydney Observatory.....	72

Plate 3.29: The face of the Hardy sidereal clock at Sydney Observatory. Note the 24 hour circle. This was the main clock used by Dunlop at the observatory. ....	73
Plate 3.30: The Breguet mean time clock, now at the Sydney Observatory. ....	74
Plate 3.31: A plate from Bode's 1801 <i>Uranographia</i> . This was similar to the atlas used by James Dunlop. ....	75
Plate 3.32: Location of the house in Parramatta where Dunlop made his catalogues of clusters and nebulae, and double stars. ....	76
Plate 4.1: John Herschel in 1845 after his time at the Cape and his father William Herschel (right). ....	86
Plate 4.2: John's drawing of Observatory House at Slough and William's coat of arms showing Uranus and the 40 ft telescope. ....	87
Plate 4.3: Map of Slough showing the location of the monument that marks the site of the 40 ft telescope at Observatory House and the monument to William Herschel. Also shown is the location of St Laurence's Church. ....	88
Plate 4.4: St Laurence's Church where William is buried and the stained glass window by Andrew Taylor commemorating William Herschel. ....	88
Plate 4.5: Margaret Brodie Stewart (after Alfred Edward Chalon 1829), wife of John Herschel. ....	94
Plate 4.6: A highly finished camera lucida sketch by John Herschel of Devil's Peak, from the front of his home Feldhausen. ....	95
Plate 4.7: Feldhausen, the Cape Town home of John Herschel, in later years just before it was demolished. ....	96
Plate 4.8: Stone obelisk marking the site of the 20-foot telescope in the grounds of the Grove Primary School and the satellite image showing its location. ....	99
Plate 4.9: The 18.5-inch aperture, 20-foot reflector at the Cape and the building housing the 5-inch aperture, 7-foot refractor. Table Mountain is shown in the background. ....	104
Plate 5.1: A section of the <i>Uranometria 2000.0</i> star atlas. ....	115
Plate 5.2: A section of <i>Uranometria</i> showing NGC 5128. The small rectangle covers approximately the same 75' wide area as the UK Schmidt image in Plate 5.3. ....	116
Plate 5.3: Photograph from the Schmidt plate, SERC (J), of NGC 5128, Dunlop 482. ....	117
Plate 5.4: Guide Star Chart showing NGC 104, Lacaille I.1 (L101), Dunlop 18 and Herschel 2322. The labels Dmf 53 and Dmf 61 refer to the microfilm of Dunlop's notes. ....	119
Plate 5.5: The elongated galaxy NGC 4945 using Guide merged with RealSky. ....	120
Plate 5.6: The globular cluster NGC 6397 using Guide and RealSky. ....	122
Plate 5.7: NGC 6397 using Desktop Universe with approximately the same 25' wide field as Plate 5.6. ....	122
Plate 5.8: The open cluster NGC 3114 in RealSky with 50' wide field. ....	123

Plate 5.9: NGC 3114 in Desktop Universe is more conspicuous.....	123
Plate 5.10: RealSky image of the nebula NGC 3199 with 60° wide field.....	124
Plate 5.11: NGC 3199 is more obvious in Desktop Universe.....	124
Plate 5.12: Guide 8 for part of the LMC showing many non-stellar objects. ....	125
Plate 5.13: Desktop Universe of the same area ( $1^{\circ}$ by $0.5^{\circ}$ ) of the LMC as shown in Plate 5.12.....	125
Plate 5.14: A sample from the microfilm of Dunlop's hand written notes.....	126
Plate 5.15: Identification of objects discovered by Dunlop in the LMC on 27 September 1826, drift 3.....	131