

## DEEP-SKY COMPANIONS

# Southern Gems

In *Southern Gems*, Stephen James O'Meara makes a detour beneath the southern skies, presenting a fresh list of 120 deep-sky objects for Southern Hemisphere stargazers to observe. Showcasing many exceptional objects catalogued by the pioneering observer James Dunlop, known as the "Messier of the southern skies," all are visible through small- to moderate-sized telescopes under dark skies. The list features a rich assortment of bright and dark nebulae, planetary nebulae, open and globular star clusters, and galaxies of all types. Each object's profile includes beautiful photographs and sketches, original finder charts, visual histories, and up-to-date astrophysical background information. Whether you live in the Southern Hemisphere or are just visiting, this new *Deep-Sky Companion* will make a perfect observing partner, whatever your background. There is no other southern sky guide like it on the market.

Author of several highly acclaimed books, including others in the celebrated *Deep-Sky Companions*

series, Stephen James O'Meara is well known among the astronomical community for his engaging and informative writing style and his remarkable skills as a visual observer. O'Meara spent much of his early career on the editorial staff of *Sky & Telescope* before joining *Astronomy* magazine as its Secret Sky columnist and a contributing editor. An award-winning visual observer, he was the first person to sight Halley's comet on its return in 1985 and the first to determine visually the rotation period of Uranus. One of his most distinguished feats was the visual detection of the mysterious spokes in Saturn's B-ring before spacecraft imaged them. Among his achievements, O'Meara has received the prestigious Lone Stargazer Award, the Omega Centauri Award, and the Caroline Herschel Award. Asteroid 3637 was named O'Meara in his honor by the International Astronomical Union. In his spare time, he travels the world to document volcanic eruptions. He is a contract videographer for National Geographic Digital Motion and a contract photographer for the National Geographic Image Collection.

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STEPHEN JAMES O'MEARA



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To Donna,  
My love

To Daisy Duke,  
My joy

And in memory of Milky Way, Miranda-Pywackett, and Pele,  
My angels.

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# Preface



I LOVE EXPLORING THE SOUTHERN night sky. For much of my life, this large and lush celestial wilderness was a secret garden to which I hadn't a key. I grew up observing the stars from a mid-northern latitude, in Cambridge, Massachusetts. Back then, I could only imagine the beauty of objects such as globular cluster Omega Centauri, 47 Tucanae, the Jewel Box open cluster, the Eta Carinae nebula, and, of course, the Large and Small Magellanic Clouds, to name but a few. These objects, though familiar to me by name, were among the many "invisible wonders" of the universe. I finally obtained a key to a large part of the garden when I temporarily resided in Hawaii for several months in 1981 and 1982 – before moving to Volcano on the Big Island of Hawaii in 1994.

Actually, I have been traveling to the Southern Hemisphere since 1982, and over the years I've accumulated impressions of

some of the more prominent southern-sky objects through a variety of instruments. In August 1997, I traveled to New Zealand, where I used the Auckland Observatory's 20-inch f/13.5 Zeiss reflector and 4.5-inch finderscope to observe some of these objects. I also used the 9-inch refractor at Carter Observatory (in Wellington), as well as a Celestron 8-inch Schmidt-Cassegrain telescope set up in the backyard of a friend's house in Wellington, to view others. I've also observed deep-southern objects from the Australian Outback, from the Altiplano in Bolivia, from the plains of South Africa, and with friends in Central America.

For my observations at home, I used several instruments, principally a Tele Vue 4-inch f/5 Genesis refractor (from 1994 to 2007) and a Tele Vue NP-127 Nagler-Petzval 5-inch (660-millimeter) f/5.2 apochromatic refractor (from 2007 to the present). I also used 7 × 35 and 10 × 50 binoculars, and, on occasion, a nineteenth-century brass telescope made by Ross of London, which I refer to simply as "the antique telescope" in Chapter 2; its tube measures 17 1/8 inches when open and 7 1/4 inches when closed.

But that's only part of the story behind the making of this book.

## HOW THE 120 SOUTHERN GEMS WERE SELECTED

The foundation for the Southern Gems list was laid in 1996, when I started work on my book titled *Deep-Sky Companions: The Caldwell Objects*. While researching the histories of some of the southern objects in the Caldwell list, I became aware of discoveries made by James Dunlop, who in 1826 surveyed the southern skies for nebulae and star clusters from Australia with a 9-inch f/12 reflector. This led to the creation of his *Catalogue of Nebulae and Clusters of Stars in the Southern*

*Hemisphere observed at Parramatta in New South Wales*, which he presented to the Royal Society of London in 1827. The Society published the catalogue of 629 objects in its *Philosophical Transactions* for 1828.

