

# Introduction: why another stargazing guide?

I had been an armchair astronomer for years: I loved reading about science, and I had some general knowledge about the Universe and how it works. However, I knew little about the actual night sky as it appears above the Earth, and I had never owned a decent telescope.

Then, in 1995, I started a nature program for urban nine- to twelve-year-olds. For the program, I bought a good Nikon “spotting scope”: a small telescope made primarily for viewing birds and other Earth-bound objects (see Figure 1). On an overnight camping trip, I aimed the telescope at the Moon, so the kids could see the detail: craters, mountains, and “seas.” The children were amazed, since most of them had never really seen the Moon before. I was impressed, because the telescope gave excellent views: The images were very sharp. But I had seen the Moon through binoculars, and it was familiar enough that it was not as thrilling for me as it had been for the children.

After the kids were asleep in their tents, I used the telescope again. The sky was very dark once the Moon had set, and I looked at fields of stars in the Milky Way for some time. Then I aimed the scope at a bright yellow star. I was not expecting much: Stars are so far away that they appear only as sharp points in even the largest telescopes. But this “star” had *rings*: I was looking at the planet Saturn!

I had known, of course, that Saturn was up there in the sky somewhere. I had also seen more detailed views of it in satellite photographs. But here it was, real and bright and sharp; a ringed ball floating in space right before my eyes! I had no idea that so small a telescope could show it so clearly; and I had just stumbled upon it, like a jewel on the beach.

Well, that was it: I was hooked. As soon as I could afford it, and after much research – often confusing and contradictory – I bought a larger telescope, on a sturdy mount that was better for astronomy. Though I have been finding more jewels ever since, I am still continually amazed at just how much I can see through a fairly small scope.

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Paul E. Kinzer

Excerpt

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## Stargazing Basics

**Figure 1** Spotting scopes, though designed for terrestrial (Earth-bound) use, can be useful for wide views of the nighttime sky. This model, with its angled eyepiece, provides comfortable upward viewing.



**Figure 2** Even a small telescope can show the detail seen here when viewing Saturn; and the “live” view seems much more three-dimensional.



Until I actually started doing it, there was something about stargazing that I would not have guessed. It is *much* more satisfying to find objects myself than it is to look at a photograph in a book or magazine. To see the real thing. To know that the light hitting my eye actually left the object up there, and that that light may have traveled countless trillions of miles and, possibly, millions of years, seemingly just for me to find it. Of course, the light would have come even if I was not there to catch it, but each new catch is, literally, wonderful to me.

Others agree. It is always fun to see the happy, dumbstruck look on people’s faces when *they* see Saturn (or Jupiter, or a close-up view of craters on the Moon, or a galaxy) for the first time through one of my telescopes. They are filled with excited questions afterwards; and, at least for a little while, they are hooked, too.

Many of these people ask a particular question: Can I recommend a single, basic book to help someone who is an absolute beginner get *started* in recreational astronomy?

Well, I know of many great books. Some were especially written to explain the make-up of the Universe. Others were written to help people

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learn the constellations and the night sky, and how they change through the night and year. Still others were written to help people choose and buy astronomy equipment. And a few do all of these things, thoroughly and well.

However, it has seemed to me that many people who have looked through one of my telescopes want something that is more basic than what these books offer. They want a *simple* outline that will provide them with all the necessary information to make a good beginning, both on what is “Up There” and on the techniques and equipment used to view it; but not so much information that they will be overwhelmed or intimidated. (There is an amazing amount of jargon in astronomy publications, which often goes unexplained.)

In other words, I believe there is a need for a sort of road map that will allow people to get to a place where they can dip their toes into recreational astronomy before deciding whether to take the plunge. For someone who is enthusiastic, yet knows little, getting started can be a daunting job. It is for these people, and I think there are a lot of them, that I have written this guide.

