



## **Astronomy Without a Telescope**

***Phillip Ostroff, Phil's Astronomy Blog Article #1***

So, you're thinking about getting into astronomy but maybe you don't have a lot of money or you're not really sure about whether or not you want to lose that hard earned cash or whip out the plastic to buy something you fear you may never use. Maybe your significant other, or if you're a youngster, your parents can't justify the purchase of a scope just yet. Still, you have a nagging sensation to take the time to look up on a clear night and see what's going on out there.

Fear not!

You don't have to buy a whiz-bang scope to enjoy the night sky. To the contrary, you might find that you can really enjoy the night sky without a telescope, more than you may realize! While having a scope may get you up-close and personal with some deep sky denizens and planetary delights, without a scope you are set up to enjoy the heavens without the fear of equipment failures, fogging of lenses and, as is often the case, logistical issues. More on that later...

No. You are equipped with the two most basic, fundamental tools that you will find are all you need to enjoy what the dark heavens have to offer; your eyes, and a sense of curiosity. Obviously, you're curious about the stars because you're reading this article! Your eyes simply need a few more tools which will enable you to satisfy this sense of curiosity and start you on a path that will have you enjoying the hobby of astronomy for years to come.

The skies are free, and they are there for everyone. Go out to your driveway on a clear night and there they are, presenting themselves to you unabashedly and begging further exploration. Despite the beauty of them, there is fear there, fear of the unknown. How many stars are out there? What are those shapes that you think you can make out? How far out are you actually seeing? What is that one object that seems to be moving amongst them? What the heck was that one object you just saw streaking through them like a bat out of hell? How small are we, and how significant are we in the grand scheme of things? Will I make it to work on time tomorrow? I digress.

But you're not alone, and you're not the first. A long time ago, since the dawn on humankind, our ancestors did the same thing. Up they looked, wondering the same things – what is all of that stuff up there? They had no telescopes or fancy instruments that gave them even an inkling of the understanding that we now possess. And yet they looked. Sure, from time-to-time they saw things that scared the life out of them, but they continued to look up and over the ages, we grew wiser and gained a much better understanding of the stuff that surrounds us out there in that big, black void.

Anyway, we're putting a hold on a scope purchase for now. We'll continue to look at glossy ads on the internet and in astronomy magazines of black, shiny, electronic telescopes that you are sure will reveal amazing beauty each time you look through its eyepiece. We'll continue to work hard on our parents or loved ones to try and secure funds for that eventual purchase. We may consider using some binoculars we already own or maybe can afford, but more on that a little later. But until then, we're going to examine ways in which you can enjoy the night sky naked eye.

### **The Naked Eye**

You use your eyes every day. For driving, studying, work, reading etc. They are readily available, they don't cost anything to use, and they work relatively well (depending on your age and other factors). In any case, they are a tool that we can use with great effect to examine the night sky.

There is a lot to see with the naked eye. You just need to know what to look for! The first thing you want to try to do is to find somewhere dark and safe to go to at night. Look around for a decent spot, somewhere relatively far from nearby white light but still relatively safe; maybe a nearby park, camp ground or something similar. Take a deck chair or regular folding chair, a jacket and flask of hot coffee or chocolate if it is cold or a few cans of cold drinks if it is balmy and some snacks to keep you going.

Let your eyes acclimate to the dark. A good thing to do is go out around sunset. As the sun sets and the light gives way to dark, your eyes will gradually become more sensitive, making them perfectly ready to view things you otherwise wouldn't be able to take notice of. Another good thing about starting your observing at sunset is that as the brighter stars come out first, you will be able to better pick out constellations as they are typically made out of the brighter stars in the sky anyway.

So, there are a few things you can check out with the naked eye now that you've found a nice safe spot to observe, and that your eyes are relatively adjusted for dark sky seeing. We're going to go over some of them here, and I'll provide links to further information on them so you can explore them in more detail at your leisure.

