DEEP-SKY COMPANIONS

# The Messier Objects
## Second Edition

The bright galaxies, star clusters, and nebulae catalogued in the late 1700s by the famous comet hunter Charles Messier are still the most widely observed celestial wonders in the sky. The second edition of Stephen James O'Meara's acclaimed observing guide to the Messier objects features improved star charts to help you find the objects, a much more robust telling of the history behind their discovery – including a glimpse into Messier's fascinating life – and updated astrophysical facts to put it all into context. These additions, along with new photos taken with the most advanced amateur telescopes, bring O'Meara's first edition more than a decade into the twenty-first century. Expand your universe and test your viewing skills with this truly modern Messier guide. It is a must for all budding night watchers.

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 for 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 upon 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.

For Deborah Carter, who helped me to see the stars through new eyes. Thank you.

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STEPHEN JAMES O'MEARA

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# Preface to the second edition

Cambridge University Press first published *Deep-Sky Companions: The Messier Objects* 15 or so years ago. It was the first in what is now a series of five *Deep-Sky Companions* volumes. The other books in the series are subtitled *The Caldwell Objects*, *Hidden Treasures*, *The Secret Deep*, and *Southern Gems*. Not only was *The Messier Objects* the first book in this series, but it was also the first deep-sky book I had ever written. As such it stands apart from the other volumes for several reasons.

First, many observers already had in their possession one or more books on the Messier objects, most notably *The Messier Album* by the late John H. Mallas and Evered Kreimer (Sky Publishing, Cambridge, MA, 1978), segments of which first appeared in *Sky & Telescope* magazine in the late 1960s, and *Messier's Nebulae and Star Clusters*, 2nd edition, by the late Kenneth Glyn Jones (Cambridge University Press, 1991). Thus, I realized, my book would need a fresh approach.

For instance, to me, the most outstanding aspects of Glyn Jones's book are the rich histories he presents on Messier and his contemporaries, as well as his summaries of historical observations of the "M" objects. Not wanting to duplicate this effort, I decided to minimize those aspects in my own book. I saw the Mallas and Kreimer book as having three strengths: (1) Kreimer's beautiful photographs of the Messier objects taken through his 12 1/2-inch Cave reflector from Prescott, Arizona; (2) Mallas's pencil drawings of each M object as seen through a 4-inch f/15 Unitron refractor from his backyard in Covina, California; and (3) Harvard historian Owen Gingerich's scholarly biography of Messier and his contemporary Pierre Méchain.

To avoid duplicating these efforts, I asked comet hunter David Levy to write a short history on Messier, who was himself predominantly a comet hunter. I also decided to include photographs by different amateur astronomers that would help to inspire observers. And, although I, too, had a 4-inch telescope, mine was an f/5 refractor, which offered a wider field of view than Mallas's f/15 refractor, so our impressions of these objects would be different. It was this latter impression that I wanted most to share with observers in the first edition of *The Messier Objects*. So I put my heart and soul into that aspect of the book, perhaps even more so than in the other volumes, only because, through a small telescope, the Messier objects offer the most detailed views of those visible from mid-northern latitudes.

Second, while both the Glyn Jones and the Mallas and Kreimer books included finder charts and directions to each Messier object, I tried to improve on them. Now, looking back, I see the charts in the first edition of *The Messier Objects* as "rough" compared with those in my other *Deep-Sky Companions* volumes (which are all hand plotted). The charts in the first edition were computer generated by an old software program, and the stars didn't bin very well. Nevertheless, they still were a slight improvement over those in the Glyn Jones and Mallas and Kreimer works.

And third, when I wrote the first edition of *The Messier Objects*, I decided to include *some* interesting historical and astrophysical facts about these objects, but I didn't treat each with equal concern. I rectified that in the other volumes in the series. Also, while I did include some astrophysical highlights in the first edition, it does not compare, overall, with what I have done for the other *Deep-Sky Companions* guides.

This last point is further exacerbated by the tremendous leaps in telescope technology and imaging (both from orbit and on the ground), which have opened vast

new vistas throughout the electromagnetic spectrum to our eyes and offered astronomers new insights into the mechanisms and forces governing the appearance of these glorious objects. Furthermore, when I wrote the first edition, amateur charge-coupled device (CCD) imaging was still in its infancy. No more! Take for instance the beautiful CCD images accompanying each object in Chapter 4, taken by my friend Mario Motta in Gloucester, Massachusetts.

