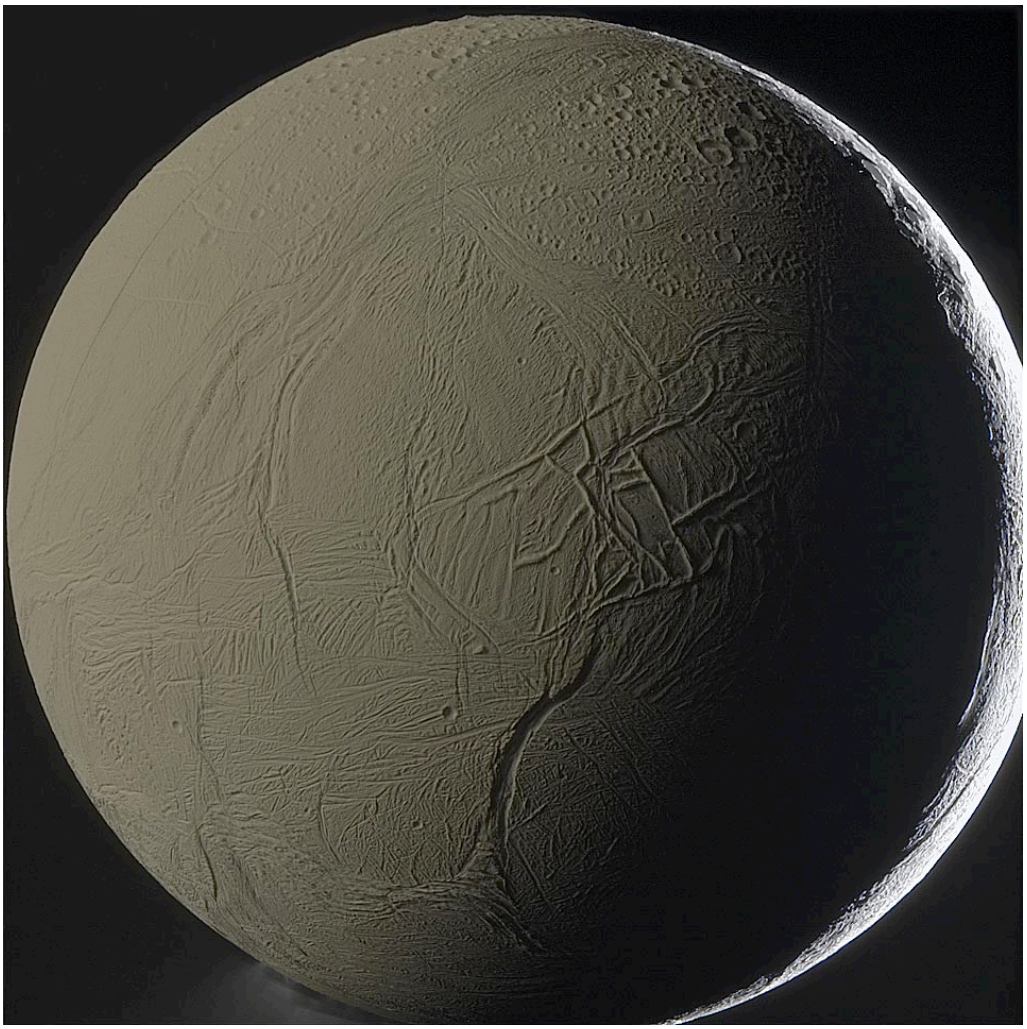
SkyWAAtch



Enceladus

This moon is shining by the light of its planet. Specifically, a large portion of Enceladus pictured above is illuminated primarily by sunlight first reflected from the planet Saturn. The result is that the normally snow-white moon appears in the gold color of Saturn's cloud tops. As most of the illumination comes from the image left, a labyrinth of ridges throws notable shadows just to the right of the image center, while the kilometer-deep canyon Labtayt Sulci is visible just below.

