

Ruben Kier

The 100 Best Astrophotography Targets

A Monthly Guide for CCD Imaging
with Amateur Telescopes

Patrick Moore's
Practical
Astronomy
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**The 100 Best
Targets for
Astrophotography**



Ruben Kier

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To my parents, Pearl and Ralph, in celebration of their 60th wedding anniversary:

For the nights when you would fall asleep in the car waiting for me at the local observatory, to your support and encouragement of my education, and your enthusiasm about my astrophotography, I am eternally grateful.

To my children, Melanie and Shelley, through whose eyes I have rediscovered the marvels of the cosmos; may you never abandon your sense of wonder at the miracles of nature.

And to my wife, Stephanie, who by her example has motivated me to become a better citizen, physician, teacher, parent, and spouse.



Preface



A picture tells a thousand words. Some of the astronomy's best communications and teaching tools are its rich legacy of images. Astroimaging began in 1840 when American astronomer John W. Draper took a 20-min exposure of the Moon through a 5-in. Newtonian reflecting telescope. Since then, professional and amateur astronomers, nature photographers, and ordinary people with cameras have created millions of celestial images. Some of these photos have led to important discoveries.

In 1888, a photograph of the Andromeda Galaxy (M31) revealed its spiral structure. In 1919, a picture taken during a total solar eclipse confirmed Einstein's theory that massive objects bend starlight. In 1930, American astronomer Clyde Tombaugh discovered Pluto on a photograph of a starry region in Gemini. And in 2004, the Hubble Space Telescope took a million-second-long exposure of a seemingly empty region of space in the constellation Fornax and revealed thousands of distant galaxies.

Likewise, amateur astronomers have made important contributions. Some of their images have shown previously unknown comets, asteroids, and supernovae. Most amateurs, however, image celestial objects for the sheer joy of it. They produce impressive results using techniques unknown to astronomy only a decade ago.

Like a telescope, astroimaging encompasses two aspects. Most people picture a telescope as a long tube through which you view celestial objects. But the optical tube assembly is just half of a high-quality telescope. Without the accompanying mount, the tube would be of little value.

So it is with astroimaging. If all it took to be an astroimager was to sit for long hours at a telescope, many amateur astronomers would be great at it. But there is another facet to producing excellent images – postprocessing. This includes everything that happens after you acquire the raw data, which, in many instances, does not look all that appealing.

Astroimagers spend years developing and refining their techniques. A high-quality image will show intricate detail, have a wide dynamic range, and exhibit the correct color rendition.

As Photo Editor of the world's best-selling astronomy magazine, I receive thousands of images each year. Of those, we publish perhaps 100. Ruben Kier's images are well represented every year.

By following his instructions, you, too, can produce equally beautiful astroimages. When you do, be sure and send them to me for the magazine. Send your very best work. Remember, you will be competing with Ruben.

Senior Editor/Photo Editor, *Astronomy* magazine

Michael E. Bakich



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I would like to thank my editors at Springer, Maury Solomon and John Watson, for supporting my interest in producing this book. Their advice and guidance have been invaluable in bringing this project to fruition.

This book is a compilation of many influences. I first became interested in CCD imaging after hearing Robert Gendler speak at the Connecticut Star Party in 2001. Since then, his lectures on luminance layering and hybrid imaging have influenced my processing routines, and the images in his book, *A Year in the Life of the Universe*, have been an example of what I aspire to create with more humble equipment. Ron Wodaski's book, *The New CCD Astronomy*, served for several years as my basic text for CCD techniques. Mike Rice, at the New Mexico Skies Guest Observatory, provided me with invaluable hands-on training. Neil Fleming has helped me to streamline my focusing routines. Scott Ireland's textbook and Jerry Lodriguss' CD on Photoshop techniques have improved my processing skills. Stephen O'Meara's observing guides have helped me understand more about my celestial targets, and his *Hidden Treasures* have helped me select some of the more obscure targets in my book. Robert Burnham's *Celestial Handbook* has provided valuable background detail on many of the Best Targets. Most of the object data was compiled either from Robert Strong's *Sky Atlas 2000 Companion* or from CCDSoft's program *TheSkySix*. Jay Pasachoff and Alex Filippenko's college textbook, *The Cosmos*, has been a resource for clarifying many of the more difficult concepts in astronomy. Ray Galak has kindly provided data on the



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periodic error of several mounts. Finally, I thank Michael Bakich, Photo Editor for *Astronomy* magazine, for selecting many of my favorite images for the Reader Gallery over the past several years. Each inclusion reinforces my interest and enjoyment of this exciting hobby.



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Introduction

How This Book Differs from Observing Lists

Over 200 years ago, many of the celestial treasures on the following pages were cataloged by Charles Messier and William Herschel using telescopes primitive by today's standards. These catalogs have formed the basis of most amateur astronomers' targets for observing. The most famous is Messier's Catalog of 109 objects. Despite their popularity with visual astronomers, Charles Messier's choices were neither the brightest nor the most beautiful through the eyepiece. His list was compiled to define objects that might be confused with comets by other comet hunters – in other words, a list of potential mistakes. Entire regions of the sky, which fell outside of the area where comets might be found, were excluded from his list. This may explain how several bright deep sky objects such as the Double Cluster in Perseus were excluded.

In this century, the growth in quality and accessibility of amateur telescopes has driven an explosion of observing lists. The Herschel 400 list, compiled more than 30 years ago by the Ancient City Astronomy Club of Florida, includes objects selected from Herschel's General Catalog that would "challenge" observers with telescopes 6 in. or larger. In 1995, Patrick Moore published the Caldwell list (his legal last name is

Caldwell-Moore) of 109 objects, which includes both bright and dim objects excluded by Messier. His selection includes some small and challenging targets, not just the crowd pleasers. Most recently, in 2007, Stephen O'Meara published a list of 109 "hidden treasures" that seeks to fill in the gap left by the Messier and Caldwell lists. Like the Caldwell list, O'Meara's list dips deep into the southern hemisphere.

These famous lists are excellent for visual astronomy but can be disappointing for the astrophotographer. For example, a sparse open star cluster sparkles at the eyepiece but can be uninspiring as an image. A small planetary nebula may be striking visually but may be too small to show interesting detail in a photograph. On the other hand, many nebulae that are faint to the eye can have striking texture and hue on long exposures. Spiral galaxies blossom into a rich diversity of shapes and colors.

How the Targets Were Chosen

This book showcases the 100 best targets available to backyard astrophotographers in the Northern Hemisphere. These selections include 48 Messier, 28 Caldwell, and 13 O'Meara objects, plus several others cited in catalogs by Arp, Hickson, Sharpless, and Barnard. Almost a third of the targets can be framed to include multiple objects. The criteria for inclusion were simple:

- Does the image inspire the viewer?
- Is the object bright enough to image with a backyard amateur telescope, an average CCD camera, and 2–3 h of exposure?
- Is it large enough to show detail, usually 5 arcmin or more?
- Can it be photographed successfully from northern latitudes? (This usually requires a declination above -25° .)

Other features favoring inclusion are:

- Among similar objects, is it the easiest to image because of declination, size, color, or brightness?
- Can the object be framed with a second object to create a more dynamic image?

The images on the following pages represent what an average amateur can expect to accomplish with some practice and effort. In some cases, with