So, much has happened in the 15 years leading up to the publication of this second edition, including my exchanging the 4-inch f/5 Tele Vue Genesis refractor for a Tele Vue 5-inch f/5 refractor, then a 3-inch f/5 Tele Vue refractor, some observations from which have been added in Chapter 4. Still, I have kept the basic structure of the book the same, but I have included a new history (a glimpse into the fascinating life of Charles Messier and the making of his now famous catalogue); new, detailed star charts (hand plotted to show the most efficient way to find objects by star-hopping); and a much more robust telling of historical and astrophysical facts. All these additions bring the twentieth-century first edition of the book more than a decade into the twenty-first century. I hope you enjoy this fresh look at the Messier objects – the most popular deep-sky targets for more than two centuries.

Stephen James O'Meara
Volcano, Hawaii

# Preface to the first edition

Two and a half centuries ago a French comet hunter named Charles Messier began compiling a catalogue of nebulous sky objects. He explained his motivation in the French almanac *Connaissance des Temps* for 1801:

> What caused me to undertake the catalogue was the nebula I discovered above the southern horn of Taurus on 12 Sept. 1758, while observing the comet of that year.... This nebula had such a resemblance to a comet, in its form and brightness, that I endeavored to find others, so that astronomers would not confuse these same nebulae with comets just beginning to shine.

Messier died long before twentieth-century astronomers realized the profound nature of these hauntingly diffuse glows. The 110 "Messier objects," it turns out, are an eclectic collection of celestial treasures: 39 galaxies, 57 star clusters, 9 nebulae, a supernova remnant, a swath of Milky Way, a tiny grouping of stars, a double star, and even a duplication. The list includes the most massive and luminous galaxy known, the ghostly remains of a cataclysmic stellar explosion, and an immense cosmic cloudscape that cradles newborn stars in dense cocoons of hydrogen gas.

Every Messier object is within reach of a small telescope, and many are visible with binoculars and the naked eye, especially under clear, dark skies far away from city lights. Amateur astronomers of all ages enjoy tackling the Messier catalogue members, because they represent a good sampling of what's "out there," and because finding them helps to hone observing skills. In a sense, the Messier objects are the testing grounds for budding skywatchers.

The Messier objects entered my life in 1966, when I was 10 years old. They were mentioned in the *Sky Observer's Guide*, a Golden Guide by R. Newton Mayall and Margaret Mayall, whose words also taught me the basics of astronomy. I quickly located the brightest Messier objects from my back porch in Cambridge, Massachusetts. Then one winter evening a friend loaned me his 2-inch refractor. I recall pointing its white enameled tube over a frozen city landscape, beyond the smoking chimneys, and seeing swirls of nebulosity surrounding the Trapezium, a group of young, bright stars in the mighty Orion Nebula (Messier 42, or M42), then the knitted stars of the Pleiades (M45) – Lord Tennyson's "glittering swarm of fireflies tangled in a silver braid." These views were visual poetry, and like Tennyson and countless others before him, I became captivated by the allure of the stars.

Several years later, when I acquired a 4 1/2-inch reflector, another friend gave me a box of *Sky & Telescope* magazines – a monthly publication devoted to the hobby of amateur astronomy. An article immediately caught my eye; it was one in a series by John Mallas and Evered Kreimer spotlighting the Messier objects. Each article featured drawings by Mallas and photographs by Kreimer, as well as visual descriptions and brief histories of the objects. On the first clear night I eagerly set up the scope, and with magazines and red flashlight in hand, I followed along with Mallas and Kreimer as they toured the "M" objects. No longer feeling alone in my pursuits, I began dedicating one clear night to each Messier object – studying it, writing down impressions, and making drawings.

That Mallas and Kreimer series was later compiled into a book called *The Messier Album*, which served the astronomical community for many years. But time has marched on. The optical quality of many commercially available telescopes and eyepieces is superior to the telescope Mallas used a quarter-century ago, providing sharper images and revealing fainter details. We also have more

accurate astronomical information today about many of the objects – their sizes, distances, magnitudes, and more – than we did when *The Messier Album* was written. Object positions and maps have been updated to equinox 2000.0 coordinates from the equinox 1975.0 coordinates used by Mallas and Kreimer. Clearly, the time was right for a fresh new look at these classical astronomical specimens.

