Planisphere

The first thing a new amateur astronomer needs to get and learn to use is a planisphere (Star Finder or Star Wheel). Print the accompanying pieces and follow the instructions for construction. It will help you find the stars and constellations at any time during the year from our latitude. Notice how the night sky changes each hour, day and month as the stars continually rise in the East and set in the West; how the sky at midnight on January 1st is the same as November 17 at 3 AM and February 15 at 9 PM. Orion the Hunter, an easily recognizable winter constellation that actually looks like its' mythical namesake, can be seen high in the South sooner and sooner after sunset. While the Earth revolves once around the Sun each year, we get new views of the sky each night. Orion is opposite the Sun on January 1st, but in line with the Sun on July 1 and so is not visible, unless we have a total solar eclipse.

Use the planisphere to plan your night of observing. You won't find M13, the compact globular cluster in Hercules, at 8 PM on January 1st, but you will easily find M45, the spectacular open cluster in Taurus. Set your planisphere for the correct date and time using your red flashlight so your eyes stay dark adapted. Stand facing South; from Robert Moses that means facing the ocean. Hold it overhead with North pointing North. You will see that East, from where the stars appear to rise due to the rotation of the Earth, points to your left, and West to your right. Remember to readjust the date/time configuration throughout your observing session.

While you were moving the planisphere chart, did you notice that some stars were always visible? Spin the chart and watch the stars of Cepheus, Cassiopeia and the Big and Little Dippers. They are called circumpolar: stars that circle the North pole star, Polaris, the end star in the handle of the Little Dipper asterism, but don't set. Therefore, you could observe any clear night of the year to see the galaxies M81 and 82 in the constellation of Ursa Major, the big bear, of which the Big Dipper asterism is a part. An asterism is an easily recognizable shape that is not one of the established 88 constellations.

Did you observe that Polaris, the star to which the Earth's North Pole points, is not directly overhead? It is also not the brightest star in the sky: both common misconceptions. The only place to see this is on the frozen Arctic Ocean at 90 degrees North latitude. Here on Long Island, at about 40 degrees North latitude, Polaris is 40 degrees, 4 fists held at arm's length, above the horizon. For those in Albuquerque at 35 degrees North latitude, Polaris is the same number of degrees, 3 1/2 fists, above their horizon. Along the Equator, 0 degrees latitude, Polaris would skirt the horizon. Below the Equator, it isn't visible at all.

The sky or Celestial Sphere is divided by imaginary vertical and horizontal lines called Right Ascension (RA), broken into 24 equal units called hours, and Declination (Dec), broken into 360 equal units called degrees, much the same way as our Earthly globe had been divided into Longitude and Latitude. One of the accompanying charts shows these lines. So, if someone tells you to look at 6h15m RA and -6^0 Dec you will be treated to a spectacular sight, the Orion Nebula, the birth place of stars.

Don't just look at things, see them.

Star-Finding with a Planisphere

By Alan M. MacRobert

http://skyandtelescope.com/howto/visualobserving/article_75_1.asp

Using a planisphere, or "star wheel," soon becomes second nature for stargazers. Here an observer gazes at the eastern horizon with the guidance of *The Night Sky*, a planisphere designed by astronomer David Chandler. *Sky & Telescope / Craig Michael Utter*

The movements of the stars have taxed the human intellect throughout the ages — from ancient Babylonians seeking to predict sky events, to Greek philosophers wrestling with the structure of the universe, to beginning amateurs today trying to point a new telescope at the Andromeda Galaxy.

At first, the turning of the celestial sphere perplexes everyone who takes up skywatching. Sooner or later the picture snaps into place and the whole setup becomes obvious. But those who think the sky's motion is inherently simple should try explaining to a beginner why every star follows a different curved path across the sky at a different speed. And why do some stars move from west to east while most move east to west? Can you explain why some constellations turn somersaults during the night while others just tilt from side to side?

To bring the sky's motion down to Earth, astronomers for millennia have built little mechanisms that duplicate it. A working model not only illustrates how the sky turns but can help locate objects at any given time. The simplest sky model is a *planisphere*. Untold numbers of these star finders have been designed and published in the last century. Even the most experienced observers rely on them, especially at unfamiliar hours of the night. The word "planisphere" simply means flat sphere. It incorporates a map of the sky that pivots at the celestial pole. As the map revolves around the pivot, it slides under a mask that represents your horizon. Turning the map mimics the apparent daily motion of the sky, complete with risings and settings at the horizon edges.

Ancient Origins

The basic idea behind the planisphere was used in ancient Rome. The architect and engineer Vitruvius, writing around 27 B.C., described a star map engraved on a solid plate and a horizon mask that rotated over it to show the risings and settings of celestial bodies. A water clock turned the mask once a day to keep up with the sky. Nearly two centuries later, Claudius Ptolemy analyzed the map projections used for such devices in his treatise *Planisphaerium*.

By the 4th century A.D. a version known as the planispheric astrolabe was in use. Its star map was a skeletal metal framework sliding over a solid plate engraved with the observer's horizon. Medieval Arabs and Persians refined the astrolabe to a peak of versatility and beauty. Some of these rnate "mathematical jewels" made their way to Europe, where they were prized as almost magical. "All the conclusions that have been found, or might be found in so noble an instrument as an astrolabe, are not known perfectly to any mortal man in this region," wrote Geoffrey Chaucer in 1391. By the end of the Middle Ages astrolabes were the universal trademark of astronomers and astrologers.

