

Welcome guide to Astronomy

by the publishers of **Starry Night**

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Welcome to Astronomy

Astronomy is the oldest of the sciences. Human fascination with the heavens is timeless. Stargazing is intellectual as well as aesthetic. It combines the thrill of exploring new realms of knowledge with the delight of appreciating new spheres of beauty.

Getting Started

You can start exploring tonight! All you need is a little practical advice and this guide. There's an infinite universe of celestial wonders to see and discover.

You'll be surprised at how much you can see with just your eyes. You'll be able to make out the star patterns of the constellations, follow the phases of the Moon and watch the five brightest planets moving against the background stars. Meteors flash unexpectedly and artificial satellites drift slowly in and out of view. And don't forget the colorful tapestry painted across the skies by the rising and setting Sun.

Celestial Road Map

Once you know a few constellations, the sky will always be a familiar friend. It will always be a familiar friend. You can learn the star patterns of the constellations with the simple star maps in this guide. Start by choosing the correct map for the season. You don't even need to be out in a dark country location. The brightest stars that mark the constellations can be seen from many urban and most suburban locations. Sometimes a dark country sky can even make things harder for a beginner because there are so many stars that it's *hard* to find the familiar patterns of the constellations!

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When you go outside to look at the stars, give your eyes a few minutes to adjust to the dark. Turn off as many lights as you can to reduce your local sky glow. A flashlight with a red filter is helpful. It will allow you to read your star map without destroying your night vision. Find north, south, east and west around your horizon. Hold your star map up in front of you and turn it so that the direction at the bottom of the map matches the direction in which you are facing. The lower edge of the map represents your horizon. The center of the map is your overhead point, the zenith. You should be able to match the pattern of stars in the sky with the constellations shown on your map. Once you have identified a star pattern like the Big Dipper, you can use it as a guide to find the next one. Congratulations! You're on your way to a very rewarding hobby.

Another kind of star map is the planisphere. It is a round map printed on card or plastic that allows you to set the time of night and time of year, so it matches your current sky. Planispheres are good for determining what's up in the sky, and when the stars and constellations rise and set.

As you read along, remember that this guide only scratches the surface. For more information there are many good guidebooks available in your local library and bookstores. We have a list of suggested resources to help you get started at the back of this guide. Starry Night software can help, too. Use it to help plan your observing sessions and to make and print your own customized star maps.

Make Some Astro-Buddies

If you are interested in astronomy and don't already belong to an amateur astronomical organization, local or national, you should consider joining one. Not only will you make new friends and enjoy swapping ideas, it's also the best place to get help and advice if you need it.

In the United States, the largest national organization of amateur astronomers is the Astronomical League (AL). In Canada, the largest is the Royal Astronomical Society of Canada (RASC). The member clubs of these organizations hold annual and regional conventions at which amateurs talk shop and exchange ideas. The AL and RASC are composed of scores of local amateur astronomical clubs and groups, totaling thousands of individuals.

Many astronomy clubs offer field trips or courses to help you get acquainted with the stars. If you own a telescope, but are having problems with it, there is no better place to go than an astronomy club. Take advantage of these gold mines of knowledge, experience and fellowship. The camaraderie of the night sky is a universal feature of astronomy clubs. There is no substitute for spending time with other people from different walks of life who all share the same love for the nighttime sky.

www.astroleague.org

www.rasc.ca



NGC 300: NASA, ESA, and The Hubble Heritage Team (AURA/STScI)