Image Credit: Cassini Imaging Team, SSI, JPL, ESA, NASA; *Color Composite:* Gordan Ugarkovic

Events for March 2012

WAA Lectures

“"The Latest on Water on Mars with a Description of the Launch of Mars Curiosity""”
Friday March 2nd, 7:30pm
Miller Lecture Hall, Pace University
Pleasantville, NY

Br. Robert Novak will describe he lecture will describe the temperature/pressure state of water followed by a description of the nature of water on Mars. Recent results in what is believed to be outflows of water along the sides of craters and the isotopic distribution of water will be described. Part of the talk will review the instruments on Mars Curiosity with pictures of the Atlas V rocket and launch. Br. Robert is the Chair of the Physics Department at Iona College. He holds degrees in Physics from Iona College (B.S., 1972), Stevens Institute of Technology (M.S., 1977), and Columbia University (M.Phil, Ph.D., 1980). Since 1996, he has worked with the Astrobiology Group at NASA’s Goddard Space Flight Center in Greenbelt Maryland. Free and open to the public. Directions and Map.

Upcoming Lectures
Miller Lecture Hall, Pace University
Pleasantville, NY

On April 13th, Josh Knight will present a talk entitled “New Mexico Southern Skies - a development for Amateur Astronomers devoted to Astronomical Imaging". Free and open to the public.

Starway to Heaven

Saturday March 17th, 6:30pm
Meadow Picnic Area, Ward Pound Ridge Reservation, Cross River

This is our scheduled Starway to Heaven observing date for March, weather permitting. Free and open to the public. The scheduled rain/cloud date is March 24th. Participants and guests should read and abide by our General Observing Guidelines and Disclaimer. Directions.

Special Event
A New York Evening with NASA Astronaut Ron Garan

Wednesday, March 14th at 7:00 pm
Murphy Auditorium
Iona College
New Rochelle, NY

The event is free and open to the public, but space is limited. You must obtain a (free) ticket for this event by logging on to:

http://rongaran.eventbrite.com/

where you can also find directions to Murphy Auditorium and parking information.

Renewing Members. . .

Doug and Vivian Towers - Yonkers
Robert Rehrey - Yonkers
Harry Butcher - Mahopac
Dennis and Margot Dilmaghani - Purchase

Westchester Amateur Astronomers, Inc., a 501(c)(3) organization, is open to people of all ages with the desire to learn more about astronomy. The Mailing address is: P.O. Box 44, Valhalla, New York 10595. Phone: 1-877-456-5778. Observing at Ward Pound Ridge Reservation, Routes 35 and 121 South, Cross River. Annual membership is $25 per family, and includes discounts on *Sky & Telescope* and *Astronomy* magazine subscriptions. Officers: President: Doug Baum; Senior Vice President: Larry Faltz; Vice President Public Relations: David Parmet; Vice President Educational Programs: Pat Mahon; Treasurer: Rob Baker; Secretary/Vice President Membership: Paul Alimena; Vice President Field Events: Bob Kelly; Newsletter: Tom Boustead.

Articles and Photos

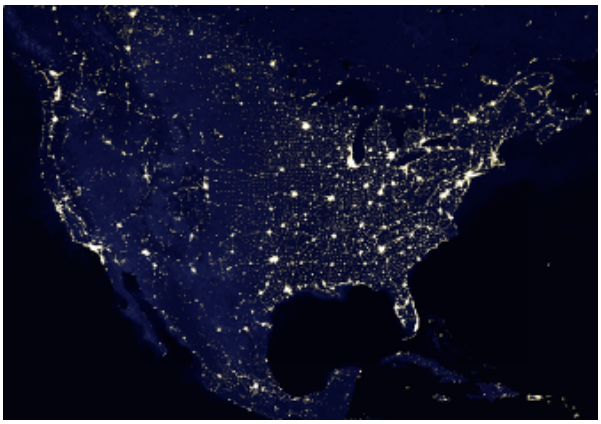
The Astronomer at the Movies: The City Dark
by Larry Faltz

In the magical last act of Mozart's *Marriage of Figaro*, which takes place in a moonless garden in 17th century Seville, the horny Count Almaviva, having tired of his loyal and still-beautiful wife, waits for her newly-married chambermaid Susanna, with whom he expects to assert the aristocratic privilege of *droit du seigneur* in spite of her reluctance. However, the ladies have hatched their own plan: they will switch clothes and the Countess will seduce her husband, who all the while will think that he is bedding the nubile Susanna. The plan succeeds, and the humbled Count pleads for forgiveness and reconciliation.

