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

—

**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.

Mr Ian Jupp, from the UK, assisted in taking some astronomical photos at the AAO for this thesis.

Mr Ian McDonald, of Murwillumbah NSW assisted with editing and proof reading.

My wife, Julie assisted with typing and proof reading, and she encouraged and supported me through the years of this research.

My former employer (the North NSW Conference) provided financial assistance. Mr Dean Bennetts allowed me time to continue with this research.

The Australian Government also provided financial assistance.

Signature

5/2/08
Date

ACKNOWLEDGEMENTS

I wish to thank many people who have made valuable contributions towards this thesis:

My supervisor Dr Graeme White, from the Centre for Astronomy at the Faculty of Science, Engineering and Information Technology, James Cook University for his advice, suggestions and help especially in Chapter 5 of this thesis.

Dr Wayne Orchiston, from James Cook University loaned me copies of the original Lacaille and Herschel catalogues and also supervised the final stages of the thesis.

Dr Andrew Walsh, from James Cook University contributed to the completion of the thesis.

Dr Harold Corwin, Jr from the California Institute of Technology offered encouragement and suggestions.

Dr Carol Liston, from the University of Western Sydney provided support and ideas.

Dr Paul Jones, (University of Western Sydney) precessed the coordinates for all objects to J2000.0 and provided support and encouragement.

Mr John Dunlop Heuston, who now owns Boora Boora, NSW (formerly owned by James Dunlop) provided historical information and allowed access to family memorabilia.

The late Dr David Allen allowed me the use of the Schmidt plates at the Anglo-Australian Observatory, Epping. Also Robyn Shobbrook and Sandra Ricketts supported my research at the AAO library.

Yann Pothier, from France made suggestions regarding the Dunlop catalogue.

Hartmut Frommert, of Germany provided encouragement and information on Lacaille and the history of deep-sky astronomy.

The late Kenneth Glyn Jones, from the UK sent information on Hodierna's observations of nebulae.

Kent Wallace, of California made suggestions regarding planetary nebula.

Dr Ragbir Bhathal (University of Western Sydney) and Dr Alex Hons (James Cook University) made suggestions and provided encouragement.

Wolfgang Steinicke¹ (Germany) and Robert Erdmann² (USA) provided inspiration through correspondence and via their web pages.

I also wish to thank the following institutions for their help:

The Australian National Library, Canberra provided a microfilm copy of Dunlop's notes.

The State Library of NSW supplied a copy of John Service's biography of James Dunlop and allowed me the use of their special collections.

The Space Telescope Science Institute provided *the Digitized Sky Surveys*.³

This research made use of databases available at the Centre de Données astronomiques de Strasbourg, Strasbourg, France.

Finally, I would like to thank my wife and three daughters for their patience and support throughout.

¹ 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>

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

³ 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!”⁴

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 preprocessed to J2000.0 coordinates. These modern positions for

⁴ James David Forbes, ‘Results 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 limit⁵ 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.

⁵ 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.

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