Sky WAAtch

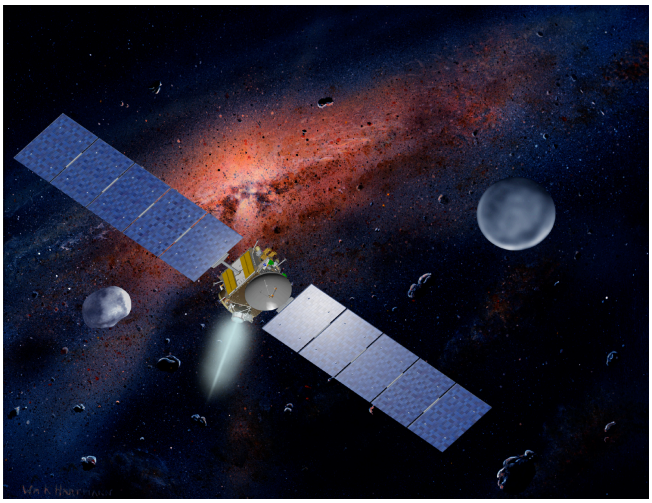
Enterprise Turning Over the Tappan Zee Bridge

David Parmet took this photo of the space shuttle Enterprise on April 27th as it toured the metropolitan area on the back of a Boeing 747. David used a Nikon d80, (70 - 300 mm zoom, 100ASA). The tour was part of Enterprise's sojourn to her eventual home, the Intrepid Sea, Air & Space Museum. The Shuttle landed at JFK airport; it will be barged to the Museum's Hudson river location and should be ready for public exhibition by mid-July.

Named after the starship from the sci-fi series *Star Trek*, the Enterprise was the first of the space shuttles to be commissioned. Enterprise spent its service life as a test vehicle for the examination of shuttle characteristics within the atmosphere. It never made a spaceflight.

Events for May 2012

WAA Lectures



"The Dawn Mission to Asteroid Vesta"
Friday May 4th, 7:30pm
Miller Lecture Hall, Pace University
Pleasantville, NY

David High, Ph.D. will speak on the NASA/JPL Dawn Mission, which seeks to delve into the mysteries of the early solar system by investigating primordial objects like asteroids. Dr. High is a NASA/JPL Solar System Ambassador. Free and open to the public. Directions and Map.

Upcoming Lectures
Miller Lecture Hall, Pace University
Pleasantville, NY

On June 1st, Duane Lee, a doctoral candidate at Columbia University will speak on Tracking the Evolution of Galaxies through Chemistry. Free and open to the public.

Starway to Heaven

Saturday May 12th, 7:30pm
Meadow Picnic Area, Ward Pound Ridge Reservation, Cross River

This is our scheduled Starway to Heaven observing date for May, weather permitting. Free and open to the public. The scheduled rain/cloud date is May 19th. Participants and guests should read and abide by our General Observing Guidelines and Disclaimer. Directions

New Members. . .

Craig and Aaron - Glendale
Amy Saland Nodiff - Scarsdale
John & Maryann Fusco - Yonkers
Pierre-Yves Sonke - Tarrytown
Christopher Freeburn - Yonkers
Barbara Matthews - Hancock-Greenwich

Renewing Members. . .

Frank Jones - New Rochelle
Gary Miller - Pleasantville
Arumugam Manoharan - Yonkers
James Cobb - Tarrytown
Alex Meleney - Greenwich
Everett Dickson - White Plains
Joseph Depietro- Mamaroneck
Walter Castro - Mt. Kisco
Carl Lydon & Traci Aronson -Stamford

Call: 1-877-456-5778 (toll free) for announcements, weather cancellations, or questions. Also, don't forget to periodically visit the WAA website.

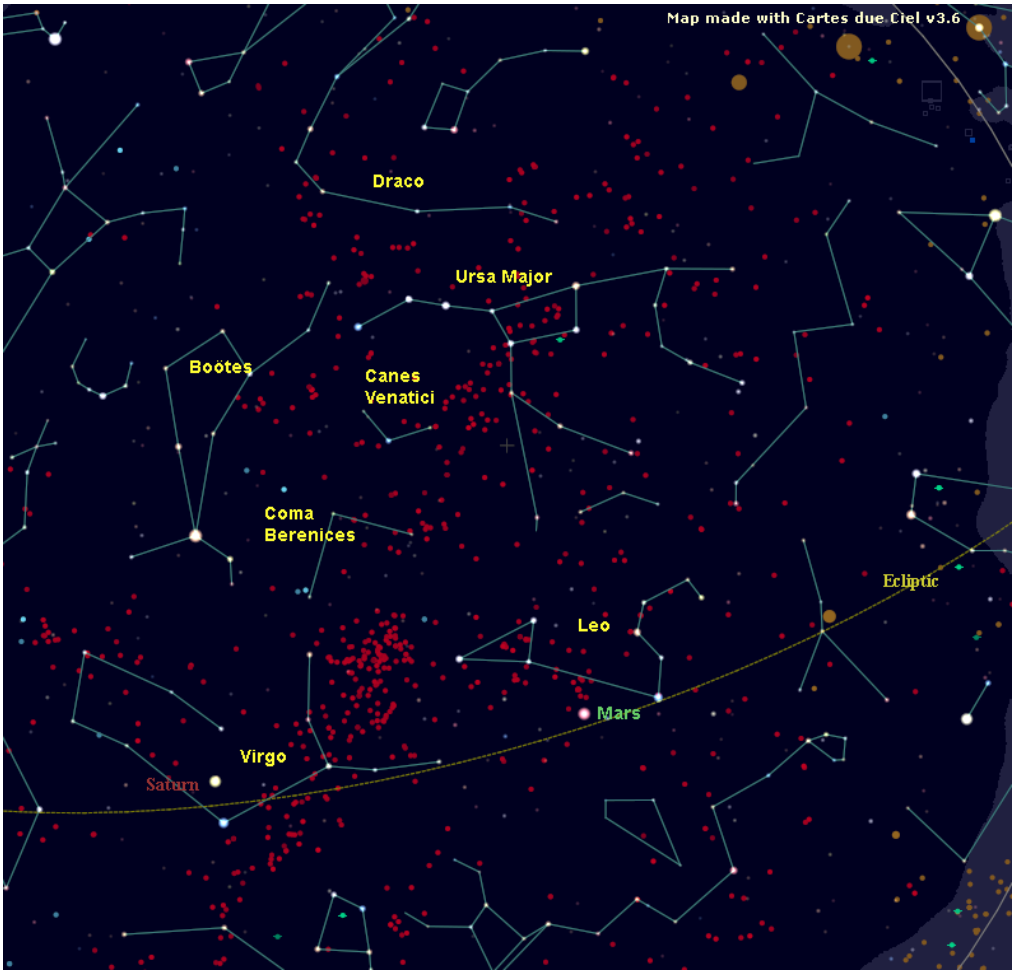
WAA APPAREL

Charlie Gibson will be bringing WAA apparel for sale to the May meeting. Items include:

- **Caps, $10** (navy and khaki)
- **Short Sleeve Polos, $12** (navy).

