

1 Introduction

1.1 Astronomy Stories

Most of the constellations in the night sky have names which come from ancient myths. Different cultures have different stories. The official constellation names all come from either Greek and Roman myths or, for the southern hemisphere, names given by 18th century European adventurers. Those adventurers were very fond of their gadgets so we have names like Telescopium named after (you guessed it) the telescope, Octans named after the octant, a tool sailors used for navigation, or Microscopium named after the microscope. Those constellations don't have very interesting stories

The stories that go along with the names given by the Greeks are much more interesting, but some of them have been lost so we have only part of them.

1.1.1 Equuleus – the Foal

This is an example of a lost story, a mystery horse whose origin is uncertain. The name first appears in a book by Ptolemy in the second century AD. One ancient writer claimed it was named by Hipparchos in the second century BC, but Hipparchos doesn't mention it in his book about the constellations, nor does anyone after Hipparchos for 400 years until Ptolemy does.¹ So where did the little horse come from and what is its story?

1.1.1.1 Celeris, Brother of Pegasus

There are several possibilities. Some think Equuleus represents Celeris, the brother of Pegasus, the great winged horse, which was given to Mercury by Castor. However, while there are several versions of how Pegasus was born, none of them has another horse being born as his brother! Some of the tales do talk about Pegasus having a foal named Celeris.

1.1.1.2 Cyllarus

Some think it was Cyllarus which was given to Pollux by Juno.² The problem is we don't know much about Cyllarus except that it was a great horse!

1.1.1.3 Neptune versus Minerva

Some think it was the creature that came from Neptune's trident when he struck the earth when he and Minerva had a contest to see who could give the greatest gift to mankind.³ In the contest, whoever gave the greatest, most useful gift to mankind would gain the honor of naming a new city just founded in Greece. Neptune struck

1 *Star Names, Their Lore and Meaning*, pages 212-212, by Richard Hinckley Allen, Dover Publications, 1963.

2 Cyllarus is mentioned by Virgil in *Georgics III*, around 29 B.C. You can find an online copy of this poem at <http://classics.mit.edu/Virgil/georgics.3.iii.html>

3 This is recounted in the story of Arachne in *The Stories of Months and Days*, chapter 11, by Reginald C. Couzens, 1923. You can find an online copy of this book at <http://www.sacred-texts.com/time/smd/index.htm>.

the ground and from it sprang a horse. Everyone was very impressed and even more so after he explained how helpful the horse would be. Then Minerva produced an olive tree which made everyone laugh! But then she explained how each part of the tree could be used and that the branches symbolized peace while the horse was the symbol of war. Minerva won the contest. Minerva is the Roman name, but the Greeks called her Athena and so the city is now known as Athens.

1.1.1.4 Phylira and Saturn

And others think it was the horse in the story of Phylira and Saturn. I'm not sure why they think that because in that story, Phylira and Saturn turn themselves into horses and give birth to Chiron who was a centaur, not a horse.

1.2 Astronomy in the City

Its a common myth that you can't do astronomy in the city. Perhaps you've seen the movie Madagascar and remember the part where Alex, trying to cheer up Marty comments about what a beautiful night it is and says "Look the star is out." "The" star, like you can only see one. Marty quickly points out that it's a helicopter and sure enough, it soon flies away.

But while its true that if you stand on a typical street corner directly beneath the street lights you will be unable to see much, that's simply because you have the bright light shining directly in your face! Move away to someplace where you can avoid the direct glare of the street lights. If you live above the 3rd floor and have a porch, it should be easy to get a good view of at least part of the sky. For three years, I set up a telescope on my 3rd floor porch and even took some photos from it. All while living in Forest Hills, only one block away from Queens Boulevard!

The one thing to stress about finding a good place for observing the night sky is safety. While parks and back alleys can be relatively free of glaring street lights and none of them are truly dark like a country field, you need to be aware of your surroundings. Check with your parents before going out, see if they will come with you, or go with another responsible adult.

1.2.1 Things to See

First, there is the moon. You can't always see the moon, but that has nothing to do with how bright the city lights are. Our first activity is going to be keeping track of the moon's appearance and when you can see it.

The planets are easily visible from the city. Unlike the moon, whose visibility changes quickly from day to day, the planets are visible for long stretches or time. Mercury may be visible for only a few days at a time, Venus can often be visible for a month or two, and the outer planets, Mars, Jupiter, and Saturn can be visible for half of each year!

And yes, you can see stars and constellations. Compared to the view from a dark country sky, the constellations are "missing" a number of stars and some of the fainter ones are not visible to the naked eye. However, the brigher constellations are easily seen and with some practice you can find those that aren't quite so bright.

Here in Bay Ridge, it's a bit tough, almost as bad as in Manhattan. However, as you near the edges of the city or move over to Staten Island, the sky begins to darken a bit making it possible to see quite a few more stars.