### **The Constellations**

A lot of folks who are beginners perhaps like you can't pick out too many constellations. Surprisingly, a lot of astronomers that do have fancy-schmancy telescopes can only pick out one or two constellations! They may rely more on their on board computers to tell them where various deep sky objects are, but if their scopes break down they are more often than you think left feeling a little lost.

Learning the constellations is a very important part of the hobby. You don't have to learn every single one, but it is very helpful to know the major constellations. Knowing constellations such as Scorpio, Orion, Andromeda, Cassiopeia, Centaurus, Crux, etc. will really help you give you an edge. It will help you quickly navigate the heavens later on when you want to hunt down comets, star clusters, nebula and the like. It will also help you get an appreciation for the apparent movement of the stars over the course of time. For example, find Ursa Minor, the Little Dipper. Then, find at its tip the star Polaris, or "North Star". This star is located extremely close to the North Celestial Pole, the point at which all stars in the northern hemisphere rotate around. (Or if you're in the Southern Hemisphere, locate the Southern Cross, and use its longer elongation to get you to the Southern Celestial Pole). Now, if you've got the time to spare, give it an hour or two and note the position of the constellations around that particular point in the sky, and you will see their movement. Give it a few more hours (again if you have time) and you'll be rather surprised to see just how much the constellations have moved. It's neat stuff!

So, what you can use to help find the constellations in the first place? Here are some inexpensive tools you can use:

### Star Charts

Like a map of your local neighborhood, or a map of the country or indeed the world, we have maps of the stars. Some are horribly complex that show entire catalogues of objects, while others are relatively straightforward and show the constellations and maybe some of the brighter deep sky objects. The latter is what we're interested in for now.

Some good sources of star maps are:

- a. Astronomy Magazines. Magazines like *Astronomy*, *Sky and Telescope*, and *BBC's Sky at Night* have wonderful center pullouts containing star maps that are easy to use and understand.



Some examples of fine astronomy magazines. All images copyright Astronomy, BBC Sky at Night and Sky and Telescope.

- b. Planispheres. These simple tools are relatively cheap, maybe about US\$10-30 depending on size. They can be used all year round and again show the major constellations and

maybe some deep sky objects. They are also usually made with plastic so are well protected against the elements.



*The popular Philips Planisphere. Copyright Philips.*

### Software

If you have a laptop/notebook and don't mind setting it up outside, you can download some terrific software programs that have excellent star map applications to varying degrees of complexity. Simply enter your location, date and time, set your computer to a darker presentation theme (remember, you have to maintain your dark sky vision so try and lower the brightness of your laptop screen AND use a reddish desktop theme to minimize stray light) and use your software to help you navigate the sky. One really nice program I like to use and often recommend is Stellarium (<http://www.stellarium.org>). It presents a real time view of the night sky, portrays actual movement over time, and draws nice mythological pictures for each constellation. The good news – it's FREE!



*Stellarium screenshot, Copyright Stellarium*

Other software programs you might want to consider are:

- Cartes Du Ciel (<http://www.stargazing.net/astropc/index.html>): Perhaps a bit more advanced for the beginner, but this program is freeware and can produce slightly more complex star charts.
- Starfinder (<http://www.geocities.com/freestarfunder/>): Another freeware program, this is a basic star map generator
- Calsky (<http://calsky.com>): Free *online* star map generation
- Heavens-Above (<http://www.heavens-above.com>): Free *online* star map generation

## The Moon

Our nearest neighbor, our own Moon, can often provide us with some lovely naked eye sights. Here are some Moon-based occurrences that are a joy to behold:

- Moon Phases: Watch the Moon night by night and see its phase change throughout the month. On a nightly basis, it's pretty impressive to see just how much it actually does change!
- Occultations: Quite frequently, the Moon grazes various other celestial objects because of its different rate of movement in comparison to other objects in the sky. It can often seem to graze the planets and even brighter deep sky objects like the larger star clusters of the Beehive Cluster and the Pleiades.