As observers today, we are not only better equipped but also wiser. Looking back, it is hard to believe that Mallas used a 4-inch f/15 refractor to make his observations. Although a popular telescope type in its day, it was best suited for studying the Moon and planets. Today's deep-sky observers prefer rich-field telescopes over long-focus refractors. It is also amazing that Mallas made his observations from a Los Angeles suburb tainted by light pollution and smog! These problems are even more pervasive today and represent an insidious threat to our continued enjoyment of the heavens. More and more, residents of cities and suburbs must pack their gear and drive some distance from their homes to less populated areas to enjoy a night under the stars. And several times a year thousands of amateur astronomers journey to national conventions and star parties held at first-class, dark-sky sites. In fact, one such journey inspired this book.

For a week in May 1994, I attended the Texas Star Party, a deep-sky observing event held on the Prude Ranch near Fort Davis, Texas, at an altitude of just over 5,000 feet. One sparkling-clear night, Al Nagler, founder of Tele Vue Optics, showed me a wide-field view of the Milky Way – specifically, the region known as M24 – through his 4-inch Genesis refractor. The field was bristling with starlight and threads of dark nebulosity. I didn't want to take my eye from the telescope. Later that week, I borrowed another friend's Genesis and spent three hours studying the Whirlpool Galaxy (M51) in Canes Venatici; I spent many more hours on subsequent nights. The graceful spiral arms, the numerous punctuating knots – all the subtle detail was awesome to behold. I began to wonder what the other Messier objects would look like through a telescope of uncompromising quality, with superior eyepieces, and viewed from the darkest sites on earth. Thus, I decided to revisit, one by one, the deep-sky gems that Charles Messier catalogued more than two centuries ago and that started me on what was to become my latest adventure in an already long and exciting career in astronomical observation, teaching, and writing. The result is this book, which I hope will inspire and inform you as much as Mallas and Kreimer's seminal articles and book did for me and the countless others who have used them.

The purpose of this book is to provide new *and* experienced observers with a fresh perspective on the Messier objects. Chapter 1 is a brief account of the life of Charles Messier and how his catalogue of deep-sky curiosities came to be. Chapter 2 introduces beginners to the basics of skywatching and to some important terms and concepts. It is designed specifically to help newcomers orient themselves to the sky and start locating the brightest Messier objects. In Chapter 3, "The making of this book," I review the methods and the equipment with which I conducted the observations described herein and provide additional information about the book's content.

Of course, the heart of this book is Chapter 4, which looks in detail at each Messier object. Since this book is a "companion," I've used a conversational tone; I speak to you as if I'm with you in the field. Along with the descriptive text, I have provided for each object a list

of essential data, including its coordinates, size, brightness, and distance. The equinox 2000.0 finder charts have been carefully drafted to work together with Wil Tirion's all-new, wide-field constellation map at the back of the book; together they will enable you to quickly zero in on your targets. A new and comprehensive translation of Messier's original published catalogue was commissioned and is included here. It supersedes earlier translations, which often were abridged and prone to occasional errors and misinterpretations. I have also included, in Appendix A, the endnotes to Messier's original catalogue, in which he lists a number of objects reported by other observers that he tried, but failed, to find himself.

The detailed drawings I made of the Messier objects are another distinctive feature of this book. Each drawing was based on several hours of observing each object over several extremely transparent nights. I think you will find these illustrations revealing and useful in helping you to see subtle details in the objects that you may not have noticed before (and which may not be apparent in photographs). I have also updated and revised many of the objects' magnitude estimates, offered thoughts about some of the "missing" Messier objects, and distributed observing challenges throughout the chapter.

In Chapter 5, "Some thoughts on Charles Messier," I offer some summarizing thoughts or "analysis" on Messier and his catalogue, which I felt compelled to do having spent so much time thinking about the man and what he saw – and didn't see. I also felt compelled to describe, even in a book devoted to the Messier catalogue, 20 of my favorite *non*-Messier objects, in Chapter 6. Consider them honorable mentions to the catalogue that are conspicuous by their absence from it and certainly deserving of a look while you're out hunting Messier objects.

The appendices contain additional information that you will find useful, including a brief discussion about "Messier marathons" and a guide to navigating the Coma–Virgo Cluster.

Perhaps the most unique aspect of this book, and what I most want to convey, is the *approach* I take to observing. It's an approach based on creative perception and on using the imagination to see patterns and shapes in the subjects seen through the eyepiece. It involves using not just your eye but also your *mind's eye* to associate those patterns and shapes with things that are familiar to you, to create pictures and even stories. Rather than barrage you with just facts (of which you get plenty), I thought you'd also enjoy seeing these objects in new ways – especially the clusters, whose multitude of inherent shapes lend themselves to being seen as celestial Rorschach tests. By using the imagination you can add another dimension to your observing – a highly personal and entertaining one (after all, this is a hobby). Anyone who has read *Hard Times* by Charles Dickens will understand my protest of a diet consisting totally of fact. (By teaching youngsters fact not fancy, conformity not curiosity, Dickens's bleak character Thomas Gradgrind tried to stifle inquisitive minds.) If you have never gazed at the ethereal quality of a Messier object through a telescope, I encourage you to look upon them as you would a painting or a piece of art – and let that art add meaning to your experience.