Articles and Photos

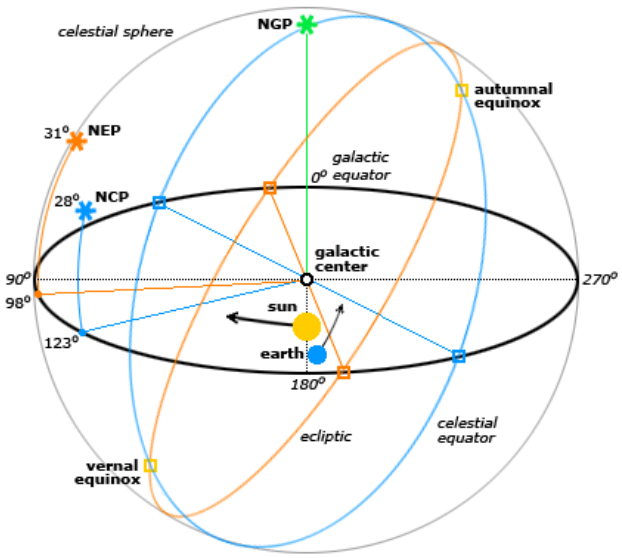
Galaxies of Spring
by Larry Faltz



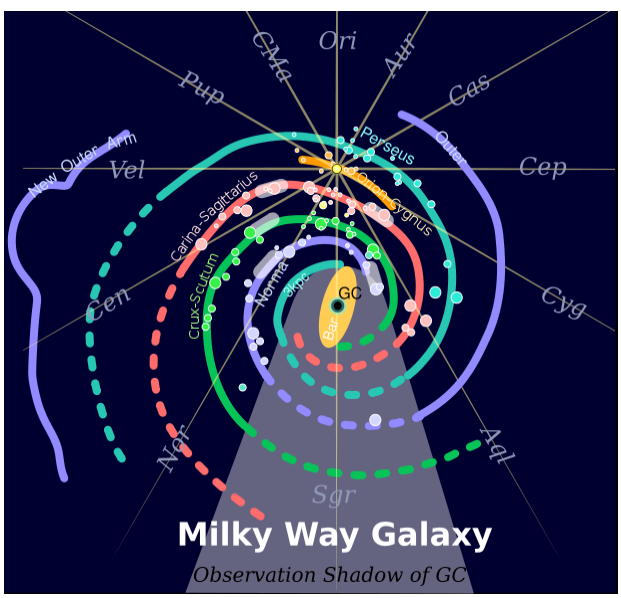
Brighter spring galaxies are shown in red on this map centered just west of the meridian for May 15th at 9 pm. Canes Venatici will be at the zenith at that time.

The sun is an ordinary type G star situated just above the plane of the Milky Way galaxy some 27,000 light years from the galaxy's center, about halfway to its edge. It is on the inner aspect of a band of stars known as the Orion Arm (or Spur). It rotates around the Milky Way once every 250 million years. The solar system, however, is not oriented in the plane of the galaxy, but is tilted at an angle of about 60 degrees. This fortuitous angulation allows us to view neighboring galaxies well on clear spring and fall nights, when we don't have to look through as many neighboring stars and dust to see beyond the Milky Way. In the fall, our view is dominated by two galaxies in the Local Group, M31 in Andromeda and M33 in Triangulum. But in the spring, we look beyond the Local Group to clusters of galaxies in Virgo, Coma Berenices, Canes Venatici, Ursa Major and Draco. These make up the Virgo Supercluster, of which the Local Group is a minor member. This collection of over 100

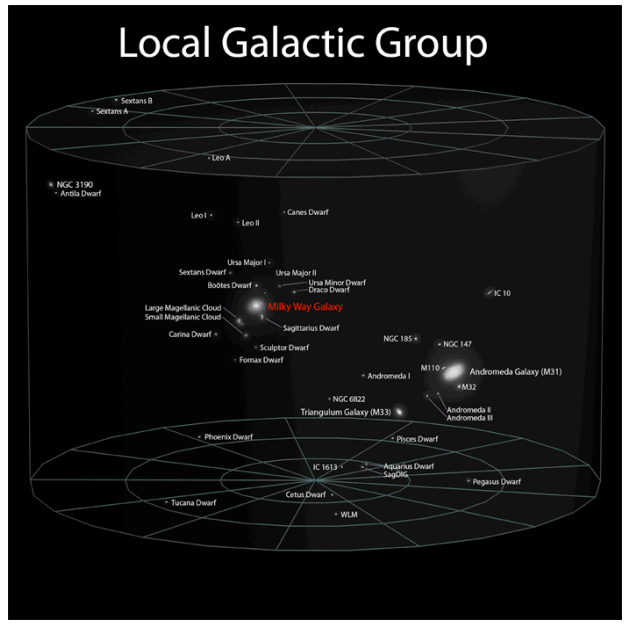
subgroups is more than 110 million light years in diameter. As galaxy groups go, it is probably fairly ordinary. There are millions of superclusters in the observable universe. This one is special, but only because it's ours.