When the opera was premiered in Prague in 1786, the audience would have had no problem accepting that a husband might be unable to make out the features of his own wife in the dark of night in the middle of a large European city. Today's audiences find the situation merely a charming plot device (although it doesn't deter our appreciation of Mozart's greatest masterpiece). In cities before the 19th century, the moonless night was truly dark. The Milky Way was familiar to all. A few public streets may have been illuminated by candles or oil lamps, but that hardly lifted the darkness. Gas lamps were deployed in the first decade of the 19th century, but their cumulative impact on the sky was negligible. Just 80 years later, electric lights began to appear on urban streets. Since then, the exponential growth of outdoor lighting has challenged, and in many places conquered, the night sky.

Light pollution is a true tragedy for amateur astronomy, but it also has disastrous biologic and ecologic consequences on living organisms, including man.

Ian Cheney's new documentary *The City Dark* tells the sad and frustrating story of the impact of light pollution in a clever, elegant and convincing way. Born in Maine, Cheney became interested in astronomy and astrophotography as a teenager, building his own reflector. To pursue a career in film-making, he moved to New York, settled in Brooklyn and left the dark sky behind. The movie is energized by his wistful sadness at losing the companionship of the stars. Built as a suite of 6 "chapters", *The City Dark* explores a variety of themes, interspersing short segments with expert talking heads (Neil DeGrasse Tyson and Ann Druyan among them) with longer on-location scenes and interviews. The first two chapters are about astronomers, initially in the city and suburban areas (Long Island amateur Sam Storch reminisces about massively attended star parties at Jones Beach, where the night sky is no longer very dark), then out at Jack Newton's Arizona Sky Village, and finally on Mauna Kea. A side trip to a lighting store in New Jersey provides an interesting history of the light-bulb and its ever-increasing potency.



The third chapter is about the effects of light pollution on animals. The most remarkable scene in the movie is of newly hatched sea turtles emerging from the sand on a beach in Florida. These hatchlings are programmed to search for the brightest light, which for eons meant the reflection of starlight on the ocean. This would draw them to the safety of the sea. Instead, they

now head for brightly lit buildings along the shore, where they are easy picking for predators or die of dehydration. When one finally makes it into the ocean, the audience erupts in applause. Cheney informs us that his team made sure that all of the errant turtles he photographed were rounded up and placed in the water.

We are taken to Chicago to make rounds with volunteers who collect the bodies of birds that crashed into brightly-lit skyscrapers as they fly along their transcontinental migration paths. A few manage to survive, usually with broken beaks, but we see their dead cousins, by the hundreds, in the vaults of the Field Museum.

Moving on to the effect of light on humans, Cheney introduces us to Suzanne Goldklang, a breast cancer patient who used sell jewelry on late-night TV. The incidence of cancer is doubled in night-shift workers and the World Health Organization has formally identified night shift work as a carcinogen. Research studies suggest that the serum of rested animals, high in the pineal gland hormone melatonin, retards tumor growth, and we meet a scientist studying this phenomenon.

But night-time lighting was not simply created to bedevil us and our fellow creatures. Cheney's film turns to some reasons why we continue to light up the night. A tour of Newark with a former police officer provides fairly straightforward justification for urban street illumination as a disincentive to crime. The point is also made that for modern society lighting has replaced the smokestack of the Industrial Revolution as evidence of civic wealth, success and stature.