*The Moon occults Venus and Jupiter, December 2008 as captured by the author*

- Around the New Moon: See if you can see the early or late crescent Moon around the time of the new Moon. Quite a few astronomers have taken to finding the thinnest crescent possible as a bit of a challenge. Good fun!
- Moon Rise and Moon Set: These can be spectacular sometimes. Often, the Moon looks absolutely massive near the horizon. Many folks think this is just an optical illusion. Nevertheless, an impressive thing to keep an eye out for!

## The Planets

Yes, even though our solar system neighbors are further away from us than the Moon, some of them still make for very nice naked eye viewing! The planets, or “wanderers” as the Greeks defined them, make their way across our skies along an invisible line called the “Ecliptic”, and their position changes over time in relation to the stars in the background.

Some really nice naked eye planets to view are:

- Mercury: Sometimes visible shortly after sunset and before sunrise through various times of the year

- Venus: The brightest object in the night sky, next to the Moon of course! Sometimes called the “Morning Star” or “Evening Star”, Venus usually gives astonishing sights to naked eye observers in the early evening and early morning.
- Earth: Just look down!!! ☺
- Mars: The red planet has haunted observers for centuries. From time to time, as Mars’ orbit brings it relatively closer to the Earth, it becomes increasingly bright in the night sky and an amazing sight as a result .
- Jupiter: Not quite as bright as Venus, but close! Another very bright object worth looking at from time to time.
- Saturn: Even the ringed giant can be seen naked eye, presenting a bronze-red color.

Use the internet (<http://www.calsky.com>) or current astronomy magazines to get information about planet rise and set times.

### **Artificial Satellites**

There’s a lot of junk up there! Seriously! NORAD (the North American Aerospace Defense Command) estimates there are approximately 9,800 satellites in orbit, both operational and defunct. That’s a lot of fast moving metal objects! Many of these objects can be seen, and they are best seen with the naked eye. When I’m out under the skies, I often see satellites making their way here and there. It’s quite fun and very unpredictable. It adds to a general feeling of activity and turns a sometimes stagnant sky into something much more interesting.

Here is a sampling of the types of man-made space sprockets you can see:

- International Space Station (ISS): The king of all man-made craft in orbit. When you see this, you’ll know it. If its pass is relatively high above the horizon, it will be a very bright object, almost as bright as Jupiter or Venus on occasion. An excellent target to look for!



*ISS pass, 20 second exposure captured by the author*

- Space Shuttles: Not quite as bright as the ISS, but fun to look at nonetheless. If you live in the USA, see if you can catch a re-entry. They are simply amazing. From my home in Texas, I have seen re-entries as shuttles have landed on Florida, and they leave massive tails behind them that remain in the sky for many minutes after their pass.
- Hubble Space Telescope: The space-based telescope that captures the most awe-inspiring images of the cosmos can also be seen, although not quite as bright as the shuttles but pretty close!
- Various Communications Satellites: Then there are the other several thousand current and disused satellites up there, civil and military. These can be seen throughout the night as smaller star-like objects. Look hard for a fair few of them!
- Iridium Flares: Now these are cool, especially from darker sky sites. This is essentially the occurrence of the sun's light reflecting from the panels of Iridium satellites. Such flares can be quite bright (often annoying astronomers who are imaging) and very neat to observe!

So, how can you see them? Because they are man-made, they are relatively easy to predict. One specific web site is Heavens-Above (<http://www.heavens-above.com>). Go to this web site, enter your location, and it will give you predictions for all objects mentioned above. Going outside and looking for these objects based on the web site's predictions is awfully good fun!

### **Comets**

In the ancient times and perhaps even more recently, comets were considered bad omens, bringers of death. Today, they are wonderful sights to behold if they become bright enough to view with the naked eye. While comet paths are somewhat easily predicted by advanced astronomers and amateur comet hunters alike, sometimes their brightness levels take us all by surprise. In recent history, as was the case with Comet Holmes in October, 2007, some comets brighten beyond expectations and present beautiful if haunting sights for us all to observe.