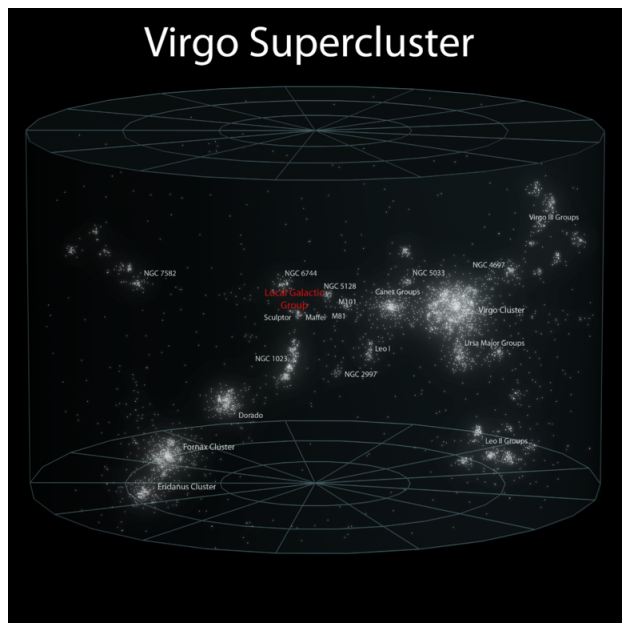


The ecliptic (yellow) is angled 60° from the galactic plane (black) and 23.4° from the celestial equator.



Milky Way structure





Diagrams from NASA/JPL

Group	Distance (LY)
Virgo Cluster	65 million
Draco Group	40 million
Leo Group	35-38 million
M81 Group (Ursa Major)	11 million
Ursa Major Group	55 million
M101 Group (Ursa Major)	24 million
M51 Group (Canes Venatici)	31 million

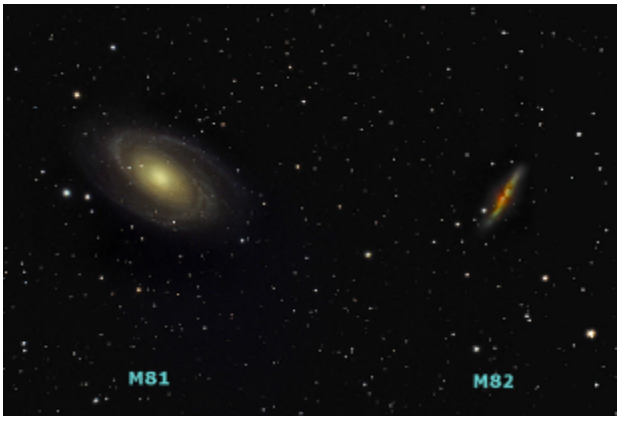
There are at least 184 galaxies magnitude 11.0 or brighter in this area of the sky. They are in reach of moderate aperture telescopes on clear

nights with good transparency (low humidity, few particulates). Of course, the darker the sky, the easier they are to see. The photographic images here are not what you'd see in your telescope: you'll have to be satisfied observing typical "faint fuzzies" frequently utilizing averted vision, unless you can get a hold of a scope with significant aperture (>16 inches). Nevertheless, it's very exciting to see these objects visually and I try to view them as often as I can with my Mallincam video camera.

A useful tool for galaxy observing is a light pollution reduction filter. Although this decreases total image brightness, it increases contrast, and combined with averted vision it often makes the difference between seeing the object and missing it altogether.

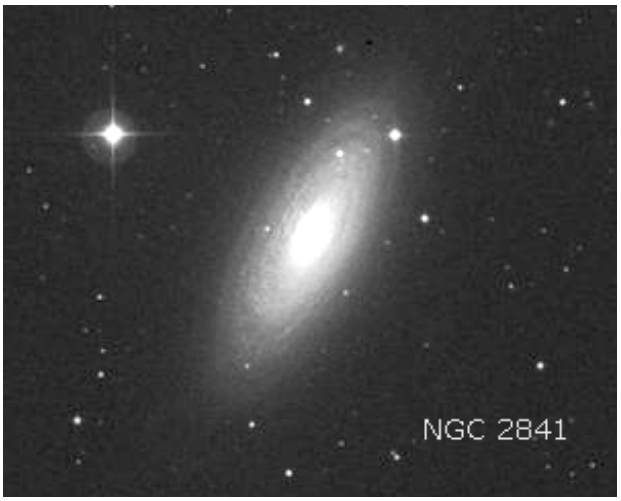
With all these riches, where do you start? If you just concentrated on the Messier galaxies in this region, you'd still have 32 to examine. The rest are in the NGC catalog. A go-to scope makes finding them a simple matter. A decent star map or planetarium software (the powerful and easy to use freeware *Cartes du Ciel* is highly recommended) will help orient you. The galaxies are so tightly packed in Virgo that you can just move from field to field and find them.

We'll start in the north. There are many bright galaxies in Ursa Major. M81, also known as Bode's Nebula, at magnitude 6.9 is the brightest galaxy in this part of the sky. Its total extent is almost half a degree, but its outer portions have low surface brightness and are harder to see compared with the brilliant core.

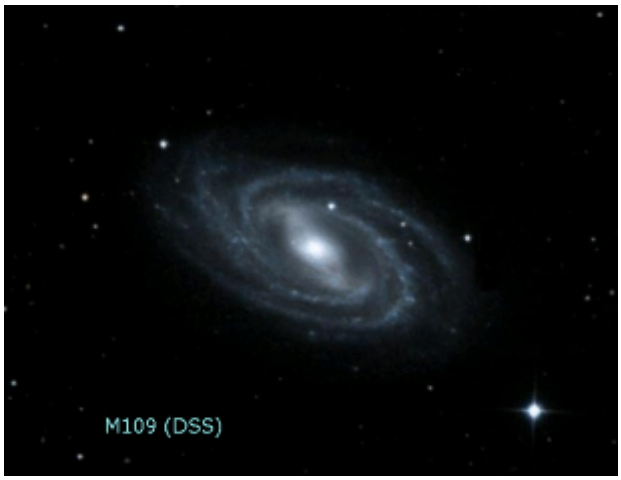


More interesting is the Cigar Galaxy, M82 (8.4), an irregular galaxy with a central dust lane and a good bit of new star formation in its center. It is thought that many recent (in galactic time) supernovae have caused the ejection of vast quantities of gas and dust from the center of the galaxy. It's easy to see the red glow of hydrogen with my Mallincam/8" SCT combination. M81 and M82 appear in the same low power field, since they are less than a degree apart. It's an exquisite sight, visible with a 6-inch scope in good conditions.