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Star Maps

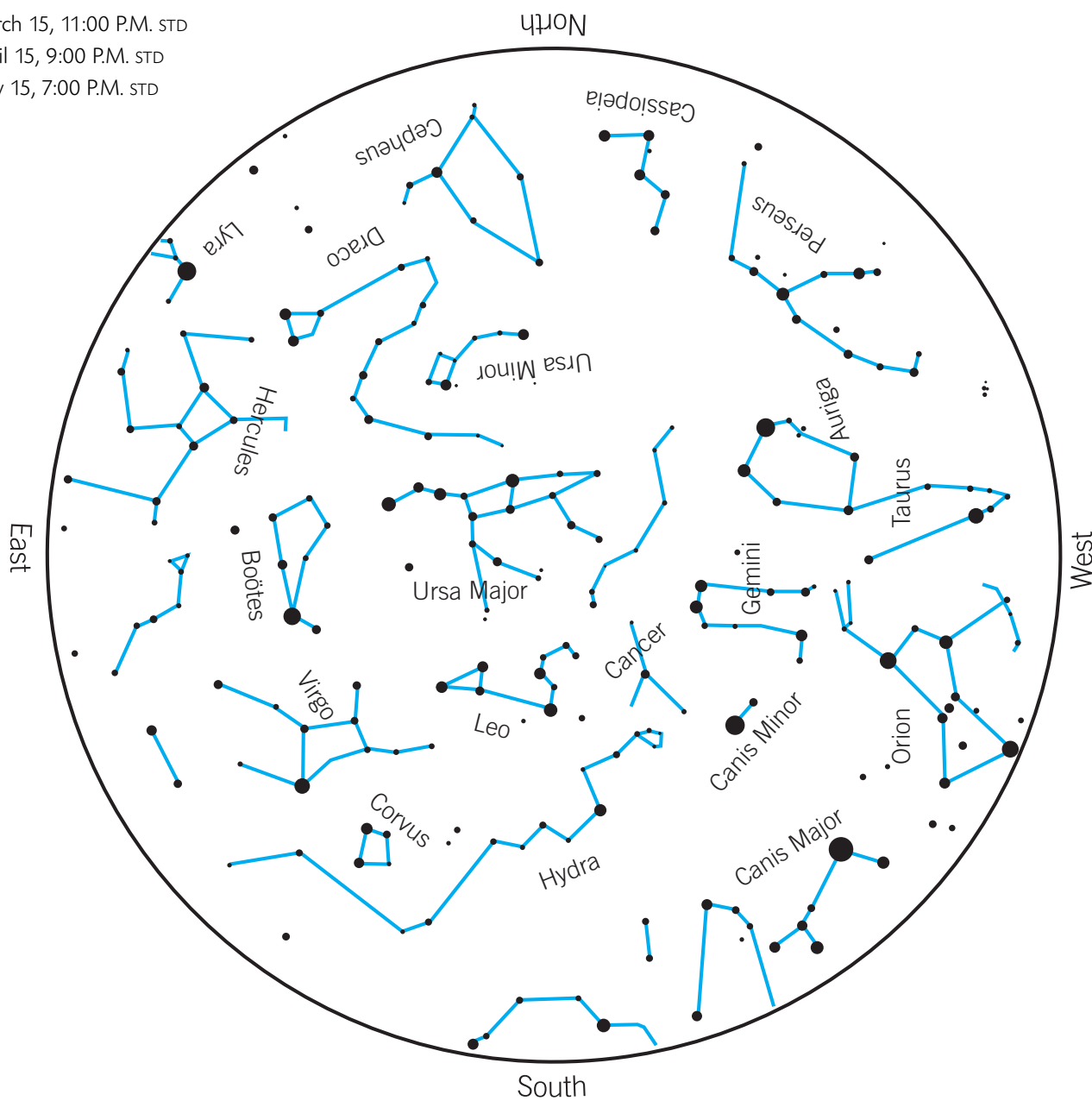
Map 1: Constellations of Spring

Constellations of Spring as seen from approximately 40°N
(the approximate latitude on Earth of New York, Chicago
and San Francisco)