### What this guide is

*Stargazing Basics* is meant to be a starting point. I hope it will provide enough information to allow just about anyone to get started in recreational astronomy, or stargazing. The guide is divided into three sections:

First, Part I, “Stargazing techniques and equipment,” starts with a brief description of how the night sky “works,” and goes on to explain what the novice will need to view it; whether with eyes alone, binoculars, or a telescope. Since this is a guide for beginners, the equipment discussed is of small to moderate size, and relatively inexpensive.

Part II, “What’s up there?,” is a brief tour of the Universe that is observable to the beginner. We start nearby, in astronomical terms, and head outward.

*More info* boxes will appear along the way in both of the first two sections. These contain information which may add meaning to the main text, but which might be distracting if contained within it. *A step beyond* boxes are a bit different. They describe equipment and techniques that are not usually for beginners, but may be of interest to those who stay with the hobby. I’ve separated them out to make it clear that they are not something a novice needs to purchase or understand when just starting out (or ever, really). The first two parts also have *Resources* sections at various points. These are references to equipment, books, magazines, websites, and organizations that can provide more information and assistance.

Finally, as you read these first two parts, you will notice that many words and phrases appear in **bold** print the first time they appear. These

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### **Stargazing Basics**

terms are described in alphabetical order in Part III, “A stargazing glossary.” They are terms that may be commonly used in other publications, but are not always clearly defined for a beginner. They may also be explained in the main body of the guide, but I thought it would be helpful to point out that clear, simple definitions are readily available for easy reference at a later time. If you see an unknown term, try looking it up in the Glossary.

### **What this guide is not**

This guide is not “a complete guide.” It may lead you toward completion, but it is not meant to be the only resource you need.

This guide is not really meant to be taken into the field. Simple star charts are included, but anything more would have made the book too expensive. Besides, there are already many good books specifically designed to show the detailed layout of the night sky, and it is possible to get up-to-the-minute sky maps from the Internet, which show the night sky as it will look from your exact location on Earth.

This is also not a complete guide to equipment buying. Astronomy can be both the least and most expensive of hobbies, and this guide emphasizes the least. If you are wondering whether you should buy that wide-field apochromatic refractor, or a 20-inch Dobsonian reflector instead, then this book is not for you!

This guide is, finally, not very long. Too much information can be both confusing and intimidating to someone who is unfamiliar with a topic. I have tried to include only what the beginner may need or want to know at the very beginning.

# Part I

## Stargazing techniques and equipment

If you asked most people to name the one thing that is most needed by someone who is just starting out in **astronomy**, they would almost certainly say “a **telescope**.” And if you then asked them to name the most important thing to look for when choosing that telescope, the answer – if there was one – might be “power” (as in **magnification**). The first answer is definitely questionable, and the second answer is simply wrong.

Many people believe both answers, and who can blame them? How would they know any differently? Few people have had any education in the understanding of amateur astronomy and its equipment, and cheap-telescope distributors know it.

Here is a typical experience from not so long ago:

A certain young person looked through a telescope on a camping trip one night, and became interested in the idea of pursuing this hobby (as many people do after looking through a *good* telescope). It seemed, to this person, only natural to think that the first thing to do was to buy his own telescope. He remembered seeing them in department stores, camera dealers, and at a gift shop in a museum. He went to one of these places and asked someone to help him, only to find that there was no one there who could. So all he had to go on was the information provided on the telescope packaging. All the boxes had large, bold print, boasting of things like “magnifications up to 600×!”

He bought the one with the “highest power” and took it home. That night, he set it up in his suburban backyard. He looked up at the sky, but wasn’t sure where to aim the new scope. “Where’s the **Moon**?” he wondered. Four nights ago, at the campground, he had looked through a telescope at the Moon. His friend had said it was just past full.

Oh, well. He had also looked at the **planet Jupiter**, and it had been amazing. He was almost certain it was that bright “**star**” up there. But where were all the other stars? He knew the city lights washed some of them out, but only now did he see how few were visible. Anyway, he tried to aim the

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**Figure 3** An example of a telescope that is not very “powerful,” but still very useful for astronomy.

telescope at what he thought was Jupiter, but the **finder** scope was next to impossible to adjust, or even to see through, and the telescope would not stay where he aimed it because the **tripod** was too shaky. When he finally got the object in view, it would not come into clear focus, no matter what he did. It was a dim, fuzzy ball. It was not worth looking at, which was lucky, because just being near the telescope seemed enough to make the image bounce all over. And it kept moving out of the **field of view**. He felt like he had done something wrong, and was so frustrated that he packed the telescope up and never used it again.