About 15 degrees southeast of M81/M82 is the pretty, tight spiral NGC 2841 (mag. 9.3).



A variety of excellent galaxies adorn the cup of the Big Dipper, including M108 (10.1) and M109 (9.8), a classic barred spiral.



While you're hunting for galaxies in this area of the sky, don't miss the first-rate planetary nebula M97, the Owl Nebula, large and quite bright at magnitude 9.9.

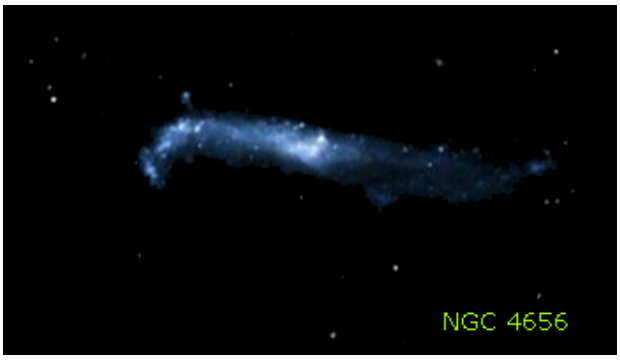
Just above the handle of the Dipper, forming an equilateral triangle with Alkaid, the end star of the handle, and the famous double star Alcor/ Mizar, we find the very large (half a degree) Pinwheel Galaxy, M101. Even though it is listed at magnitude 7.7, its low surface brightness makes it somewhat challenging.

Two wonderful galaxies lie near a line between Alkaid and Cor Caroli, the brightest star in Canes Venatici. One third of the way down is the glorious M51, the Whirlpool Galaxy. Actually a pair of interacting galaxies (NGC 5194 and 5195), the Whirlpool's spiral arms can be seen with larger scopes or in very dark skies. I've seen them with a 6" f/5 scope in Bortle 2 skies at 9,200' altitude in Colorado. They're easily seen in an 8" scope with video. Last year, a bright supernova was easily observed on the outer spiral arm connecting the two galaxies. I never tire of looking at this object. My Mallincam shows knots of stars and globular clusters in the arms.

WAA President Doug Baum's CCD image of M51 (box around SN2011dh, at about 11 o'clock)

Two-thirds of the way to Cor Caroli is the Sunflower Galaxy, M63, an 8.6 magnitude spiral with complex outer arms.

On the south side of Canes Venatici is the Whale Galaxy, NGC 4631, an irregular 9.3 magnitude object, most likely an edge-on spiral galaxy that has undergone some gravitational disruption. Cradled next to the Whale is the Pup, NGC 4627, a smaller elliptical galaxy that's rather faint at magnitude 12.4. Video can pick it up from our area, but it takes very dark skies to see it visually. Half a degree away is another oddly shaped galaxy, the magnitude 10.4 NGC 4656, often called the Hockey Stick or Crowbar Galaxy, for evident reasons.

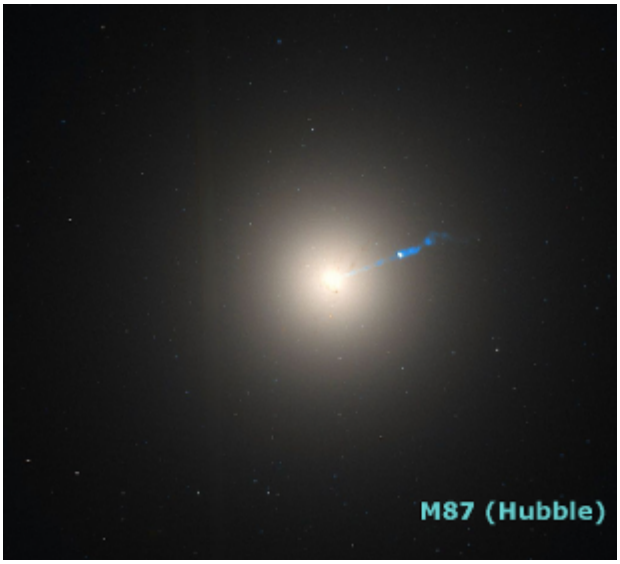


Heading further away from the celestial pole, we come to Coma Berenices. The Black Eye Galaxy, M64, has a large dust blob that obscures some of the nucleus of this 8.5 magnitude object. It is more prominent visually or with video than in many long-exposure CCD images. My wide-field Mallincam screen capture from the March 2012 WAA star party, not the most transparent of viewing nights, was taken with an 8" (0.2 meter) SCT. It is shown for comparison with a Sloane DSS image. The Digital Sky Survey uses a 2.5 meter mirror telescope.

Below Coma Berenices is Galaxy Central, the vast riches of the Virgo cluster.

The brightest galaxy in Virgo, at magnitude 8.3, is M104, the famous Sombrero Galaxy, noted for its central bulge and sharp dust lane.

The next brightest is the elliptical galaxy M87 (mag 8.6), famous for its jet. The magnetic field thrown out by a rapidly rotating supermassive black hole, estimated to have a mass of 6.6 billion suns, powers a jet of a high energy plasma moving near the speed of light that copiously radiates energetic gamma rays and radio waves. It takes a very large telescope and optimal sky conditions to see the jet visually. There are also two small galaxies near M87 that can be confused with it. They are at a 90 degree angle to the jet and 6 times farther away from the nucleus. John Paladini and I once were able to see it with the Mallincam at Ward Pound. At least we think we saw it.

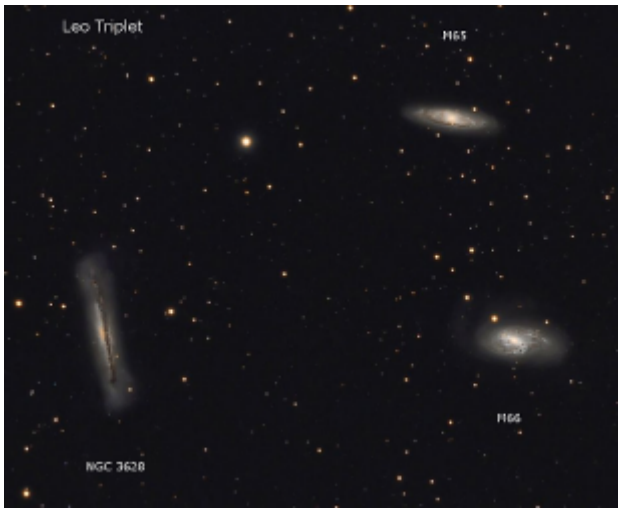


The Virgo cluster also contains Markarian's Chain, a group of galaxies with common proper motion. The main members of this group are M84, M86, NGC 4477, NGC 4473, NGC 4461, NGC 4458, NGC 4438 and NGC 4435.

