

Welcome to Rappahannock Astronomy Club Star Party

About RAC: F'burg area, 30 members, monthly meeting, star parties, outreach, scout clinics, school lectures, web site **RAClub.org**, Yahoo group **rac_group** needs admin add

Rules: ① Light pollution & Laser safety ② No Smoking or Bug Sprays or aerosols
③ Careful in the Dark ④ Time for Scope Alignment
⑤ No White Lights or Flash Photos ⑥ Don't Grab Eyepiece!

Calibrating Expectations

We're Here to Observe! We may answer a few questions, but we're not going to talk about Black Holes, Pulsars, Quasars, Dark Matter, etc. We're observers tonight, and we hope you'll agree with us that seeing the night sky with your own eyes is exciting.

What We Can & Can't See compared to Hubble Space Telescope & 400 inch telescopes on mountain top observatories in hour long exposure photos.

Why Can't We See Color in our scopes? Cones see color (fovea only), rods don't (night vision). Small scopes don't gather enough light to stimulate the cones.

People ask questions: How Big or How Far Away! Hundreds of objects are visible in our telescopes. Needless to say, we don't know the answer for every object out there!

Getting Started in Astronomy

No Shortcuts: ① Learn Bright Stars & Constellations (Planisphere, SkyMaps.com, Red Flashlight) ② Binoculars, Star Charts & List of Objects ③ Buy a Telescope ④ Join Club

Types of Telescopes: Refractor, Reflector, Catadioptric

Mount Types: Alt-Azimuth & Equatorial; Manual & Driven; Digital Readout & Go-To

Telescope Functions: Magnification; Light Gathering; Resolution (Bigger is better!)

The Fun Stuff

Objects: Moon, Planets & Occasional Comets; Double & Multiple Stars;
Open Star Clusters; Globular Star Clusters; Diffuse Nebulae,
Planetary Nebulae; Supernova Remnants; Galaxies

Welcome to Rappahannock Astronomy Club Star Party

About RAC

Located in Fredericksburg Area with about 30 members
Web site raclub.org; Yahoo rac_group requires administrative add
Monthly meetings at CRRL HQ Branch, Caroline St.; one hour program, one hour business meeting
Star parties, mostly at Caledon, backup each month, outreach events by request
Light pollution and laser safety

Rules of the road

- ① **Light pollution and laser safety**
- ② No smoking or use of any type of aerosol sprays including bug spray or hair spray
- ③ Watch your step in the dark & no running; keep track of kids; don't want anyone to get hurt
- ④ Many of our scopes are computer controlled and require a period of calibration before use
- ⑤ No white lights because it takes about 30 minutes to restore night vision
- ⑥ Don't grab the eyepiece when you're at the telescope; natural tendency but disturbs alignment

Can and Can't See

We always need to help audiences understand what they will and won't see at a star party.
People see photos from Hubble or 400 inch scopes on mountains, high above the atmosphere.
Furthermore images are often the result of hour-long time exposures.
There's a natural tendency to expect to see similar things at a star party, which is impossible!

Why no Colors?

The first question some will ask is "What's wrong with your telescope? I can't see any colors."
The answer to that question is simple. Our eyes have two types of vision cells, rods and cones.
Cones see bright light and color, only in the fovea; and rods help us see in the dark, but are color blind.
Small amateur telescopes simply don't gather enough light to stimulate the cone cells in your eye.

How Big, How Far

Another question visitor often ask is, "How big is that object?" or "How far away is it?"
Well, as it turns out, there are hundred objects within reach of instruments like ours.
Furthermore we're not professional astronomers, so it should come as no surprise that most of us
don't spend our spare time memorizing facts and figures for those hundreds of objects.

Observing, not Science

As amateur astronomers, we're here to observe night time beauty, not to do science.
We can't see pulsars, quasars, neutron stars or black holes. Nor do we give lectures on such subjects.
We can't explain relativity, quantum theory, the Large Hadron Collider or the Higgs Boson.
What we can do is show you the night sky with your own eyes, which has a charm of it's own.