March 15, 11:00 P.M. STD

April 15, 9:00 P.M. STD

May 15, 7:00 P.M. STD



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Star Maps

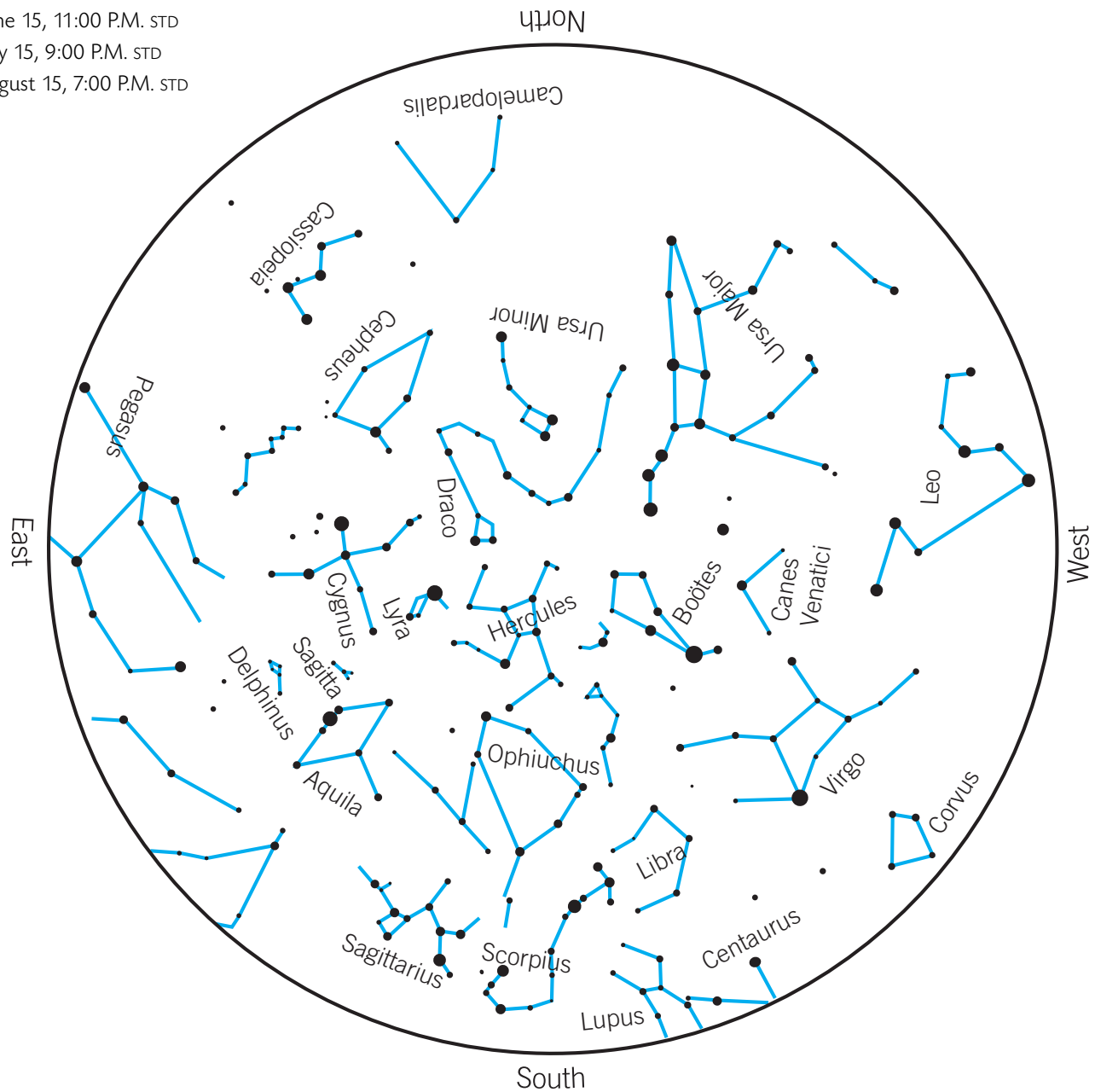
Map 2: Constellations of Summer

Constellations of Summer as seen from approximately 40°N
(the approximate latitude on Earth of New York, Chicago and San Francisco)