Markarian's Chain. M84 is second from the right.

M86, the brightest member, is a lenticular galaxy that is blue-shifted, which means it's actually approaching us at 244 km/s because it's actually falling towards the center of the cluster from the opposite side. We're not in danger, and anyway M31 will get to us first.

Over in Leo, quite near to where Mars is this year, is the magnificent Leo Triplet, 3 bright galaxies within a degree of each other. M66 (9.0), M65 (9.3) and NGC 3628 (9.5) are breathtaking in a large telescope with a large enough field of view. They fit comfortably in the field of an 8" f/5 Newtonian. I viewed them in an 8" Orion Intelliscope at the Visitor's Center of the Fred Whipple Observatory in Arizona, an hour south of Tucson, last spring, and they looked pretty much like the photograph.



On the western side of Leo is a very nice 9.0 magnitude spiral galaxy, NGC 2903.

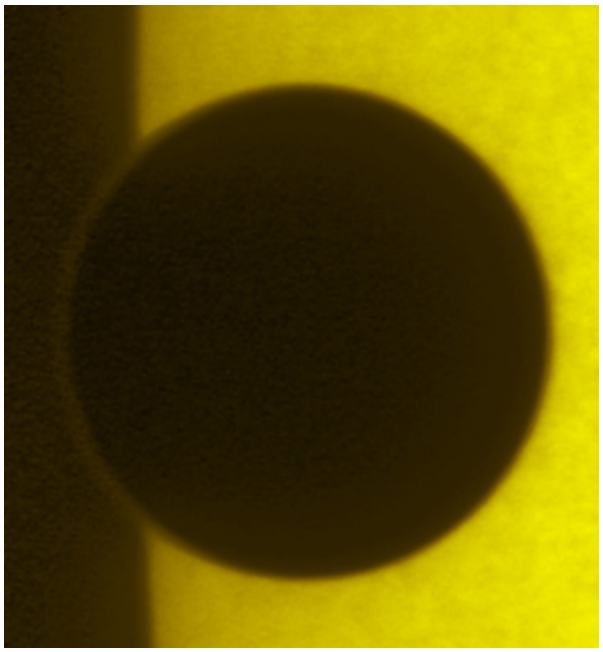
This is just a sampling of the brighter Virgo Supercluster galaxies. If we get good skies at the May and June Ward Pound star parties, they would make fine targets. Give some of them a try.

The Transit of Venus
by Larry Faltz

The Transit of Venus is one of the rarest predictable astronomical events: only 6 have ever been witnessed. Transits occur in a 243-year cycle, with pairs of transits 8 years apart separated by a gap of either 121.5 or 105.5 years. Each pair occurs in December or June. If you miss this one, you'll have to wait until 2117.

Ptolemy's *Almagest*, for nearly 1,500 years the standard reference work for planetary motions, was incapable of predicting a transit because its model assumed, wrongly, that the planets moved in circular orbits. In the first decade of the 17th century, Johannes Kepler realized that the planets had elliptical orbits, providing the correct mathematical basis for planetary orbital calculations (published in *Astronomia Nova*, 1609). He predicted the 1631 transit, but his initial formulae were still not accurate enough to pinpoint the event, and it was not observed. Jeremiah Horrocks of Much Poole, England, refined Kepler's data, and he and a colleague, William Crabtree, each observed the 1639 event.

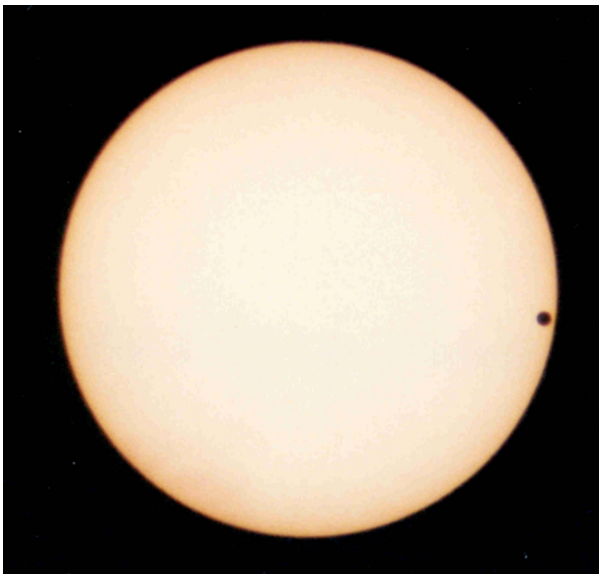
Later in the century, the Astronomer Royal, Edmund Halley, realized that a transit afforded an opportunity to determine the earth-sun distance, defining the "astronomical unit", by timing the planet's course across the solar disk from different latitudes on Earth. As a result, the next transit in 1761 was the subject of a large number of observing expeditions. Jeremiah Dixon and Charles Mason, observing from the Cape of Good Hope in South Africa, made successful measurements. Observing at the St. Petersburg Observatory in Russia, Mikhail Lomonosov established that Venus had an atmosphere. He observed an arc of refracted sunlight in the Venusian atmosphere as the planet crossed the solar limb. In 1769, the fabled Captain James Cook headed an expedition to Tahiti sponsored by England's Royal Society. They observed the transit from the northernmost tip of the island, which to this day bears the name "Point Venus".



The atmosphere of Venus refracts sunlight in this image of the 2004 transit.

The Transits of 1874 and 1882 were also widely observed in order to refine calculation of the astronomical unit using far better instruments than were available to mid-18th century astronomers. During these expeditions, the new technology of photography produced the first direct transit images. By the time of the June 4, 2004 transit, digital imaging had pretty much replaced film. The event had lost much of its scientific interest but a vast number of amateur astronomers were able to capture pictures of the event. Transits of Venus are veritable astronomical Brigadoons: Each time their paired occurrences happen, the world is very different.