OK with the preliminaries out of the way, let's talk about how one goes about getting started in astronomy, then we'll talk a little about the telescopes we use, and finally we'll talk about the types of objects we'll be looking at tonight.

To Get Started

No substitute for learning the night sky. That means learning the bright stars and the constellations.

You need a few simple seasonal star charts, which you can print out online, and a red flashlight. After that, a pair of binoculars and a list of deep sky objects such as might be listed in Sky & Telescope. From there, we encourage you to visit an astronomy club and just come out and participate.

Types of Telescopes

Now, let's talk just a little about the telescopes we'll be using.

We won't spend much time on this, but I mention it in case anyone is considering a purchase.

There are three basic types, with many variations.

The oldest type uses a lens to collect light and is called a refractor.

That's what Galileo used to discover the moons of Jupiter 400 years ago.

Today, refractors are usually the most expensive type of telescope.

The next type uses a mirror to collect light, and they are called reflectors.

They are the most economical type of scope, and all the major observatories use reflectors.

This makes them a best buy for people wanting to get into amateur astronomy.

There's a low cost method of mounting reflectors called the Dobsonian mount.

The third type of telescope uses both a mirror and a lens.

They go by the fancy name of catadioptric telescopes.

They come in many flavors, the most popular of which is called the Schmidt-Cassagrain.

Their big selling point is that the light path is folded so that they can have very short physical tubes,.

Functions of a Telescope

The common misconception about telescopes is that their most important function is magnification.

This is false. The most important function is light gathering power and next to that is resolving power.

Both of these are directly related to the size of the lens or mirror, which is why bigger is better!

A stable mounting is also important because at high power any instability will case the image to jitter.

There are two types, alt-az and equatorial, undriven and driven, digital readouts & computer go to.

Types of Objects

Moon and Planets

The Moon is always good in any size scope, and show well even with lights in the area.

With small telescopes, we can see Jupiter and Saturn fairly well any time they are above the horizon.

Mars is more difficult, and detail is visible, if at all, only at closest approach, every couple of years.

Venus makes a nice crescent at sunset sometimes but no detail can be seen.

Uranus and Neptune barely reveal a disk, so they aren't much to look at.

Deep Sky Objects

Double Stars

What we most like to show to visitors are what we call Deep Sky Objects.

These are things that are outside our solar system, and they represent a wide variety of objects.

One of the most common is double and multiple stars; that is, stars that orbit around each other.

Often, they are different colors, and they can make an attractive setting, kind of like a pair of jewels.

Open Clusters

There are several interesting types of objects within our galaxy to look at.

The most common are star clusters, which come in two types, open clusters and globular clusters. Open clusters are loose aggregations of stars that are gravitationally bound together. Open clusters originated from the same molecular gas and dust cloud. Over time, they will eventually disperse as they orbit the galaxy center.

Globular Clusters

The second type is the globular cluster, which is a tightly bound ball of up to a million or more stars. Globular clusters formed a “halo” around our galaxy in the early stages of galaxy formation. They are so dense that they are one of the most awe-inspiring sights we see in amateur telescopes.

Diffuse Nebulae

Open clusters formed from another type of object, gas and dust clouds called nebulae. We see nebulae either because they are lit by reflected light or because stars that have ignited within them are exciting molecules of the nebula and causing them to reradiate energy. Nebulae can also be dark, and we only know they are there because they obscure stars beyond.

Planetary Nebulae

There is another category that can be quite interesting, although the name is misleading. They are called planetary nebulae, but they have nothing to do with planets. Planetary nebulae represent the end stage of the life cycle of stars about the same size as our Sun. As stars of that size age, they burn up their hydrogen, gravity causes their outer layers to collapse. This squeezing, in turn, causes a helium burning phase to start up, which is hotter. This in turn causes the outer layers of the star to expand, turning the star into a red giant. (By the way, about 5 billion years from now, Earth will be incinerated by this process!) During this phase, the star expels its outer layers of gas as a shell that can be seen from distant space. To early astronomers, this shell looked vaguely like a planet, hence the name, planetary nebula.