This has been the first – and last – experience that many people have had with astronomy. It is, more or less, a description of *my* experience as a teen. Many of the problems I had were caused by my lack of knowledge, all of which will be explained by the end of this book. But if I had managed to get a steady, sharp view of Jupiter for even a few seconds, I might have tried harder to overcome my ignorance. Unfortunately, the “starter” telescopes sold at many stores are often just cheap junk.

However, there is good news: New technologies, and many new manufacturers and distributors, have led to keen competition, which has resulted in an improvement in quality and the lowering of prices. Even

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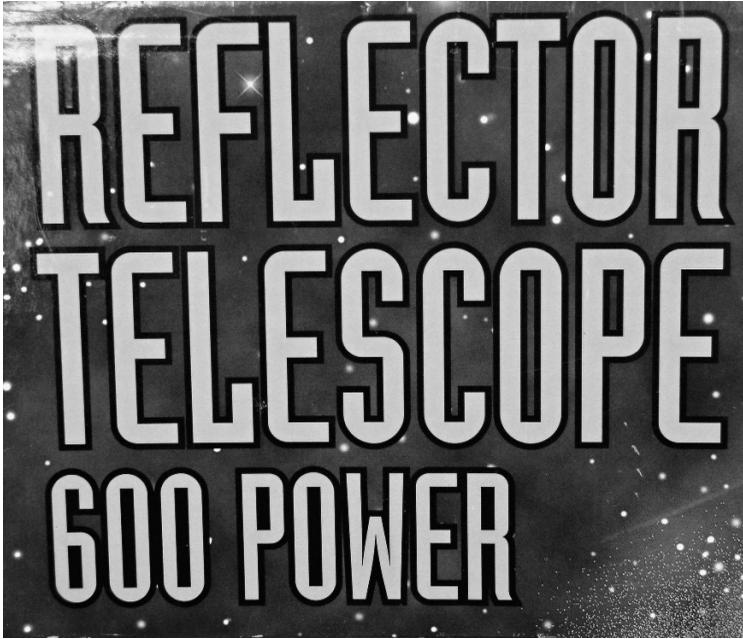
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### Stargazing techniques and equipment



**Figure 4** A very suspect claim. The telescope that came in the box with this printed on it, purchased at a well-known national chain store in the USA, could not produce sharp images even at its lowest magnification, 40 $\times$ .

department stores now often carry inexpensive, yet decent, beginner's equipment. (But beware: There is still plenty of junk!)

This first section of the guide discusses the selection of a first telescope. Having a little knowledge ahead of time will be a big help in avoiding disappointment.

However, there is much to getting started in stargazing that can come before the selection of a telescope. In fact, a telescope is not even a necessity for exploring and enjoying the night sky. Binoculars, and even your unaided eyes, can show you many wonderful sights! If I had realized this as a teen, I could have saved a lot of money and disappointment. I might also have stuck with the hobby, instead of waiting decades to rediscover it.

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# With the naked eye alone 1

*Note: It may be that the information presented in this first section would more properly fit in “Part II: What’s up there?” But I wrote the guide with the idea in mind that people would probably read it from beginning to end. It seemed to me, then, that a very basic description of the night sky – as a whole – would be very helpful right at the start.*

People have been looking up and pondering the night sky since – well, since there have been people. Every culture in the world, both past and present, has studied and tried to explain what is up there. However, until **Galileo Galilei**, in 1609, took a small telescope and aimed it upward, all others who had studied the stars used just their eyes.

Exploring the night sky with a telescope is made much easier if a person has at least some knowledge of the layout of the heavens. But it is also a great pleasure in itself to just lie back and look up at the wide expanse of the “starry bowl.” It looks essentially the same as when ancient cultures named the stars and **constellations**, many of which have had the same names since before recorded history began (see Appendix 2 for a complete list).