June 15, 11:00 P.M. STD

July 15, 9:00 P.M. STD

August 15, 7:00 P.M. STD



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Star Maps

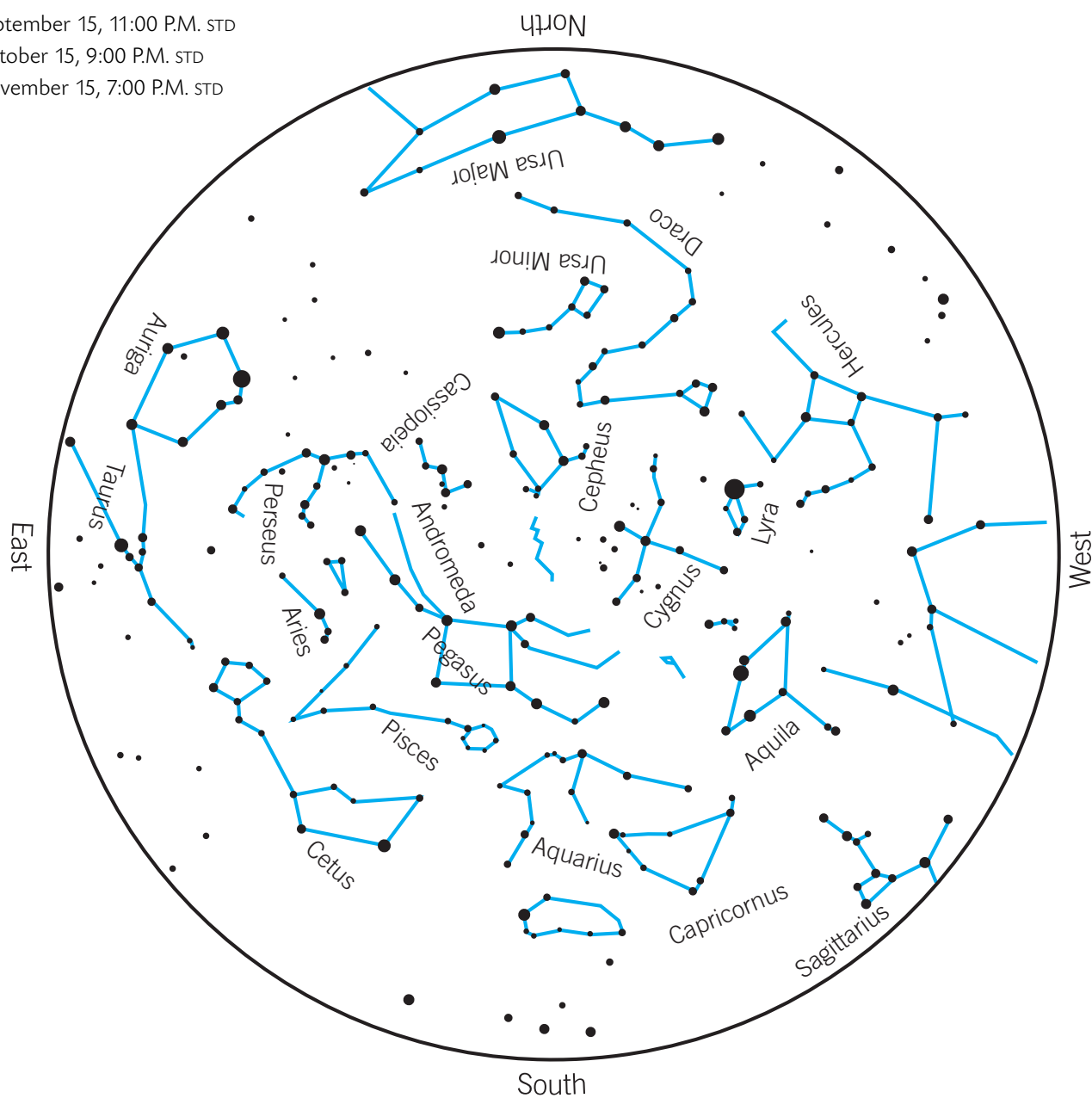
Map 3: Constellations of Fall

Constellations of Fall as seen from approximately 40°N
(the approximate latitude on Earth of New York, Chicago and San Francisco)

September 15, 11:00 P.M. STD

October 15, 9:00 P.M. STD

November 15, 7:00 P.M. STD



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Star Maps

Map 4: Constellations of Winter

Constellations of Winter as seen from approximately 40°N
(the approximate latitude on Earth of New York, Chicago and San Francisco)

December 15, 11:00 P.M. STD

January 15, 9:00 P.M. STD

February 15, 7:00 P.M. STD



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Binoculars – a Good Start

If you already own binoculars, put them to work. Be prepared for a pleasant surprise. They are easy to aim and use, giving bright, wide-angle images that are upright and not reversed (as is often the case with a telescope). Experienced amateur astronomers are never without binoculars, no matter what kind of telescope they might own.