Supernova Remnant

The last type of object in our galaxy we’ll mention is the supernova remnant. There aren’t many of these that we can see, but there are a few, and some of them are quite beautiful. Supernovae, as you know, are what happens when truly massive stars reach the end of their life cycles. Unlike our Sun, which isn’t heavy enough to burn carbon, massive stars can burn everything up to iron. Once they reach a certain point, they collapse because of their gravity and then in a final blast everything left that will fuse does so all at once, blowing the star apart in a titanic explosion. The supernova remnant is the expanding shell of wreckage that is left over after the explosion!

Galaxies

The last objects we look at are galaxies, which are island universes just like our own Milky Way. There are billions of them, but even the few we can see are very far away and thus are very faint. We call them “faint fuzzies,” and it takes a huge scope to see them as other than a faint blob. With our scopes, we never see the kind of detail that seen in Hubble or observatory photographs.

Well, that’s it. Welcome to the star party. Thank you for joining us, and we hope you enjoy you stay!

Welcome to Rappahannock Astronomy Club Star Party

About RAC

We are located in Fredericksburg Area and we have about 30 members at any one time. We hold monthly meetings at CRRL, HQ Branch on Caroline St. The meeting consists of a one hour program followed by a one hour business meeting. We schedule a star party each month, mostly at Caledon, with a backup the following weekend. We do outreach events by request for schools, scout groups and local and state parks and other public organizations. We have a web site at www.raclub.org and a Yahoo group called **rac_group**. To join the Yahoo group, one must make a request to the group administrator, who will then add you to the group. The procedure for this is explained on our web site and on the Yahoo group itself. Incidentally, you must also have a Yahoo account to join the Yahoo group.

Finally, a few words about a couple very important subjects. The first is light pollution. Our skies are becoming increasingly bright at night due to our increasing population and our tendency to light up everything in our environment with as much light as possible. The consequence is that not only is the beauty of the night sky that you will see tonight threatened, but that unnecessary energy is consumed and also the migration and breeding cycles of many wildlife species is disrupted. So, we urge each of you to be conscious of light pollution as a conservation issue just as you would any other question impacting our quality of life.

The second point is laser safety. These days, many people use green lasers at star parties to point out stars and constellations to visitors. Green lasers project a highly collimated beam into the night sky, and everyone in the near vicinity of the speaker can see what is being pointed out. However, lasers are inherently dangerous, even at several thousand feet of altitude, and even to pilots in cockpits in airliners high up in the atmosphere. Pilots have reported being momentarily blinded by ground-based lasers. In fact, it is illegal to point a laser at an airplane for just that reason. So, rest assured that if anyone points a laser at an airplane, either by accident or deliberately, someone with a badge will come looking for them. And we don't want that to happen. So, look before you point, please!

Rules of the Road

At star parties, we do have a few rules of the road. They are first and foremost intended to insure the safety of our visitors and secondly to insure the safety of some very expensive equipment, some of which can run into the thousands of dollars. Finally, they are designed to insure that everyone has a fun night of observing!

The first rule I always mention in the summer is **① no smoking or using any type of aerosol sprays including bug spray or hair spray** anywhere near the telescopes. Bug sprays especially can instantly damage optics irreversibly. If you need to protect yourself from mosquitoes, either use wipes or lotion or retire a great distance from the telescope field to use your spray – and I do mean a GREAT distance!! Second, **② watch your step in the dark and no running**; keep track of your kids. We don't want anyone to get hurt. Third, **③ be patient with us as we set up our equipment**. Many of our scopes are computer controlled and require a period of alignment and calibration before use. It takes us a lot of time and concentration, so if we seem distracted, it's probably because we are! Next, please, **④ do not use white lights in the dark** because they ruin night vision almost instantly and it takes about 30 minutes to restore it again. Of course that applies to flash photography as well. Finally, when your turn comes to look through the telescope, **⑤ don't grab the eyepiece**. There's a natural tendency to do that, especially in the dark, but in doing so you will disturb the

alignment of the telescope, or even damage the mechanical components of the mount. Remember, alignment is the phase that took us so long earlier, and we sure wouldn't want to have go back and start all over again!