Keep your eyes peeled on various astronomy web sites for comet news. You never know when one might pop up!

### **Meteors**

Try looking at these fast moving hunks of rock through a telescope – I dare you!

As the Earth moves through the path of a comet's course around the sun, the debris left by the comet is pulled towards the Earth by its gravity. The larger chunks of debris burn up in our atmosphere and fall through the sky, sometimes in dull, short courses across the sky, and sometimes in magnificent fireballs that warrant a loud "WOW" from their observers!

Meteor "showers" are also relatively easy for astronomers to predict because they know the orbit of the Earth and the relative orbits of comets. The heavier showers (i.e. meteor showers with more frequent meteor occurrences) are given names based upon the constellation from which they appear to originate from. For example, typically in August, one of the more fantastic meteor showers are called the

“Perseids” because they appear to emanate from the constellation “Perseus” (Remember, learn your constellations!!). The table below gives you a high level annual view of meteor show activity, although you might be able to see meteors of varying brightness throughout the year.

Month	Meteor Shower Name
January	Quadrantids
August	Perseids
October	Orionids
November	Leonids
December	Geminids

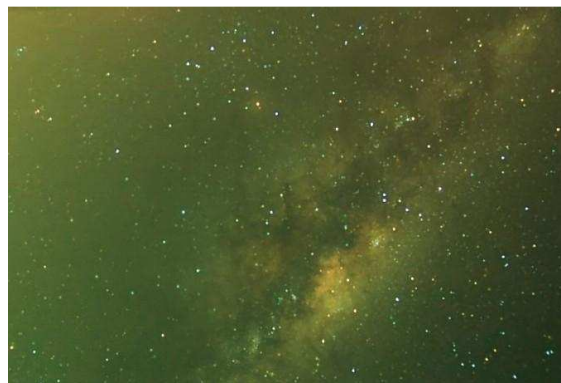
One thing to take into consideration when planning to observe meteor showers is the phase of the Moon. If it's a really bright Moon, then the Moonlight will typically wash away many meteor occurrences. Consider keeping an eye on Moon phase charts available online or astronomy websites for updates and more detailed predictions of meteor shower activity.

### **The Milky Way**

Our Solar System is part of a massive, complex group of stars and matter known as a galaxy. Our galaxy has a name, and it's called the Milky Way. I like this name because it reminds me of my favorite chocolate bar. My kids like it for the same reason!

Depending on where you observe from, the Milky Way can make for a wonderful naked eye sight. The further away from city lights you are, the more prominent it will be. Folks very close to cities will barely be able to see it, if all. Those blessed to be living far from big cities, or those lucky enough to be able to drive far away to safe, dark sky sites are able to see the Milky Way in all its glory. If it's really dark, you should be able to see the main arm of the Milky Way in which we reside, as well as some darker regions.

If you can and are able, look around the region of Scorpio's tail and Sagittarius (Yep, learn your constellations!!!) . It is here that the center of the Milky Way galaxy can be seen. In really dark skies, this is an amazing thing to behold!



*The Milky Way central region, as taken by the author*

## Using Binoculars

Between using your naked eyes and short of buying a telescope, using binoculars is a great way to get just that little bit closer to the heavens without breaking the bank.

Binoculars are good to use for a number of reasons:

- a. They are light weight and very easy to transport
- b. They are pretty cheap compared to telescopes (you may already have a pair lying around!)
- c. They can be dual-use! If you want to buy a pair but those who control the purse strings need convincing, binoculars can also be used for:
  - Bird watching
  - Spying on the neighbors
  - Spying on the children

The latter two excuses might be good with the significant other ;-)

Binoculars vary in magnification and field of view. Typically, binocular specifications will be denoted by a magnification and lens diameter. So, a pair of 7\*50 binoculars denotes 7X magnification with 50mm lenses.