Binoculars let you see Jupiter’s moons orbiting around the planet – it is like watching a miniature solar system in motion. They provide wonderful views of the blasted surface of Earth’s Moon. Binoculars reveal the brighter star clusters and nebulae, too. You can see bright sparks of stars shrouded in wisps of faint interstellar gases. Others will appear as a faint glow of ghostly light. The Milky Way will amaze you with its glowing star clouds and knots of dark nebulosity silhouetted against the brighter galactic carpet. With your binoculars you can enjoy countless hours of travel in the stellar realms of the night sky.

What Can You See in a Telescope?

Nothing can compare with the feeling of making a direct connection to the cosmos! This is what a telescope can bring. Seeing for yourself the distant worlds of our solar system, ephemeral comets drifting through space, far-flung clumps of stars, and the ghostly glow of galaxies deep in the void, is a deep personal experience like no other.

A telescope is a subtle space ship of the mind. The views will not look like the full color spreads in magazines and books. Such photographs need long exposures of many minutes or even hours. The human eye does not take time exposures. It cannot perceive colors in dim light. What the eye *can do* is see very fine detail in structure and contrast. Your telescope’s range is limited only by your willingness to be patient, to learn how to use it to its best advantage, and to learn how to really see what it is showing you.

The Moon will be dazzlingly bright and sharp with a lifetime of detail to explore. The planets will look very small, even with high power. But if you take the time for a good long look, you’ll be surprised how much color and subtle detail will

be revealed, especially during brief moments when our atmosphere is steady. Saturn’s rings and Jupiter’s bands are always showstoppers. The Moon and planets make rewarding targets from even the most light-polluted places.

Stars are tiny and sometimes colorful pinpoints of light, no matter how big a telescope you have. Star clusters range from large, loose groupings of brilliant celestial jewels to faint and far away smudges of light at the limits of vision. Nebulae and galaxies run the gamut from big and bright to frustratingly faint. Patience and persistence will reward you with delicate detail in structure and contrast. The best views of nebulae and galaxies are from dark sky locations where there is little light pollution. A little knowledge of your target’s place in the grand scheme of the universe can make its observation a more meaningful one.

All of your observing, with the unaided eye, binoculars or a telescope, will be easier and richer with the help of a good guide book, star maps and sky simulation software like Starry Night.