What We Can and Can't See

We always need to help audiences understand up front what they will and won't see at a star party. People these days are used to seeing photographs from a NASA space probe or the Hubble Space Telescope or one of the many 3 and 400 inch telescopes such as Keck on Mona Kea and other massive mountaintop observatories, high above the atmosphere. Furthermore those telescope images are often the result of hour-long time exposures. There's a natural tendency to expect to see something similar at a star party.

Why Can't I See Colors?

In reality, of course, that's impossible, and if people don't understand that up front a few tend to be disappointed. The first question some will ask is "What's wrong with your telescope? I can't see any colors." The answer to that question is a simple matter of biology and physics. Our eyes have two types of vision cells, rods and cones. Cones see bright light and color and are centered in the fovea. Rods help us see in the dark, but are color blind. Small telescopes such as you see on the field simply do not gather enough light to stimulate the eye's cone cells.

Star Parties are Not Science Lectures (They are Observing Sessions!)

In the same vein, we can't see pulsars, quasars, neutron stars, black holes, and we can't see out to the edge of the universe. Nor are we qualified to talk in any scientific depth about such subjects. We can't explain relativity, quantum theory, the Large Hadron Collider or the Higgs Boson. But what we can do is show you the night sky in real time with your own eyes, which we think has a charm all of its own.

There are Hundreds of Objects Out There (And No, We Don't Know How Far Away Each One Is!)

Another point that often comes up involves questions about the objects we show to visitors. There's a natural temptation for a visitor to ask, "How big is that?" or "How far away is that?" But, as it turns out, there are hundred objects within reach of instruments like ours. Furthermore, all of us are amateurs, not professional astronomers, so we're here to observe and to share those views with you. So, when people ask those natural questions, it should come as no surprise that most of us don't have all the facts and figures for those hundreds of object memorized and at our fingertips. Homework for the reader: write down the catalog number and look it up when you get home!

Now, Let's Actually Talk About the Star Party!

First, let's talk about how one goes about getting started in astronomy, then we'll talk a little about the telescopes we use, and finally we'll talk about the types of objects we'll be looking at.

How to Get Started Observing the Night Sky

To get started in amateur observational astronomy, there simply is no substitute for learning the night sky. That means learning the bright stars and the constellations. You need a few simple seasonal star charts, which you can print out online, and a red flashlight. After that, a pair of binoculars and a short list of the brighter

deep sky objects such as might be listed at the Sky & Telescope web site is the next step. From there, we encourage you to get involved with an astronomy club and just come out and participate.

Types of Telescopes

Now, let's talk just a little about the telescopes we'll be using. We won't spend much time on this, but I mention it in case anyone is considering a purchase. There are three basic types, with many variations. The oldest type uses a lens to collect light and is called a refractor. That's what Galileo used to discover the moons of Jupiter 400 years ago. Today, refractors are usually the most expensive type of telescope.

The next type uses a mirror to collect light, and they are called reflectors. They are the most economical type of scope, and just about all the major observatories in the world use reflectors. This makes them a best buy for people wanting to get into amateur astronomy, and there's a method of mounting reflectors called the Dobsonian mount that is really low cost that is especially popular as well.

The third type of telescope uses both a mirror and a lens, and they go by the fancy name of catadioptric telescopes. They come in many flavors, the most popular of which is called the Schmidt-Cassagrain. Their big selling point is that the light path is folded so that they can have very short physical tubes, which makes them easy to handle.

Functions of a Telescope

So what exactly does a telescope do? Well, most people think a telescope brings distant objects close. And they're right, of course. Except that, for most people, that's where it ends. But, in reality, that's not even the most important function of a telescope. If it was, we could just as well use these telescopes here on the field tonight to much of the science of astronomy. But, of course, we can't, because telescopes have other functions, and the most important is to gather light — lots and lots of light. The bigger the telescope the more light it gathers. And the more light it gathers the farther out in space and time it can see. And that is why scientists build enormous telescopes on mountaintops and in space — because they want to gather as much light as possible. The other important function of a telescope is resolution — the ability to discern fine detail. And there once again, the size of the mirror or lens determines the resolving power of the telescope. So you see, when it comes to telescopes, we astronomers are all subject to an affliction we call aperture fever!