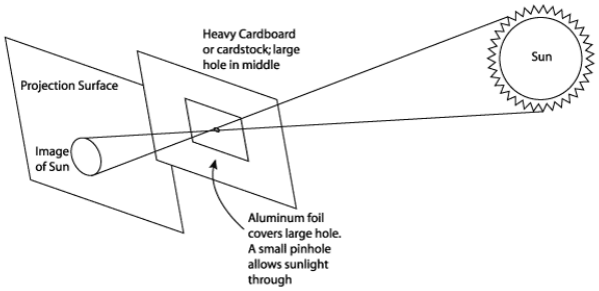
The 2012 transit will officially be a "June 6" event because in Universal Time it will start at 22:09 on the 5th but most of the 6½ hour event will take place on the 6th. In the Western Hemisphere it will occur on June 5th. Correcting for local time and daylight savings time, first contact will be at 6:03 pm EDT in the New York area, with the afternoon sun at 24º altitude. Sunset will be at 8:24 pm EDT, so we will get to observe about a third of the event. Obviously clear skies are necessary, and one can only hope for the best or to travel to a part of the world with a lower likelihood of cloudiness.



2004 transit with Venus near 3rd contact, from Manor Park in Larchmont, photo by the author (80mm f/6 refractor, 2x tele-extender, Baader solar filter)

There are a variety of methods that can be used to view the transit safely.

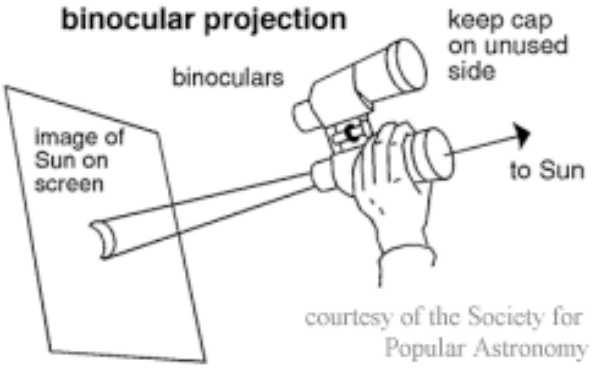
Pinhole projection



You can project the image of the sun through a pinhole to get a small but clear image. The best way to make a pinhole projector is to cut a large hole in a piece of cardboard, tape on a piece of aluminum foil and pierce that with a pin (you get a more precise hole that way). Take another piece of cardboard, tape on a piece of white paper, and project the solar image onto that, as in the illustration. The size of the solar image depends on the separation of the pinhole and the projection surface, given by the formula size=distance*0.00873. This means a 3-foot separation given a solar image of 1/3 of an inch. You'll need a significantly wider separation to give a usable image. The bright sun will tolerate it. You'll have to figure out some way of holding the cardboard, of course.

Eyepiece projection with binoculars or a telescope

You can use one side of a binocular or a small telescope to project the solar image onto a white sheet of paper. Use your telescope at low to moderate power. There is a good deal of heat build up inside the instrument, so it makes sense to use a small, less-costly scope or an inexpensive binocular, just in case. If you have to use something larger, stop it down (an off-axis mask with a 40-50 mm circular cut-out works well in telescopes with central obstructions). Cover or unmount any finders and if you use a binocular keep the lens cap mounted on one side. You can find the sun easily by simply minimizing the device's shadow on the projection screen. Never look through the instrument, of course, and make sure no curious onlookers mistakenly try for a direct look. If you are observing in a public place, we suggest posting a warning about blindness right on the scope.

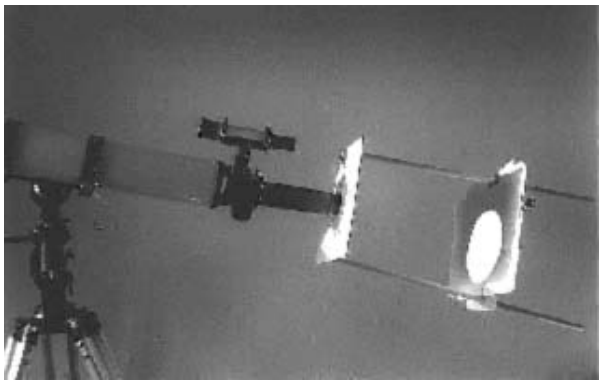


Binocular projection. Mount the binoculars on a tripod to avoid very tired arms.

Although it may not be necessary with the sun at low altitude, a shadow box of some kind will improve contrast. There are a number of clever solutions to the problem of projecting the image into a shadowed area.

Your choice of eyepiece depends on the projection distance and the size of the image you would like. You should experiment before the event.

A spotting scope projecting the solar image into a shadow box (Sky & Telescope)



An on-scope solution using cardboard and some dowels.

A clever projection device called the Sunspotter gives an excellent, large-scale image. It is a folded-path Keplerian telescope, using a 62mm lens and two mirrors to project a 3.5 in solar image onto a white screen. The Dobsonian-like wooden cradle makes for easy solar alignment. It weighs about 6½ pounds and costs about $350.

The Sunspotter

Direct observation in white light

Obviously, you cannot and must not look directly at the sun. Effective filters for the front of a telescope are made of either Mylar or glass. The most popular type is Baader AstroSolar™ aluminized Mylar. It comes in sheets or already installed in varying sized cells by a variety of suppliers.

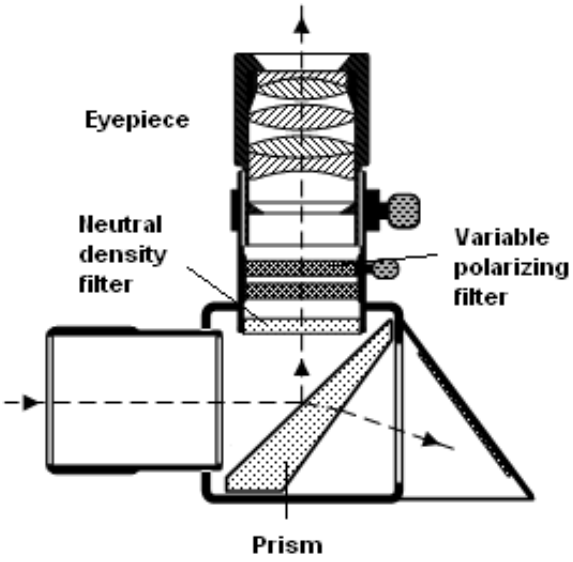
A front-cell Baader Mylar filter, this one by AstroZap

Thousand Oaks and Orion make glass filters in cells. These generally give a little yellower image than the cool blue-white of the Mylar filters, but the views through both types are excellent.