Solar eclipses are quite rare and we have not had one visible from here in New York City since December 25, 2000. That eclipse was only partial and anytime you are observing the sun, **you must have special eye protection or you can do permanent damage to your eyes.**

Lunar eclipses are always safe to view; you are viewing the moon. I have had several "eclipse" parties in the past six years where our family has sat out with neighbors and friends to watch the eclipse progress, take pictures and simply enjoy one another's company along with nature's show.

Sometimes, a comet will be bright enough to be visible from within the city. Your parents may remember comet Hale-Bopp which was visible from the city. But there was also comet Holmes visible even to the naked eye from our front porch in Bay Ridge in October 2007. I have also used binoculars to observe a few fainter comets from here in Brooklyn.

1.3 Daytime Astronomy

When we think of astronomy, we naturally think of stars and constellations, the moon, the planets, and maybe the more rare comet or meteor. But there are a large number of things you can see with the naked eye that are related to astronomy and determine what you can see.

The sun is, of course, a topic of interest to many astronomer, but how many of us think of astronomy in the daytime. The only thing I am going to say here about the sun is this: **never look at the sun without proper eye protection.** If you don't *know* what the proper eye protection is, just don't look at the sun. Using the wrong protection can permanently damage you eyes. Oh, and if you do have a telescope and it has one of those little "solar filters" that screw into the eyepiece, throw it away. These type of solar filters have a serious risk of cracking due to the heat of the sun on them when they are being used. If they crack while you are looking through them, you will suffer permanent eye damage.

Even before the sun sets, the sky will begin to darken. But once it sets below the horizon, then the sky will begin to darken faster. This period immediately after the sun sets is called twilight. There are actually three official definitions of twilight called civil twilight, nautical twilight, and astronomical twilight. For our purposes, we'll just lump them all together as that period after sunset before it gets really dark.

In the summer, twilight doesn't end and real darkness fall until after 10 pm! In the early fall, it gets plenty dark by sometime between 8:00 and 8:30 pm. After daylight savings time ends at the end of October, it will be getting dark even earlier.

1.4 Tools of the Trade

The first thing that comes to mind when you think of tools for astronomy is probably a telescope. But that's not the first thing you really need. First, you need at least

one good eye for observing. And yes, if you wear eyeglasses, your eyes still count as good. Second, you need your mind. Observing is a skill that involves both looking (your eyes) and thinking about what you are seeing. With practice, you will begin to notice things you never remember seeing before.

Just because your one good eye (and yes, if you have two good eyes, you can use them both) and mind are all you need doesn't mean other tools aren't useful. Here are some items that can be very useful.

A planisphere is a tool which allows you to find what stars are visible on any night at any time. Planispheres are made for specific latitudes. Here in New York City, you will want the most common variety, the one made for 40°N. New York City is actually at about 42°N, about 140 miles further north than the chart, but for most purposes that difference won't matter and besides, you can't buy one for 42°N.

If you have a computer, there are several programs available that can do the same thing as a planisphere. Some are designed to give you a realistic view of the night sky, some are simple charting programs, some are designed for advanced amateurs and professional astronomers.

If you have binoculars, use them! You don't need special binoculars for astronomy, the type commonly used for birding will work just fine. Even inexpensive field or opera glasses can be used to see more detail on the surface of the moon or detect the four largest moons which orbit Jupiter (they will just look like stars, but you *will* be able to see them). What is good about binoculars is that they are inexpensive compared to telescopes, they have a wide field-of-view, and they produce a natural image meaning left is left, up is up, etc. Most telescopes invert one or both directions.

Finally, yes, a telescope can be a useful tool. But it is of greatest use if, first, you know where to point it, and second, its small enough for you to carry it out and set it up quickly. Telescopes are useful mostly not because of how they magnify objects, but rather because they collect light from a larger area than your eye, making dim objects appear brighter. Most telescopes produce a view of the sky where either left-right or up-down are reversed. Some reverse both.

1.5 Home Activities

All club "assignments" are optional; regular class work has priority. No grades are given for the club, so you can *not* lose points by not doing these activities! Each week I will ask for one or two volunteers to share with the rest of the club what they learned from the assignment.

1.5.1 Moon Phases

During the next *month* we will be filling out a moon phases chart. Figure 1 shows a sample section of a chart filled out so you can see how to do this. Each day, darken the part of the moon which is dark, so the white part of the circle shows the moon phase. Write down the date and time below the circle.

You won't be able to see the moon every day; some days it will be cloudy, some

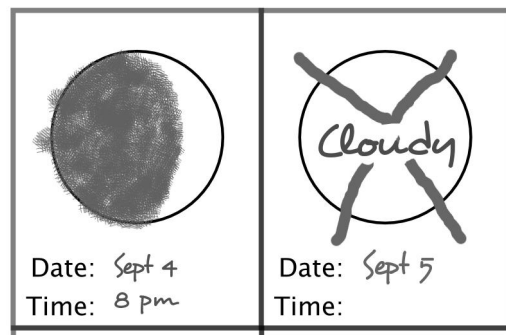


Figure 1: Exampe Moon Phase Chart

days you may be visiting friends or relatives and not get home until too late to even look. But after this first week of looking, you should start to get some idea of where and when to look to find the moon as well as how the appearance changes over time.