*The author's trusty 10\*50s*

I think that you can't go wrong with either a pair of 7\*50 or 10\* 50 binoculars. The latter will give you just a bit more punch, but either will work just fine for astronomical use. There are other, bigger binoculars out there, but they start to become cumbersome. You want to be able to hold them to your eyes, pointed at the sky, for long periods of time without making your arms tired.

You can use binoculars on all of the objects listed in this article. They are fantastic on the Moon (especially if you mount them onto a tripod) and work well with the planets (although you won't see much detail). One area in which they really excel is in scanning the Milky Way. They will reveal marvelous detail, including swathes of stars, hints of faint nebulosity and maybe a galaxy or two (like the Andromeda Galaxy).

Binoculars will reveal many nifty sites and serve as a good step up before considering purchasing a telescope. We will discuss the selection of a telescope in another article, but before splurging all of that hard earned cash on one, please consider getting some binoculars to fulfill your immediate curiosity beyond using your naked eyes. As discussed earlier, they are a dual use technology (!) and will also serve you well later in your astronomical exploits when and if you do decide to purchase a telescope. They are a great aid, and personally speaking I still use them frequently despite owning four telescopes!

### **Using Other Folks' Scopes**

Another way you can get around not having a telescope of your own but wanting to enjoy the night sky is to use someone else's! Seriously! There are opportunities for you to be able to get close-up views of the skies without buying your own telescope, at least for a while.

Okay, I am not talking about stealing one, obviously. (You would actually be surprised, however, at the amount of scopes that do get stolen from time to time). There are ways to gain access to telescopes that will both quench your thirst for some neat, close-up views and also enable you to make a sound decision as to what sort of telescope you want to buy when you reach that stage.

Here are some ways for you to do this AND stay out of jail...

### Star Parties

No, we're not talking about sipping martinis with Russell Crowe, Steven Spielberg and Demi Moore! (Although that might be fun!) Every so often, and perhaps more frequently than you think, groups of local astronomers get together, informally or formally, with their respective telescopes and essentially have a joint observing session. They may all be looking at the same things (especially when there is an event of some kind going on) or may be looking at different things, running down their own observing lists. For the most part, though, they have assembled because of their shared passion for the hobby, and for their desire to share their passion with the general public.



*Star parties will let you get up close and personal to many different types of scopes.*

There is typically a set of rules that go along with attending star parties, collectively often called "Star Party Etiquette". Some are common sense; others might be new to you:

- No white lights, use red flashlights
- Don't drive right up to the group of astronomers with your car headlights on!
- If you have kids (or are a kid!) don't run around the star party site. A lot of very expensive gear will be out there and you don't want to be responsible for making some of it topple to the ground!
- Always ASK before looking through a telescope. Make sure the scope owner has the scope ready for viewing and is not still setting it up or starting a photo-taking session. The easiest, diplomatic way to see if you can take a look through someone else's scope is to say "Hi there! What are you looking at"? These simple words will usually get you in the front door in the best way possible, and may even strike up a long-term friendship!
- Don't turn up with a loud stereo system blaring out music (portable or vehicle-based) Astronomy is best enjoyed in the quiet, and you shouldn't broadcast your musical interests to others in a loud fashion in public.

As these star parties you'll come across all sorts of equipment types, from small refractors through to motorized monster reflectors. They will give you an excellent opportunity to examine both the night sky and the myriad choices of scopes you will later to get choose from!

To find star party events, look online for your local astronomy club. Find out where they meet and how often. Even attend a regular meeting or two when they don't meet under the stars but rather in a formal meeting session to get an idea of what they are planning and how you can maybe get involved.

#### Find an Astro Buddy

You could find this person at a star party or by other means. There are a lot of amateur astronomers out there. Most of them are more than willing to share their enthusiasm for the hobby. Strike up some astronomical conversation with your friends, and you might come across someone who's really into it, or maybe just starting out like yourself. Tag along with them if they have a scope, ask lots of questions, offer them gas money or beer or chocolates in return for a joint scope session under the stars. Having a good mate to share the hobby with does help, even when you're just starting out. The excitement for astronomy is contagious...