## The celestial sphere

Because this is a *simple* guide, and because there are excellent books devoted entirely to teaching the positions, names, and lore of the stars and constellations, I will not go into such detail here. However, a basic understanding of how the sky “works,” how it changes over time (and how it does not), is very helpful to the beginning stargazer.

Amateur astronomers divide the Universe into two broad regions: the **Solar System** (containing the planets, their moons, and other objects under the gravitational influence of the **Sun**) and the **deep sky**, which contains everything beyond the Solar System. (It should be

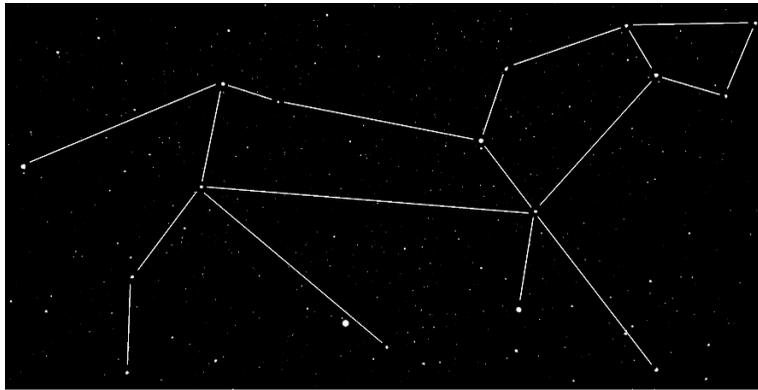
### More info

It is not strictly true that astronomers before Galileo used only their eyes to study the heavens. They had various devices for accurately measuring and mapping the positions of the stars. They made charts with the information gathered, which were used in surveying and, especially, navigation. But none of these devices magnified the view.

There is also some question as to whether Galileo was actually the first to aim a telescope at the night sky. But he *was* the first to write down descriptions of what he saw and publish the results for the world to see.

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**Figure 1.1** The constellation Leo, the Lion, actually looks like the creature it is meant to represent. This is definitely not the case with some other constellations. In this photograph, taken in 2008, one of Leo's rear legs seems to be stepping past the bright planet Saturn. Saturn has since moved to a very different part of the sky.



said that the term **deep-sky object** is often used by astronomers to describe all the objects outside the Solar System *other than* stars. Still, stars *are* part of the deep sky. This possibly confusing point is made clear in Part II.)

The reason for separating these groups is this: All deep-sky objects are so far away that they seem, in a way, to be frozen in place in the sky. They may rise and set as the **Earth** spins, and they may also change position as the Earth **orbits** (travels in a near-circular path around) the Sun, but *they do not noticeably change position relative to each other*. In other words, the **Big Dipper** is the Big Dipper, whether it is this year or next, winter or summer, midnight or 3:00 am (or noon, for that matter). There is, it seems, a large unchanging bowl of stars hanging above our heads at night. The ancients named it the **celestial** (or heavenly) **sphere**.

In contrast, all objects in the Solar System are close enough to us that they do not keep the same positions upon the bowl of heaven. Before the use of telescopes, only seven *planets* (the word originally meant *wanderer*) were known: the Moon, the Sun, **Mercury**, **Venus**, **Mars**, Jupiter, and **Saturn**. They were called wanderers because, unlike the stars, they crawled *across* the celestial dome. The motion cannot usually be seen from moment to moment, but it is there.

The ancients did not know it, but we now know that the planets, including the Earth and the millions of other objects within the Solar System, all orbit the Sun. We also know that they are far closer to us than any of the stars or other deep-sky objects.

Why is all of this important? Because it means that we can make maps of the deep sky, and that these maps can be used for decades to



### More info

I find it curious that it was not until the advent of the telescope that the planet **Uranus** was discovered. It is very dim, but it is visible to the naked eye, if you look in the right spot under dark skies. And since it moves across the sky, I am surprised that no one noticed this planet before **William Herschel** saw it through his telescope in 1781.