When my friend Brent Archinal (then of the U.S. Naval Observatory) learned of my interest in Dunlop's work, he presented me with a copy of Dunlop's catalogue, which I began to read with fascination. My interest in Dunlop swelled when I discovered that John Herschel, during his stay in South Africa in the 1830s, had failed to identify about two-thirds of the objects catalogued by Dunlop with an 18 1/2-inch speculum-metal-mirror reflector (see Appendix C).

Nevertheless, I found many of Dunlop's descriptions of the identifiable objects well suited for amateur astronomers using small- to moderate-sized telescopes – like the ones I used in the field. And that in itself attracted me.

My respect for Dunlop was further magnified by a 2010 paper titled “James Dunlop's Historical Catalogue of Southern Nebulae and Clusters” in the *Journal of Astronomical History and Heritage* ([http://eprints.jcu.edu.au/10919/1/10919\\_Cozens\\_et\\_al\\_2010.pdf](http://eprints.jcu.edu.au/10919/1/10919_Cozens_et_al_2010.pdf)). In it, authors Glen Cozens, Andrew Walsh, and Wayne Orchiston (of the Centre for Astronomy, James Cook University, Townsville, Queensland, Australia) make the following conclusions about Dunlop's work:

Dunlop's catalogue contains most of the bright star clusters, nebulae and galaxies south of declination  $-30^\circ$ , and therefore is the southern equivalent of Messier's famous northern catalogue, as suggested by Cozens and White in the June 2001 edition of *Sky & Telescope*. It unfortunately also contains a large number of entries which are probably faint double stars or asterisms, because Dunlop was unable to resolve them. Omitting the double stars and asterisms

gives rise to an impressive catalogue. We therefore believe that the Dunlop catalogue should be a useful resource for southern amateur astronomers viewing galaxies, nebulae and clusters.

Cozens promotes the same argument in his Ph.D. thesis titled “Nicolas-Louis de La Caille, James Dunlop and John Herschel: An Analysis of the First Three Catalogues of Southern Star Clusters and Nebulae”:

In defense of Dunlop's work his catalogues are actually better suited to amateur astronomers with smaller telescopes. His descriptions are of interest to those with 6- to 10-inch telescopes because Dunlop's telescope was of a similar size and had a similar limiting magnitude. The descriptions are also important because they were the first made of many bright far southern objects, including genuine objects that John Herschel failed to see.

Thanks to Cozens et al., my quest to create an observing guide for Southern Hemisphere observers had a clear focus. To help me in my selection of objects for this book, Cozens graciously supplied me with several different lists of identifiable Dunlop objects that he felt were well suited for today's amateur astronomers using telescopes of 6- to 10-inch aperture (or greater), mainly those listed in the Dunlop 100, which appeared in *Sky & Telescope* (June 2001); the Dunlop 244 (the Dunlop 100 plus 144 other objects identified from John Herschel's 1864 *General Catalogue* and Arthur Auwers' 1862 catalogue); and a list of 150 select Dunlop objects.

My task, then, was to review these lists and create a new one that would provide a balanced observing program. I wanted a mix of bright targets, as well as a few challenging objects (those that Dunlop found near the vision limit in his sweeps). I found the latter objects quite remarkable, as they are testaments to the visual prowess of Dunlop, who

used a speculum-metal-mirror telescope that performed perhaps as well as a modern 6-inch reflector.

In the end, I selected 120 Dunlop objects: 43 galaxies, 36 globular star clusters, 30 open star clusters, 6 planetary nebulae, 3 bright nebulae, and 2 dark nebulae. Given that Dunlop has been called the Messier of the southern skies, I tried to balance the list so that the number of each individual type of object in the Messier and Southern Gems lists was approximately equal (the Southern Gems catalogue includes 10 more objects than the Messier catalogue). Galaxies comprise about 35 percent of both the Messier and Southern Gems catalogues; globular star clusters comprise about 25 percent of the Messier catalogue and about 30 percent of the Southern Gems catalogue. And in both the Messier catalogue and the Southern Gems catalogue open star clusters comprise 25 percent of the objects. You can compare the other types of objects in the following table:

**Number of various types of objects from Messier and Southern Gems catalogues**

Object type	Messier catalogue	Southern Gems catalogue
Galaxies	39	43
Globular star clusters	28	36
Open star clusters	27	30
Bright nebulae	7	3
Planetary nebulae	4	6
Dark nebulae	0	2
Supernova remnants	1	0
Star clouds	1	0
Double stars	1	0
Asterisms	1	0
Unidentified objects	1 (M102)	0
Total	110	120

To ease the selection process, I did not include objects in the Large or Small Magellanic Clouds, which could be the bulk of another book. However, I did include a selection of these in Appendix B, which lists 42 additional Southern Gems (all Dunlop objects) appended with Dunlop's catalogue entries. Furthermore, because I had researched, observed, and included many deep-sky objects in my book *Deep-Sky Companions: The Caldwell Objects*, it was only natural to include in the Southern Gems list those objects in the Caldwell list that also appear in Dunlop's catalogue. I then updated most of the Caldwell essays, which I had written more than a decade ago.