Moon Map

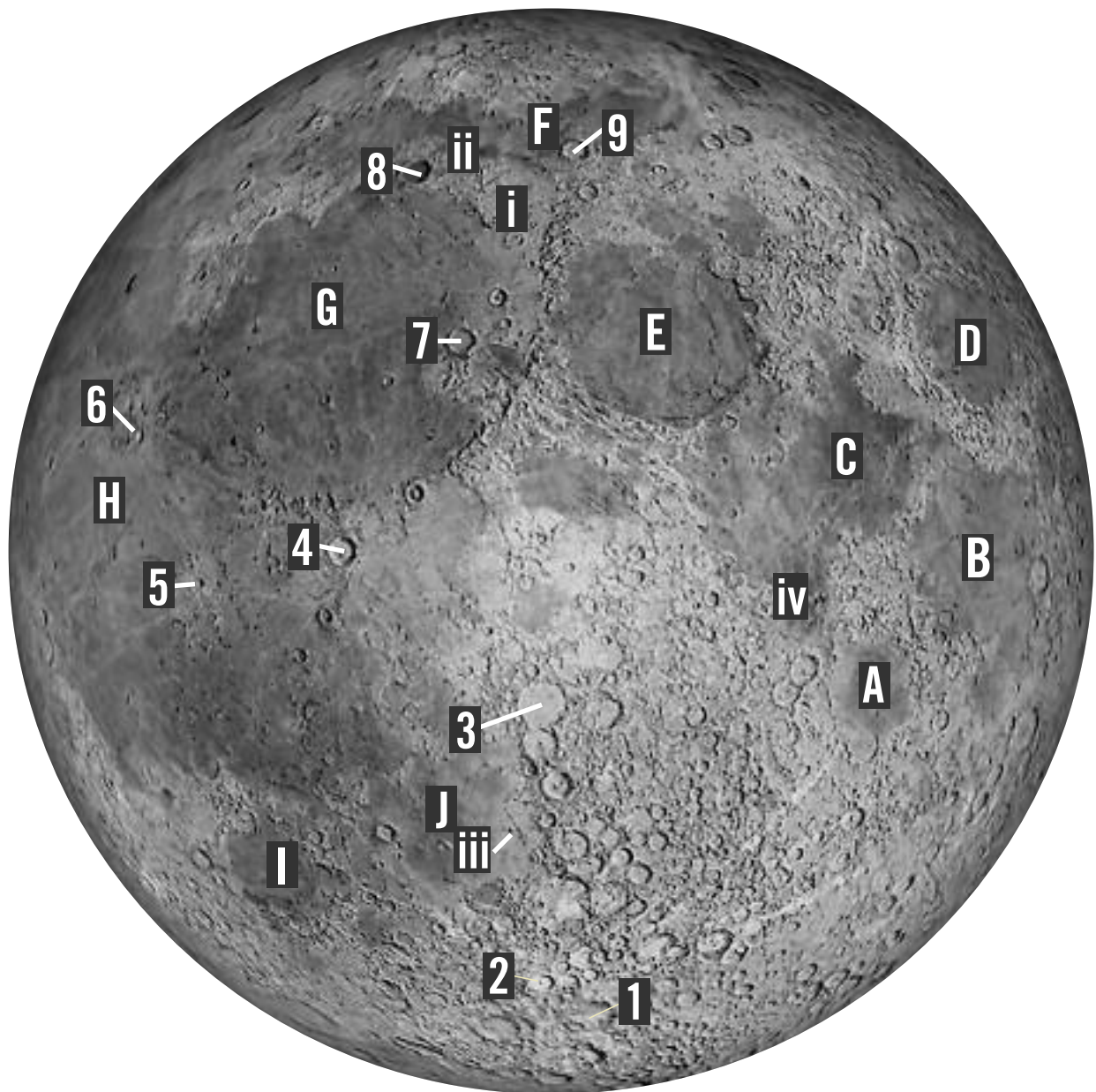
Our Moon is an endlessly fascinating world to explore. It’s a pretty rugged place for all the romantic poetry that it has inspired throughout human history. The Moon’s face records the solar system’s violent past in its multitude of craters. The most obvious features are the large, dark impact basins known as “maria.” They show up well because their floors are made of relatively smooth and dark basalt. The lunar highlands are much rougher and brighter. Together these two different surface types create the pattern of the “Man in the Moon.”

As you watch the Moon move through its monthly progression of phases, use your binoculars to examine its surface, especially along the terminator. This is the line where sunlight turns to shadow on the Moon’s surface – it separates day and night on the Moon. Sunlight strikes the lunar surface at a very low angle along the terminator. Surface detail stands out in crisp, striking relief. Look for shadows in craters, along mountain walls and in lunar valleys. Notice the bright rays of ejected material spreading out from some of the craters. Can you see any craters with central peaks? Use this Moon map to find and identify the major features on our closest neighbor in space. In no time you’ll feel at home with the Moon, and you’ll wait for it to rise each day with the feeling that you are about to greet an old friend.

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Moon Map

When you graduate to viewing the Moon through a telescope, be aware that the image you see may be inverted, or reversed left-to-right, or both! It depends on the optical configuration of your telescope.



