Astrophotography for the Amateur

Second edition

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Welcome to astrophotography 1

Welcome to astrophotography! This book is for people who want to take pictures of the stars and planets, and, perhaps more importantly, who want to understand how astrophotography works. The earlier chapters contain instructions for beginners, and the later chapters are more like a reference book.

My goal is to show you how to do astrophotography at modest cost, with the equipment and materials an amateur can easily obtain and use. I haven't covered everything. I've concentrated on 35-mm cameras and relatively inexpensive telescopes, 20-cm (8-inch) and smaller. Techniques that require unusual skill or expenditure are mentioned only briefly with references to other sources of information.

1.1 The challenge of astrophotography

Why photograph the sky? Because of the great natural beauty of celestial objects, because your pictures can have scientific value, and, perhaps most importantly, because you enjoy the technical challenge. Astrophotography will never be a matter of just taking snapshots, and Kodak's old slogan, ''You press the button, we do the rest,'' certainly doesn't apply. Astrophotographers push the limits of their equipment and materials, and a good astrophotographer has to know optics and film the way a race-car driver knows engines. There are three main technical challenges:

- Most celestial objects require magnification; that's one reason we use telescopes. (Not all objects require magnification; star fields, meteors, and bright comets can be photographed with your camera's normal lens.)
- Many celestial objects are faint, requiring long exposures to accumulate light on the film. In fact, astronomical discoveries have been made this way; the Horsehead Nebula and Barnard's Loop are too faint to see with any telescope, but are not too hard to photograph.
- Whenever high magnification or long exposures are involved, the rotation of the earth gets in the way by making the sky seem to move continuously. To compensate for this motion, telescopes have equatorial mounts and drive motors. Sometimes the camera rides ''piggy-back'' on the telescope while taking a picture through its own lens (Fig. 1.2).

Almost everything in this book deals with how to overcome one, two, or all three of these challenges in a particular situation. It's not always easy; some kinds of astrophotography are much harder than others, and I present the easier techniques first.

Fortunately, you don't have to master the hardest techniques in order to get impressive pictures. Piggy-backing and moon photography are particularly rewarding even though they require only modest effort and simple equipment. Photographing galaxies is especially hard; so is high-resolution photography of the planets.

1.2 Choosing equipment

Never buy a telescope or camera unless you understand exactly what it will do for you and how it will do it. Always educate yourself first, because the equipment doesn't take the pictures; *you* do. Chapter 9 gives detailed advice on choosing cameras and telescopes, but your knowledge should always run ahead of your equipment.

Learn the sky before buying a telescope. It goes without saying that if you can't point your finger at M31 or the Orion Nebula, you won't be able to point a telescope at them either. I usually tell young amateur astronomers that they're not ready for a telescope until they can identify at least five constellations and three

Figure 1.1 **The moon photographed at the prime focus of a 12.5-cm (5-inch) *f*/10 Schmidt–Cassegrain telescope. A half-second exposure on Kodak Technical Pan Film developed in Technidol LC; clock drive running. (By the author)**

Figure 1.2 **The author gets ready to photograph star fields with a camera and 180-mm lens mounted "piggy-back" on a 20-cm (8-inch) Schmidt–Cassegrain telescope. (Melody Covington)**

interesting objects (planets, star clusters, or the like) without a map. Don't be seduced by computer-controlled telescopes; they save time if you have a busy observing program, but you can't use them effectively unless you already know the sky.

Full advice for beginning stargazers is beyond the scope of this book, but any of the major magazines (*Sky & Telescope*, *Astronomy*, or *Astronomy Now*) will quickly lead you to all the other sources of information.

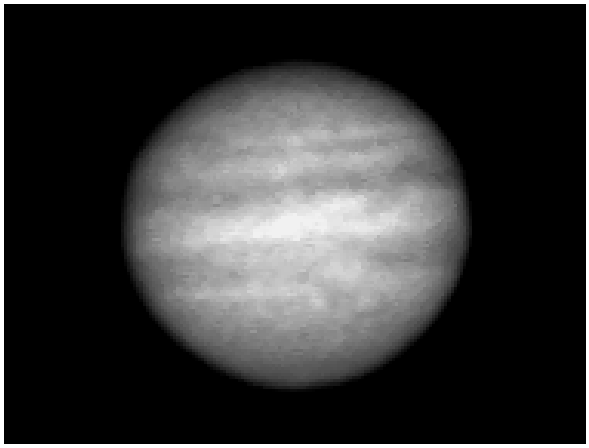

Figure 1.3 **CCD image of Jupiter, taken with 20-cm (8-inch) $f/10$ Schmidt–Cassegrain telescope and $\times 2$ Barlow lens. Exposure 100 milliseconds with Meade Pictor 216XT camera. The image was processed by unsharp masking to bring out detail. (By the author)**

The publishers' addresses are in Appendix F, along with addresses of useful astronomy sites on the World Wide Web.

Useful books for beginners include Patrick Moore's *The Amateur Astronome*r and Liller and Mayer's *Cambridge Astronomy Guide*; the latter emphasizes using a camera rather than a telescope, so its point of departure resembles Chapter 2 of this book. More advanced observers should not miss Martinez' two-volume *Observer's Guide* and Burnham's *Celestial Handbook*. As a handbook of astronomical science, including astrophysics, I particularly like *Fundamental Astronomy*, by Karttunen *et al*., because it doesn't leave out the mathematics; you can skip the mathematical portions if you like, then go back reread them if you feel the need.

1.3 Sharing your work with others

Once you have some good astronomical photographs, what do you do with them? You could join the legions of amateurs who send their pictures to major astronomy magazines. Unfortunately, your chances of getting a picture published that way are slim; none of mine ever have been! With hundreds of excellent pictures coming in every month, astronomy magazines can print only a few that are truly exceptional.

Instead, look for other ways to share your pictures with your friends and the public. Enter them in local photography contests. Assist the local newspaper with pictures of eclipses and comets. Give slide shows for school children and science clubs. Decorate your home and office with enlargements. Sell prints at art shows. Make Christmas cards. Do anything any other photographer would do, remembering that unlike most people's, your photographs probe the limits of the universe.

Figure 1.4 **An example of very advanced amateur work. The galaxy NGC 253; a 60-minute exposure on hypersensitized Kodak Technical Pan Film with a 14-inch *f*/7 telescope. (Chuck Vaughn)**

Figure 1.5 **A picture well worth sharing: the moon rising over Lick Observatory. Richard A. Milewski carefully calculated the position of moonrise to take this picture.**

1.4 Maintaining balance and enjoyment

Let me end with an exhortation: remember that we do this because we enjoy it. Like most amateur astronomers, I am in the middle of a thriving career in something else (computational linguistics in my case) and have neither an unlimited budget nor a perfect observing site. But that's part of the challenge – to make intelligent and creative use of limited resources. Astrophotography is not a competitive sport, the beauty of a picture is not proportional to the difficulty of taking it, and your pictures don't have to be the best in the world in order to be satisfying. As G. K. Chesterton put it, ''Anything worth doing is worth doing badly'' – that is, worth doing even when you're not an expert.