Thousand Oaks glass solar filters

You can even buy a pair of small filters to fit binoculars. When using these devices, make sure they are snug, using felt shims and retaining screws if they have them. We suggest additional security by taping the cell to the scope barrel.

The most exotic and expensive white light viewer is the Herschel wedge. It is like a diagonal, only it utilizes a trapezoidal prism which reflects 4.6% of the sun's light, passing the rest harmlessly out of the back of the device.



Herschel Wedge

The image passes through neutral density and variable polarizing filters before it gets to the eyepiece. Herschel wedges reveal more surface detail than Mylar or glass filters, but they can cost as much as $800 with the required filters. They should only be used with refractors, never with Newtonian or compound (SCT, Maksutov) instruments. Good ones are made by Baader and Lunt. Some inexpensive "department store" telescopes used to include really cheap glass "sun filters". If you've got one of these filters, discard it. The image is terrible and the device is dangerous, since the sun's heat will eventually crack the filter, causing instant eye damage.

Direct observing in hydrogen alpha light

Viewing the sun is completely safe through special hydrogen alpha telescopes, which are becoming common in amateurs' instrument quivers. These pass a single wavelength of light, 6262.8 Ångstroms, with bandpasses from 0.5-1.0 Ångstroms (the narrower the bandpass, the more contrast in the image). They show the solar chromosphere (white light scopes show the photosphere), allowing all sorts of structure to be viewed, including solar prominences.

What to do if it's cloudy

If the atmospheric deities curse the transit in Westchester, you can still follow it by logging on to www.nightskiesnetwork.com. A number of amateurs are likely to broadcast video images with white-light and hydrogen-alpha telescopes. NASA plans a webcast from the top of Mauna Kea, in cooperation with the University of Hawaii Institute for Astronomy, with expert commentary. The images will be shown in multiple wavelengths.

Resources

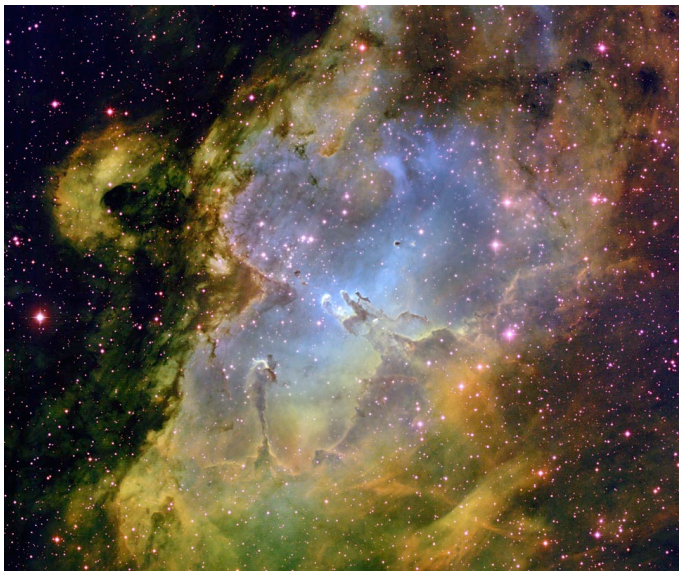
There's a wonderful web site that was set up just for the transit, www.transitofvenus.org. This has an enormous amount of historical information in addition to observing tips and other advice (and they're selling T-shirts and other paraphernalia). NASA's eclipse site, hosted by the noted Fred Espinak, also has useful information including maps and timings.

◀A Solar View

Bob Kelly captured this image of the Sun with sunspots with a Canon XS at prime focus with a barlow and 60mm refractor. His scope was equipped with a Baader Astro Solar Film and a solar finder by Kendrick

◀Seven Sisters

Gregg Navins captured this image of the Pleiades in Taurus using a Nikon D3100 on a tripod (shutter at 3 seconds, F9, iso3200, 200mm). Also known as the Seven Sisters, the Pleiades (M45) is an open cluster of stars, some 400 light years distant. Despite its common name, 10 stars in the cluster exceed magnitude 6 and so should be visible under decent conditions.



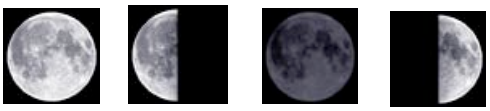
◀TheEagle Soars

Located in the constellation Serpens, the Eagle nebula (M16) is an emission nebula lying at a distance of 6,500 light years. It is an area of active star formation.

Image Credit: T. A. Rector & B. A. Wolpa, NOAO, AURA

Almanac

For May 2012 by Bob Kelly



May 6 May 12 May 20 May 28

There will be a test!

Just when you thought Venus couldn't get any brighter, well, she doesn't. We've run out of superlative adjectives to describe her over this long run of many months as an easy-to-find light in the evening. Venus reached peak brightness on April 30 at magnitude minus 4.7. Now, like a cliff diver, Venus falls slowly, then faster and faster toward the horizon into the Sun's waiting embrace, transiting the solar disk on June 5th. Thanks to Venus' position high in the ecliptic, the steep drop into the solar glare will be easier to see than usual. Closing some of the distance between her and the Earth on its faster inner orbit, Venus will get larger in size, but smaller in phase, showing a larger but thinner crescent as the month progresses.

Here's the test, in two parts: How many nights can you see Venus before the transit on June 5th? Also, what's the least amount of optical aid you can use to see the crescent shape? I saw the tiny, but unmistakable, crescent late in April in my 9x50 finder scope. By the third week of the month, at twice the size she spanned in April, some may glimpse her without any optical aid, especially early in twilight.

The hardest observation may be on June 1st, when Mercury races over from the morning sky to try to dissuade Venus from sailing into the Sun. Only 7 degrees from the Sun, magnitude -1.5 Mercury will appear to catch Venus' fall, only minutes after sunset. A clear horizon and a good telescope will be needed to catch this act. But Mercury is on the far side of the Sun from us (and from Venus) and Venus' large but thin crescent will slip by the tiny Mercury, which continues on to a nice evening appearance in June.