Finally, the film moves to possible solutions. An interview with Herve Descottes, who designed the lighting for New York's High Line, tells us what we astronomers already know: that much of the light is merely wasted and there are technological solutions that reduce the amount of squandered light and energy. That purposeless litter can destroy our enjoyment of the beautiful night sky and the profound thoughts and feelings that can come from contemplating it. Neil DeGrasse Tyson has the last word: "When you look at the night sky, you realize how small we are within the cosmos. It's kind of a resetting of your ego. To deny yourself of that state of mind, either willingly or unwittingly, is to not live to the full extent of what it is to be human".

The City Dark is a beautifully constructed, narrated and photographed film. The commentary is full of wonderful insights, the interviewees are eloquent, and many of the images are really inspiring, even night shots of cities from the International Space Station. Ironically, they reminded me of star clusters. I thought of the opening line of Sinclair Lewis' 1922 novel *Babbitt*, a sarcastic critique of American materialism, "The towers of Zenith aspired above the morning mist." The word "aspire" is wonderfully chosen: man's creations are usurping nature, in fact designed to do so. Sadly, we seem to be aspiring to banish the night and to replace the stars with our own creations.

Like many documentaries, *The City Dark* isn't easy to find. It played for a week in January at the IFC Center in Greenwich Village and it's making the rounds of various cities. You can get an idea of what it's about by going to the film's website, www.thecitydark.com.

Observing under the Light Dome

Light pollution is caused by Rayleigh scattering of light by particles smaller than the wavelength of light, which means ordinary gas molecules and pollutants in the atmosphere. It's the cause of the blue sky (more blue light is scattered than red, the result of its shorter wavelength). Light emitted upwards from the earth is also scattered, a good deal of which comes back in our direction. We can't eliminate the atmosphere, so we will always

have scattering. If you could take your scope to the moon, you'd have no atmosphere and no scattering. Only by reducing "light trespass", the useless projection of photons away from where they are needed for valid human purposes, can we reduce the scattering. Proper lighting design is key.

Scattering reduces contrast between extended objects and the background. There are a variety of strategies one can use to increase the contrast, the simplest of which is not to bother with deep sky objects and concentrate on other worthy targets: the moon, planets and double stars. But those of us who like "faint fuzzies" have some other techniques to see these objects. Many of these are discussed in Rod Mollise's fine book *The Urban Astronomer's Guide* (Springer, 2006).

Shielding

You can't do anything about the overall light dome, but you can try to avoid local lights as much as possible. Try to position your scope as far as you can from street and house lights. If necessary, seek out the night-time shadow of a tree, get a portable observing tent or build a real observatory if you've got the space, exposure and money. Use a good, long dew shield and make sure any local street lights are very far off axis, to prevent the less-than-perfect black inner surface of the shield from reflecting light onto your optics.

Aperture

There's a myth that large aperture scopes are less desirable because they collect more of the sky glow. That's simply wrong. Aperture always rules, whether in Westchester or on Mauna Kea. Get as much sky into your scope as possible.

Averted vision

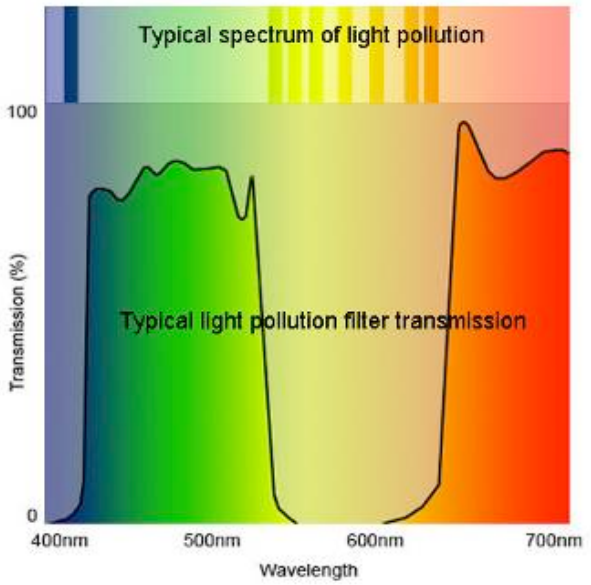
Using averted vision will help with faint objects even in the presence of light pollution. So will jiggling the telescope, because the eye can perceive moving objects better than stationary ones.