1.6 Vocabulary

Astronomy has its own set of special words, like any other science. We're going to have to learn a few of these each week in order to discuss our topics. Usually, I'll try to simply use them in conversation and in the text and explain them as we encounter them. At the end of each chapter, I'll include a vocabulary section with the important "new" words. This week we don't have any special new words.

1.7 Resources

If you have access to a computer and can surf the web, you can find all sorts of astronomical accessories. Remember to get your parents permission before-hand. Because there are so many resources, I'm not going to try to list them all. Instead, I'll list a few items in each category that I have found useful.

1.7.1 Magazines

I've lost count of the number of astronomy-related magazines, but the two most suitable for beginners are below. You can find both at any decent-sized book store and many magazine stores. While some of their web content is for subscribers only, both provide some information for the general public.

Astronomy

Web site at <http://www.astronomy.com/>. They have a special section called "Astronomy for Kids."

Sky and Telescope

Web site at <http://www.skyandtelescope.com/>.

1.7.2 Books

I have a couple of shelves full of astronomy books, and each of them is likely to appeal to different people for different reasons. I'm only going to list a few here.

365 Starry Nights

by Chet Raymo. This has one entry per day, usually covering only a page, sometimes less, with very nice “hand-drawn” illustrations. Each day will talk a little about what is currently visible in the night sky and is very readable and easy to understand.

The Stars

by H. A. Rey. Yes, the same guy who brought you Curious George. This book is a classic and many adults in their 40s and 50s remember this one fondly. The language is simple and the explanations easy to follow. Many computer programs that display the constellations figures have adopted H. A. Rey's drawings.

Starware

by Phil Harrington. This book carries the subtitle, “The Amateur Astronomer's Ultimate Guide to Choosing, Buying, and Using Telescopes and Accessories” and while the book might be boasting a little, it certainly goes a long way to making good on that promise.

Nightwatch

by Terrence Dickenson. This book contains a large amount of practical advice for “backyard astronomers.” It includes several charts of the night sky to go along with the text. The 3rd edition (1998) contains some dated information: it used to be that if you bought a telescope that was manufactured in Asia, it was probably junk, but that is no longer the case (most of Orion Telescope's products are made in China and are quite good).

1.7.3 Planetarium Programs / Star Charts

The cheapest place to start here is with a basic planisphere. You can buy them at bookstores (often bundled with an astronomy book), at science gift shops (like the Hall of Science or the American Museum of Natural History), or online.

1.7.3.1 Star Charts

Star charts can be purchased in several formats: fold-out maps, spiral bound books, map sets, or regular books. Some of these are designed for advanced amateurs and show stars which are not visible without a rather large telescope. The good thing about star charts is that you can carry them outside with you and, unlike a computer program, you don't need a power cord, just a (dim) flashlight to read by.

1.7.3.2 Planetarium Programs

Planetarium programs are computer software programs that will allow you to see what the sky looks like on any day and from any location. They will not only show you the stars, but also the position of the planets and even comets. These range from completely free to very expensive. And while the quality of the program tends to increase with the cost, the most expensive ones generally have features (like the ability to control a telescope and a camera attached to it) you won't need unless you become a serious amateur astronomer. There are more available for Microsoft Windows than for Mac OS, but some will run on both. And if your family is a hold-out

for a completely free computer operating system like Linux, then, yes, there are some (both free and commercial) for that, too. I'm only going to mention the ones suitable for beginners or which are free.

Starry Night - <http://www.starrynightstore.com/>

This program comes in several versions with the more expensive versions targeted at advanced amateurs. The least expensive version "Starry Night Enthusiast" costs about \$80. The two main features that make it very attractive is that it will run on both Mac OS X and Windows XP and that it provides "photo-realistic" images of many of the objects.

Cartes du Ciel - <http://www.stargazing.net/astropl/>

This free program will allow your to make charts of any part of the sky and has many add-ons to include information on things you won't be able to see from your backyard here in Brooklyn. Runs only on Windows.

Stellarium - <http://www.stellarium.org/>

Stellarium also offers a very pleasing view of the night sky and runs on Windows, Mac OS X, and Linux. And even better, its free.

1.7.4 Telescope and Binoculars

There are several major vendors of telescopes, and a very large number for binoculars. Most camera shops will have binoculars and many will have telescopes. Here in New York City, the two major stores where you can see telescopes on display are Adorama Camera, and B & H Photo. In addition to those two stores, I've found Orion Telescope to be very helpful.

Orion Telescopes

<http://www.telescope.com/>. This vendor sells a lot of relatively inexpensive astronomy equipment, but they also have some tutorials on their web site.

However, before you start thinking about buying a telescope, have a look at the telescope buyers guide here: <http://www.astronomytoday.com/astronomy/tbfaq.html>.