Maria: A. Mare Nectaris B. Mare Fecunditatis C. Mare Tranquillitatis D. Mare Crisium E. Mare Serenitatis F. Mare Frigoris G. Mare Imbrium H. Oceanus Procellarum I. Mare Humorum J. Mare Nubium

Craters: 1. Clavius 2. Tycho 3. Ptolemaeus 4. Copernicus 5. Kepler 6. Aristarchus 7. Archimedes 8. Plato 9. Aristoteles

Features: i. Alps ii. Alpine Valley iii. Straight Wall iv. Apollo 11 – first humans on the Moon

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Choosing a Telescope for Astronomy

Once you are familiar with the sky and are comfortable navigating around with binoculars, a telescope is the next step for many people. Choosing the best telescope can be challenging. Here are a few factors to help you make your decision:

Aperture is Important

The most important property of a telescope is its aperture, or the diameter of the telescope's main optical element, whether it's a lens or a mirror. Aperture affects the telescope's light-gathering power (which determines how bright objects will appear), and its resolving power (how much fine detail it can show). There are other factors to consider, but the larger the aperture, the more you will see.

There are exceptions to the rule that "bigger is better." One is portability. Large telescopes need housing in a permanent observatory or a strong back and a truck to get them to an observing site. The size of the perfect telescope is a balance between the largest aperture you want and the size you can comfortably handle. If you see yourself traveling with your telescope, portability and ease of set-up and use are the main deciding factors.

Don't Get Hung Up on Power

The first question most people ask is "What is its magnifying power?" Magnification is not as important as a sharp image. If a telescope gives lots of magnification, but the image is a fuzzy blob, then the magnification is of no use. The maximum useful magnification for any telescope is about 50 times the aperture in inches, or two times the aperture in millimeters. This is about 100x to 120x with the smallest telescopes, which is enough to see such wonders as the rings of Saturn and cloud bands on Jupiter.

Smooth, Solid Mounts

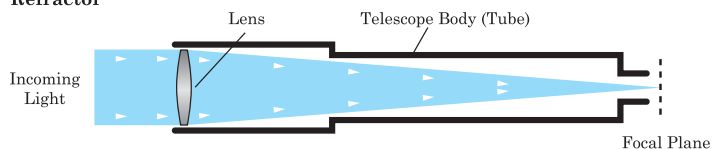
Whatever kind of telescope you are thinking about, it will need a solid, smoothly-working mount. This requirement rules out most of the inexpensive and wobbly models. They can be wiggly and difficult to aim, and their poor optics produce distorted images. Ignore their claims of uselessly high power – you're better off with a good pair of binoculars!

Different 'Scopes for Different Folks

There are three basic optical designs of telescopes: the refractor, the reflector, and the compound (or catadioptric) telescope.

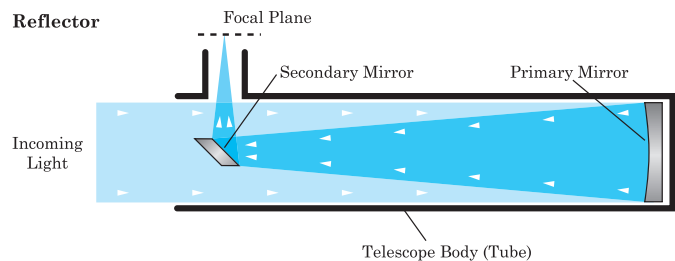
Refractors use lenses and are what most people think of when they hear the word "telescope." A refractor's tube is most often long and narrow, mounted on a tripod, with a lens at one end and the eyepiece at the other (focal plane). They give sharp, high-contrast views at high magnification but they are also the most expensive telescopes per inch of aperture.

Refractor



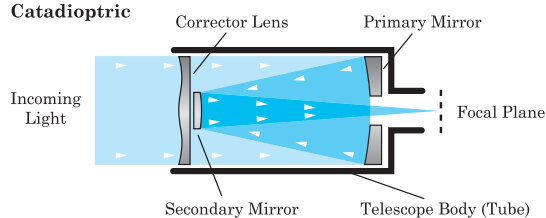
Reflectors use a mirror instead of a lens to gather and focus light. Reflectors are less costly than a refractor of the same aperture. Most amateur telescopes are reflectors. They come in a variety of designs and can be placed on different mounts. They are versatile and give excellent views of the heavens.