The Moon auditions its own transit of the Sun on the 20th of May. While attempting to show Venus how the big boys do it, the Moon has the misfortune of passing in front of the Sun when the Moon is at its most distant from Earth for the year. Looking slightly smaller than normal, the Moon won't cover the entire Sun, leaving a ring of fire visible starting at sunrise in China on the 21st, losing a day crossing the International Date Line, and ending at sunset in Texas on the 20th. Watch for magnificent photos of this annular eclipse over scenic landmarks such as the Grand Canyon. No such luck for us. You'll need to be west of the Appalachians to even catch a partial eclipse. For the lunar or Venus transit you'll need a safe solar filter, unless you are adept at projecting the Sun onto a screen, in order to observe safely.

But as darkness falls after sunset, this month is a DIY star party – look for Venus, then take a little more than a quarter turn to your left and look up to see a pair of 'stars' high in the southern sky. They are reddish Mars on the left with Leo's prime star Regulus on the right. Then go further to your left – low in early May and about level with Mars later in the month – there's another pair of 'stars. They are Saturn on the left and Spica on the right. A telescope makes the difference between stars and planets obvious. Mars is getting rather small to see details, but it's worth a try. Saturn is best higher in the sky, but its rings are unmistakable at any altitude. Tiny in a small scope, triumphant in a larger scope with tiny moons in attendance, Saturn's rings are always worthwhile. Good luck catching Jupiter low in the west right after dark as it moves behind the Sun, from our point of view, on May 13th.

Not much bling to catch the skywatchers' attention in May's mornings before sunrise. Sunrise moves well before 6am this month, cheering my fellow bus-waiters, but saddening the star gazer, who only has some lovely moon phases low in the trees in the south around mid-month to point out to his captive audience.

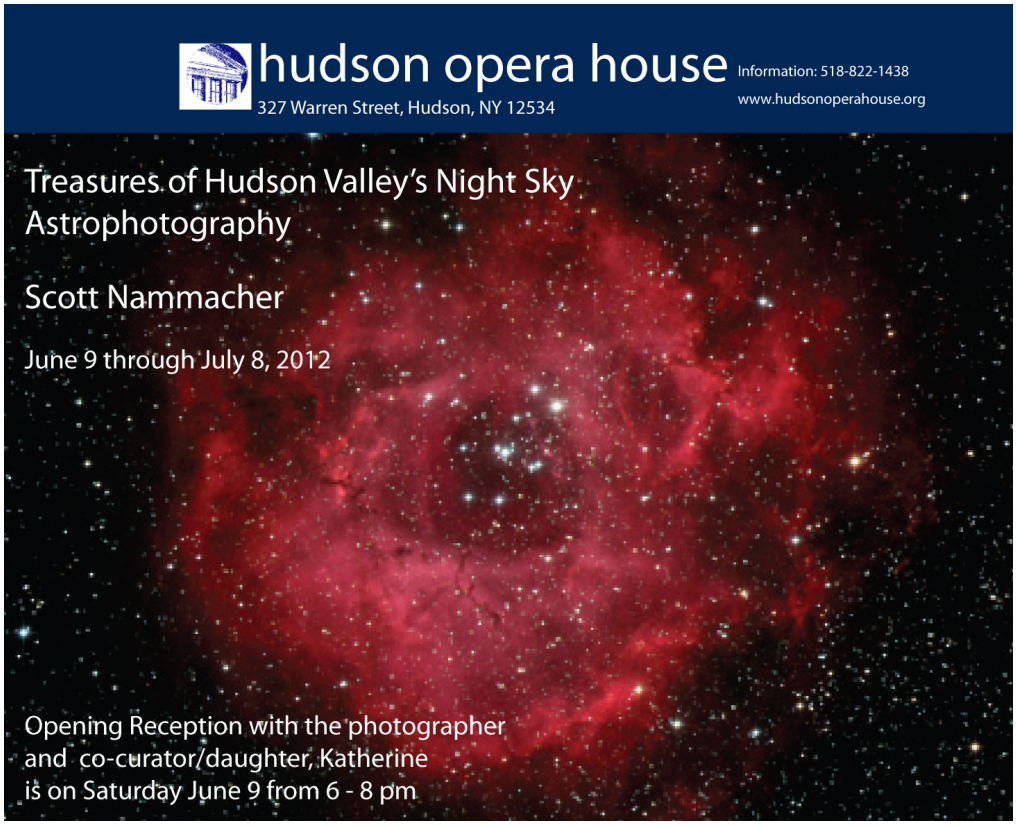
The Big Dipper soars high in the sky, five of its members part of a dispersing star cluster, bending the dipper out of shape over millions of years. But the followers of fainter flickers have more to see this month. The Milky Way is out of the way and we can see up and out through the less dusty top of our galaxy at the distant island universes, especially overhead near Coma Berenices. If you want to start a walk around our galaxy, walk toward the rising Cygnus in the evening sky and you'll be walking in the direction we travel around our galaxy's core, located on your right-hand side. Hope you like to

walk, since the Sun takes about 225 million Earth years to complete one galactic year.

Fans of human-made lights will have to find one of the many fainter satellites to follow, since the International Space Station doesn't make visible passes over us until it starts some morning passes on the 18th.

The Moon is in Mars' neighborhood on the 1st and the 28th, poses with Saturn and Spica on the 3rd and 4th and the 31st, and lines up low in the WNW with Venus on the 22nd.

Bob's blog is at bkellysky.wordpress.com



There will be a photographic exhibition of nebulas, galaxies, and other treasures of the night time sky taken from the local private observatory (Starmere) of amateur astrophotographer and WAA member, Scott Nammacher. He has captured the some of the gems of the celestial sky in stunning color and detail. Presented with basic educational material on the process of astrophotography, the components of this local observatory, and information about the objects in the night sky and the Milky Way. An opening reception with the artist and co-curator/daughter, Katherine, will be on Saturday June 9, from 6 – 8 pm. Please RSVP if interested in attending the reception, to snammacher@msn.com.

Also visit Scott's Website at: www.starmere.smugmug.com