Otherwise, for galaxies, I selected those of magnitude 11.0 or brighter – with two exceptions: NGC 7590 (magnitude 11.3) and NGC 7599 (11.1). These two galaxies belong to the famous Grus Triplet, the other member being NGC 7582 (magnitude 10.1). The only fainter object in the list is planetary nebula NGC 2818 (magnitude 11.6). Not only is NGC 2818's light concentrated into a disk only 38" across (making it a decent target), but we see it projected on the sky against the pretty open star cluster Melotte 96 in Pyxis, another Dunlop discovery.

The Southern Gems list is replete with celestial wonders, some superlative in their nature. There's the globular cluster dynamo Omega Centauri (Southern Gem 62) – one of the oldest objects in the Milky Way (its age being comparable to that of the universe itself), which may be the nucleus of a cannibalized dwarf galaxy (a former companion to the Milky Way). Centaurus A (Southern Gem 61) is a superlative in virtually every region of the electromagnetic spectrum. It is one of the brightest naked-eye galaxies; by far the nearest and most violent Seyfert-type galaxy

known; one of the most intense radio sources in the heavens; and a wellspring of infrared, x-ray, and gamma-ray radiation. Eta Carinae (Southern Gem 48) had the largest explosion that any star is known to have survived. At radio wavelengths, Eta Carinae produces the brightest known stellar wind. What's more, through a telescope, the star is surrounded by an elaborate tapestry of stellar energy fused into luminous folds of gases strung together with threads of dust.

And NGC 1365 (Southern Gem 16) is one of the most stunning barred spiral galaxies in the night sky – an impressive system with a linear diameter of 160,000 light-years and a luminosity 200 billion times that of the Sun, making it a good match for our Milky Way.

And there's so much more: some of the blackest dark nebulae known, icy blue planetary nebulae, rich open star clusters, ringed and lenticular galaxies, luminous Seyfert galaxies (extraordinary energy engines that emit about a thousand times more energy than the radio nucleus of our galaxy), starburst galaxies, interacting galaxies, grand-design spirals, extragalactic systems with supermassive black holes, and more. The 120 objects in the Southern Gems list are here for your enjoyment. All can be seen with a 5-inch telescope

under a dark sky. Many are visible with binoculars, and some can be seen with the unaided eye.

Although the title of this *Deep-Sky Companions* volume is *Southern Gems*, all the objects in it were either discovered by Dunlop or appear in his catalogue of nebulae and clusters. With 156 discoveries Dunlop, Cozens determined, is the third greatest discoverer of *bright* NGC/IC objects after William and John Herschel. By sharing these wonders with you, I hope to keep Dunlop's name alive well into the future, especially because, as Cozens, White, and Orchiston point out at the end of their 2010 paper, Dunlop is "virtually unknown today, a forgotten pioneer of the southern sky."

My tacit desire in creating this special edition of the *Deep-Sky Companions* series is to help both Southern Hemisphere observers and Northern Hemisphere observers with the desire to travel and explore the southern skies on their own to grow as observers and expand their visual envelope, and make the act of observing a fun and memorable experience – one that will inspire the collective you to share this exciting adventure with others and continually perpetuate the love, joy, and romance of observing.

# Acknowledgments

BEFORE WE JOURNEY ON, I WOULD LIKE to thank Vince Higgs, Lindsay Barnes, Helen Wheeler, and the editorial staff at Cambridge University Press for their encouragement, help, and support with this book and the *Deep-Sky Companions* series. I bow low to Al and David Nagler of Tele Vue Optics in Chester, New York, for making my nights under the stars so pleasurable with their refracting telescopes. And I thank Sue Tritton at the Plate Library of the Royal Observatory Edinburgh for granting me permission to use the Digitized Sky Survey images taken with the UK Schmidt Telescope; your contribution was invaluable. I am grateful for the help of the professional astronomers who reviewed the astrophysics on the objects covered in this book; most I list as the authors or the principal investigators of the professional papers mentioned in the text. I am honored that South African amateur astronomer and lover of the stars Magda

Streicher contributed her observations of many of the Southern Gems as seen through her 12- and 16-inch Schmidt-Cassegrain telescopes. I am also extremely grateful for the kind assistance of Glen Cozens in Australia, who inspired me to spotlight the works of James Dunlop in this book by sending me his Ph.D. thesis. He also supplied me with various lists of Dunlop objects from which I could make my object selections, reviewed my brief history of early southern sky explorations in Appendix C, and made invaluable corrections to my proofs. Of course, and to paraphrase Cassius in Shakespeare's *Julius Caesar*, "Any fault, dear readers, is not in the stars, But in myself, as I am an underling."

Finally, I would like to express my love for my beautiful wife, Donna, for helping me on this journey with her love, support, and understanding, and for Daisy Duke, our faithful papillon.

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