#### Find a Local Observatory

A lot of local colleges typically have their own observatories. There might also be an observatory facility somewhere near your town or city. Typically these observatories will have public viewing nights as part of their public outreach program. Because, typically, their instruments will be rather large, even observatories located in an urban setting will provide some pretty neat views of space objects. Again, look around on the Internet for "observatories + your city or province/state name and see what comes up...

#### **Going Virtual**

Of course, if you're really super keen, don't have access to clear, dark skies or perhaps just have difficulties getting out there, you can now explore the skies virtually. There are a couple of interesting programs out there despite the star map programs I have mentioned that can take you for a computer-based tour of the heavens and still be able to teach the basic locations of things. I have to admit that

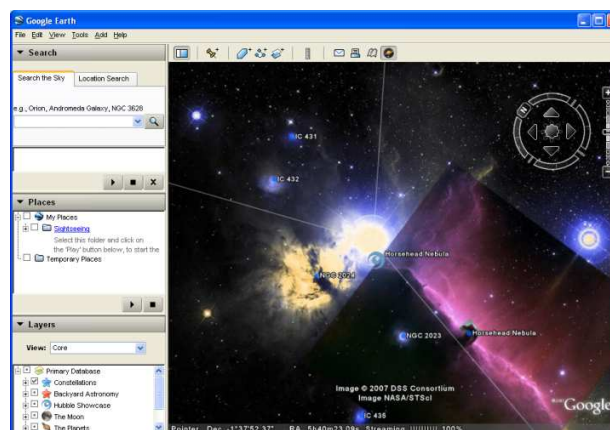
after a long bout of cloudy skies, I find myself resorting to using the two tools listed below just to handle my appetite for stellar fun. By the way, both are FREE!

- Microsoft's World Wide Telescope: This software allows you to tour the night sky using imagery and data gathered from the world's leading Earth-based and space-based telescopes. You can hang back and get a basic planetarium view, or zoom right in for close-ups of objects taken by the likes of Hubble. There are some views available which might not be too easy to understand, like the cosmic background radiation view, so try and keep it simply and use the visual views only. This software also contains tours of different catalogues and such, so it's really good fun. (<http://www.worldwidetelescope.org/Home.aspx>)



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- Google Sky: Not quite as advanced as the World Wide Telescope, but quite good fun! It also includes interesting views of the Moon and Mars. Again, a very satisfying way to sit down in the comfort of your home and enjoy the night sky in a virtual sense. (<http://www.google.com/sky/>)



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Both of these get updated fairly regularly with new add-ons and widgets to keep visiting their web sites!

Don't forget, Stellarium (<http://www.stellarium.com>) is still a very good program to use and doesn't require a net connection (unlike the two mentioned above). So definitely get a copy of that and use it if a net connection isn't available and the urge to explore the night sky takes you.

### **In Summary**

Robert Burnham, the brilliant astronomer who published several works on observing, said in his first volume of his well-respected *Burnham's Celestial Handbook* that astronomy is perhaps the greatest of sciences because unlike archeology, for example, we get to see the subjects of our study first hand, in all their glory. Using our naked eyes and, yes, binoculars, enables us to enjoy the myriad of wonderful objects, both natural and man-made, that rise, set and move above us every day.

Yes, telescopes are great fun and the ultimate way to get up close and personal to so many objects in the night sky. However, so much can be enjoyed without a telescope. Get your appetite wet by pursuing the various little projects and ideas outlined in this article, and then see if you're still really interested in the hobby and want to proceed to the next step. Learn to understand and enjoy what is up there without a telescope, and it will make you that much more appreciative (let alone knowledgeable!) of the heavens when you do decide to progress to the next step.

Clear Skies!!!!

*Phil*