What Can We See In the Night Sky?

Types of Objects

Moon and Planets

Finally, after that preamble, let's get to the fun stuff. We'll be looking at several types of objects in the sky tonight. Of course, there's always the Moon and the planets. With any telescope, the Moon is always our best target. The mountains, valleys and craters are always changing from night to night as the Sun's shadow line, the so called terminator, marches across the face of the moon. For our outreach star parties, it is our best target.

With small telescopes, we can see Jupiter and Saturn fairly well any time they are above the horizon. Mars is more difficult, and detail is visible, if at all, only at closest approach, which rolls around every couple of years.

Venus displays a nice crescent at sunset sometimes but no detail can be seen. Uranus and Neptune barely reveal a disk, so they aren't much to look at.

Deep Sky Objects

Double Stars

What we most like to show to visitors are what we call Deep Sky Objects. These are things that are outside our solar system, and they represent a wide variety of celestial objects. One of the most common is double and multiple stars; that is, stars that orbit around each other. Often, they are different colors, and they can make an attractive setting, kind of like a pair of jewels.

Open Clusters

There are several interesting types of objects within our galaxy to look at. The most common are star clusters, which come in two types, open clusters and globular clusters. Open clusters are loose aggregations of stars that are gravitationally bound together and that originated from the same molecular gas and dust cloud. Over time, they will eventually disperse as they orbit the galaxy center.

Globular Clusters

The second type is the globular cluster, which is a tightly bound ball of up to a million or more stars. These are among the oldest object in the universe, having formed on the outskirts of galaxies in the early stages of galaxy formation. In essence, globular clusters form a "halo" around our galaxy. They are so dense with stars that they are one of the most awe-inspiring sights we see in amateur telescopes.

Diffuse Nebulae

I mentioned that open clusters form from gas and dust clouds. These clouds are called nebulae, and that is another type of object we look for. We see nebulae either because they are lit by reflected light or because stars that have ignited within the cloud are exciting molecules and causing them to reradiate energy. Nebulae can also be dark, and we only know they are there because they obscure light from stars beyond.

Planetary Nebulae

There is another category that can be quite interesting, although the name is misleading. They are called planetary nebulae, but they have nothing to do with planets. Planetary nebulae represent the end stage of the life cycle of stars about the same size as our Sun. As stars of that size age, they burn up their hydrogen, after which they can no longer prevent gravity from causing their outer layers from collapsing. This squeezing, in turn, causes a helium burning phase to start up, which produces carbon. This process is hotter, which causes the outer layers of the star to expand, turning the star into a red giant. (By the way, in case you haven't guessed, about 5 billion years from now, Earth will be incinerated by this process!) During this phase, the star become mildly unstable, and starts expelling its outer layers of gas as a spherical shell that can be seen from distant space. To early astronomers, this spherical shell looked vaguely like a planet, hence the name, planetary nebula.

Supernova Remnant

The last type of object in our galaxy we'll mention is the supernova remnant. There aren't many of these that we can see with our telescopes, but there are a few, and some of them are quite beautiful. Supernovae, as you know, are what happens when truly massive stars reach the end of their life cycles. Unlike our Sun, which isn't heavy enough to burn carbon, really massive stars can burn everything right up to iron. Once they reach a certain point, they collapse because of their gravity and then in a final blast everything left that will fuse does so all at once, blowing the star apart in a titanic explosion.

Galaxies

The last objects we look at are galaxies, which are island universes just like our own Milky Way. There are billions of them out there, but even the few we can see with our telescopes are very far away and thus are very faint. We call them "faint fuzzies," and it really does take quite a large telescope to see anything other than a fuzzy blob for most of them. One never sees detail other than in Hubble or observatory photographs.

Well, that's it. Welcome to the star party. Thank you for joining us, and we hope you enjoy your stay!