Reflector



Catadioptric telescopes use a combination of lenses and mirrors to gather and focus light. They are compact, rugged and versatile. These telescopes are popular with observers who want good image quality, generous aperture and a motor-driven mounting in a transportable package. They are more costly than a reflector but about equal to the cost of a refractor.

Catadioptric



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The Cost Factor

Budget is a factor in almost every telescope purchase decision. There are three major price-related pitfalls to be avoided:

1. Don't buy a flimsy, inexpensive telescope at the mall with the intention of getting a taste of the sky and upgrading later. Many of those telescopes are so poor-quality and frustrating that they can turn budding astronomers off for good!
2. Don't give up on astronomy if the telescope of your dreams is out of reach at the moment. There are many reasonably priced, high-quality beginner's telescopes that can reveal incredible wonders, while helping a novice define his or her observing interest.
3. Finally, if you are one of the lucky few for whom price doesn't matter think twice before buying the biggest, most expensive telescope in stock. Many of the large, fully featured telescopes are also the most complicated, and are too much to grasp for someone still trying to find the Big Dipper!

The Bottom Line

Which, then, is the right telescope? That's a decision that must be made individually, but the three best pieces of advice are:

1. The best telescope in the world will bring no joy if it is never taken out of the closet!
2. All else being equal, a larger-aperture telescope will show more in the night sky than a smaller one.
3. Buy from a company that's knowledgeable about telescopes and astronomy, and who will support you even after your purchase (since you will likely have questions).

Our advice is to choose a well-made telescope, of a design matched to your main observing interest and most frequent observing site. Make sure it's a size that can be handled easily and used often, and you will enjoy a lifetime of awe and wonder under the stars!



10" Newtonian reflector
on a Dobsonian mount



8" Schmidt-Cassegrain on a
computerized equatorial mount



80mm refractor on an
equatorial mount

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Resources

Astronomy Software

- Starry Night desktop planetarium software, www.starrynight.com

Books

- *Under a Starry Night*, Steve Tomecek, Simulation Curriculum
- *Nightwatch: A Practical Guide to Viewing the Universe*, 3rd Edition, Terence Dickinson
- *The Beginning Observer's Guide*, 3rd Edition, Leo Enright, Royal Astronomical Society of Canada
- *Star-Hopping for Backyard Astronomers*, Alan M. MacRobert, Sky Publishing
- *Binocular Astronomy*, Craig Crossen & Wil Tirion, Willman-Bell
- *Touring the Universe through Binoculars*, Philip S. Harrington, Wiley

Magazines

- *Sky & Telescope*, Sky Publishing Corporation, www.skyandtelescope.com
- *Astronomy Technology Today*, www.astronomytechnologytoday.com
- *Astronomy*, Kalmbach Publishing Co., www.astronomy.com
- *SkyNews*, SkyNews Inc., www.skynewsmagazine.com

Clubs and Associations

- Astronomical League, www.astroleague.org
- Astronomical Society of the Pacific, www.astrosociety.org
- Royal Astronomical Society of Canada, www.rasc.ca
- Association of Lunar and Planetary Observers, www.lpl.arizona.edu/alpo
- International Dark-Sky Association, www.darksky.org

Web

- Astronomy and Space News, www.space.com/nightsky
- Hubble Space Telescope, heritage.stsci.edu
- Astronomy Picture of the Day, antwrp.gsfc.nasa.gov/apod/astropix.html
- Satellite visibility, www.heavens-above.com
- Weather for astronomers, cleardarksky.com/csk



Saturn: NASA and The Hubble Heritage Team (STScI/AURA)



Globular Cluster M15: NASA and The Hubble Heritage Team (STScI/AURA)



Galaxies: NASA, ESA, M. Livio and the Hubble Heritage Team (STScI/AURA)