Astrolabes were commonly used to sight on the Sun and stars to tell time. The invention of accurate clocks allowed the procedure to be reversed. If you knew the time, you could use this kind of device to find stars. And that is how planispheres have been employed ever since.

Left: To set the planisphere for a particular date and time, turn the moveable disk until the two (9 p.m. on January 1st in this example) line up with one another. *Right:* Set thus, the planisphere quickly tells you what constellations are above the horizon. *Sky & Telescope / Craig Michael Utter*

Using a Planisphere

In principle nothing could be simpler. You turn a wheel to put your time next to your date, and presto, there's a custom-made map of the stars that are above your horizon for that moment. The edge of the oval star map represents the horizon all around you, as you would see if you were standing in an open field and turned around in a complete circle. The part of the map at the oval's center represents the sky overhead — much like the all-sky map in *Sky & Telescope* each month, or the interactive star chart on this site.

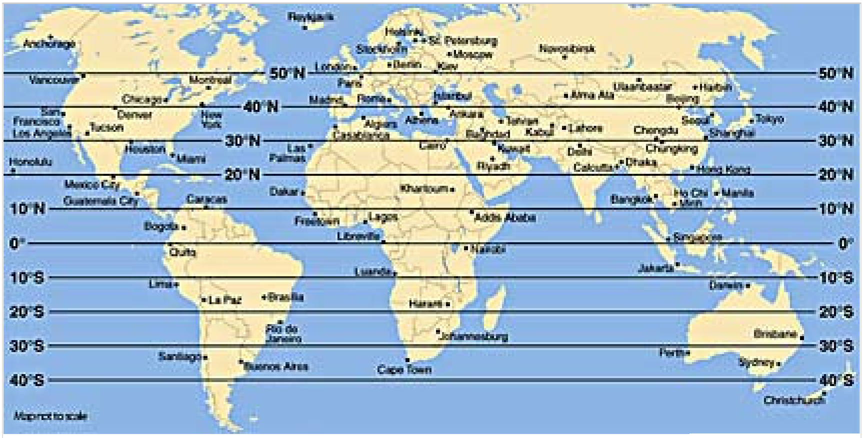
In practice, several complications can throw beginners off. The worst is that a planisphere's map is necessarily small and distorted. It compresses the entire celestial hemisphere above and around you into a little thing you hold in your hand. So star patterns appear much bigger in real life than on the map.

Moving your eyes just a little way across the map corresponds to swinging your gaze across a huge sweep of sky. The east and west horizons may look close together on a planisphere, but of course when east is in front of you west is behind your back. Glancing from the map's edge to center corresponds to craning your gaze from horizontal to straight up.

There's only one way to get to know a map like this. Hold it out in front of you as you face the horizon. Twist it around so the map edge labeled with the direction you're facing is down. The correct horizon on the map will now appear horizontal and match the horizon in front of you. Now you can compare stars above the horizon on the map with those you're facing in the sky. Then there's the distortion issue. On a planisphere designed for use in the Northern Hemisphere, constellations in the southern part of the sky are stretched sideways, taffy-like, making it hard to compare them with real star patterns. This problem does not exist on a well-designed map for fixed dates and times, such as the one in the center of each month's *Sky & Telescope* or the interactive star chart on this site. Some planisphere designers have come up with a partial solution. David Chandler's planisphere *The Night Sky* presents *two* maps, one on each side. One minimizes distortion north of the celestial equator, the other south of it. Just flip it over for the best view.

Fine Points

A further complication is that a planisphere works correctly for only one narrow range of latitudes on Earth. Fortunately, many models (notably Chandler's) are made in several editions, each for a particular latitude range.



If you don't already know your latitude, you can use this map to estimate it accurately enough to choose an appropriate planisphere. *Sky & Telescope illustration.*

Then there's the matter of *daylight saving time.* When this is in effect (from the first Sunday in April to the last Sunday in October in most parts of the United States), remember to "fall back" to standard time by subtracting an hour from what your clock says before you set the planisphere's dial.

Actually, planispheres don't employ standard time either, but rather *local mean time.* The difference, which depends on where you live in your time zone, can amount to a half hour or more. The local mean time correction (in minutes) for various U.S. cities is given in the following table. Fortunately, even a half hour one way or the other doesn't really matter for most star finding.

Anchorage	+60	Kansas City	+18
Atlanta	+38	Los Angeles	-7
Bismarck	+43	Memphis	0
Boise	+45	Miami	+21
Boston	-16	Minneapolis	+13
Buffalo	+15	New Orleans	0
Chicago	-10	New York	-4
Cincinnati	+38	Philadelphia	+1
Cleveland	+27	Pittsburgh	+20
Dallas	+27	Richmond	+10
Denver	0	Rochester, N.Y.	+10
Detroit	+32	St. Louis	+1
Durham	+16	Salt Lake City	+28
El Paso	+6	San Francisco	+10
Helena	+28	Santa Fe	+4
Honolulu	+31	Seattle	+10
Houston	+21	Tucson	+24
Indianapolis	+44	Tulsa	+24
Jacksonville	+27	Washington, D.C.	+8

In fact, if you just want to know which constellations are up and where they are, a planisphere's limitations can largely be overlooked. It's remarkable that such a simple working model of the sky can work so well.