It is my hope that this book will not only introduce you to the objects themselves – or reintroduce you, as the case may be – but that it will also challenge you to raise your observing skills to a higher level and to push your visual limits. I hope it compels you to search for new and mysterious aspects about these

objects, to see them in rich and creative ways, and to grow as an observer.

I know the magic of the Messier objects because I have been under their spell for three decades. Today I see the same magic in my wife's eyes, whenever she raises her binoculars to the sky and happens upon her "comets." May the spell never be broken.

Stephen James O'Meara
Volcano, Hawaii

# Acknowledgments to the first edition

"If I have seen so far, it is because I have stood on the shoulders of giants." Like Sir Isaac Newton and others before and after him who used this axiom, I would like to recognize the giants who have helped me in my observational and literary journeys.

Highest tribute goes to the late Walter Scott Houston, who shared his observing experiences and techniques in his Deep-Sky Wonders column in *Sky & Telescope* magazine for so many years. I will never forget the times we spent by the campfire at the annual Stellafane Convention on Breezy Hill in Vermont, or in chaise longues at the Winter Star Party in the Florida Keys, just gazing at the stars and musing on the limits of vision.

I am honored to recognize George Phillips Bond (1825–1865), second director of Harvard College Observatory, whose dedication to unlocking the visual mysteries of the Orion Nebula with the Harvard Observatory's 15-inch refractor led ultimately to his premature death. Reading his diaries two decades ago kept me enchanted on many a cloudy night and taught me how to be a patient and persistent observer.

A deep bow to "envelope pushers" Barbara Wilson and Larry Mitchell, who roped and tied this wild planetary observer at the Texas Star Party and force-fed me deep-deep-deep-sky objects until I became a convert – thank you (I think)! Assisting them was a phalanx of galaxy hunters, including David Eicher, Tippy and Patty D'Auria, and Jack Newton. Brian Skiff introduced me to many visual challenges, including seeing faint globular clusters with the naked eye. Peter Collins first introduced me to the more challenging Messier objects. David Levy was always around to say, "No, Steve, that's a galaxy not a comet." And at several star parties, Tom and Jeannie Clark were incredibly generous with their Tectron telescopes, encouraging me to sweep the Coma Cluster with these enormous Dobsonians until I nearly fainted with delight.

Al Nagler and the editors of *Sky & Telescope* will never fully know how grateful I am to them for helping me to complete this journey. Thanks for your special encouragement and support.

Steve Peters gets the blue ribbon for nurturing the book idea, and kudos to Simon Mitton and Cambridge University Press for publishing the work. Special thanks to Lee Coombs, Martin Germano, Chuck Vaughn, and George Viscome for their stunning astrophotographs. I greatly appreciated the expert assistance of Brent A. Archinal, Kevin Krisciunas, Larry Mitchell, Brian Skiff, and Barbara Wilson, who reviewed drafts of the text and made necessary corrections and welcome suggestions. Thanks to Steve and Tom Bisque of Software Bisque for their generous donation of *The Sky* astronomy software, which was used in creating the finder charts, and to master astronomical cartographer Wil Tirion for the wide-field map of the Messier objects at the back of the book. Thanks also to my good friend Storm Dunlop for his excellent translation of Messier's catalogue from the original French.

Kudos to Nina Barron for her expert, sensible, and sensitive copyediting of the manuscript. Heartfelt appreciation to the Dillingham family – Ken, Lina, Serena, and Karen – for the use of their ranch in the saddle of Kilauea and Mauna Loa volcanoes, where clear skies, steady seeing, and the feeling of home helped me to finish the observations on time. Thanks also to Nina Barron for proofreading the manuscript.

And no words can express the love and devotion I have for my wife, Donna, who, despite having been "husbandless" for a year, found solace in exploring erupting volcanoes, practicing her "free dives" to unknown depths, and peering inquisitively into the eyes of the night.

Finally, I would like to thank our "children," Pele-Hiiaka of Volcano, Milky Way, and Miranda-Pywacket, for keeping their digits off the keyboard when I wasn't looking. Alas, I cannot blame them if any errors have sneaked unannounced into this book; I take full responsibility.