Magnification

Higher magnification actually increases the contrast between deep sky objects and the background, so be prepared to eschew low-power wide-field views in favor of higher power and narrower field of view.

Filters

Street lights have their own emission spectra, and the peaks are often offset from spectral lines of greatest interest in deep sky objects. The most common street lamp in the US is the "cobra-head" high pressure sodium lamp. These lamps are relatively long-lasting and inexpensive, but they are usually designed with huge light trespass, spewing many of their photons laterally and upwards. Fortunately, much of their light is concentrated between 560 and 620 nm, a range that holds little astronomical interest. Mercury vapor lamps are also common; they have peaks at 546.1 and 578.2 nm. Low-pressure sodium lamps, with a very narrow emission line at 589.3 nm in the yellow, used to be common but are fast disappearing.



Filters are available that can block sodium and mercury lines and pass wavelengths important to astronomy. These filters can be "broad-band" (known collectively as light-pollution-reduction [LPR] filters) with complex transmission patterns, or "narrow-band" that pass just one frequency, usually hydrogen alpha (656.28 nm), hydrogen-beta (486.5 nm) or oxygen III (495.9/500.7 nm doublet).

The spectral characteristics of different manufacturers' broad-band filters vary, and the amateur community frequently argues about which broad-band filter is "best". I suspect it's a matter of *chaçun a son goût.* Many specific filter

spectra are shown on the Astrosurf website and on André Knöfel's site (the text is mostly in German!)

Filters reduce overall light transmission, but they increase contrast, so the net effect is an overall increase in detail at the expense of brightness. You may or may not find the effect satisfying.

A potential problem for astronomy is the growing use of LED light, which has a broad spectrum, and thus will be harder to filter out. Although many of the newer lamps are designed to have very low trespass, there will still be some reflection, so the best hope will be to achieve appropriate lighting usage, such as not keeping buildings, shopping centers and parking lots illuminated all night.

Video

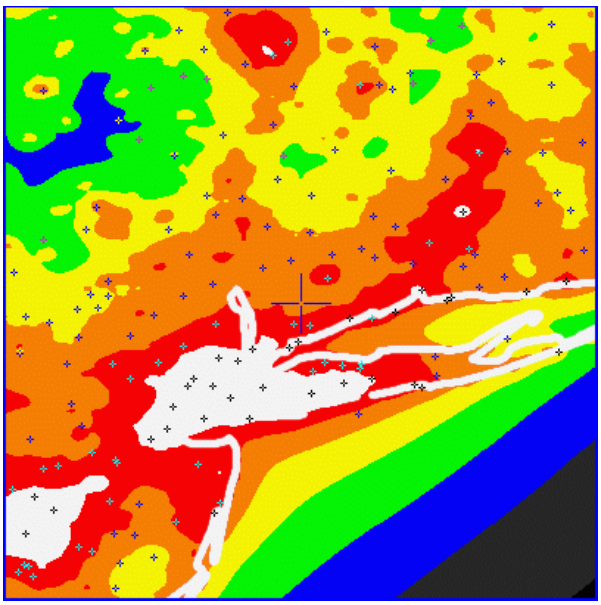
Video cameras for astronomy allow "near-real-time" viewing (see my article in the June 2010 WAA newsletter) and their processing and amplification circuits seem to manage contrast a bit more effectively than the eye. LPR filters can also be used, the camera's gain somewhat offsetting the dimming inherent in filters.

Light Pollution at Ward Pound

Our club "dark sky" site is only 39 miles from Times Square. The light pollution map shown here comes from Attila Danko's Clear Sky Clock site (it's a section of the World Atlas of Artificial Night Sky Brightness), and shows that Ward Pound is rated at "5" on the Bortle scale. The complete scale follows this article.

At one of this past summer's Starway to Heaven parties, I confirmed this rating using my Unihedron Sky Quality Meter, which gave a value of 20.11 (zone 5 ranges between 19.50 and 20.49).

Many WAA club members remember that the site was much darker in the eighties and early nineties, before the current level of development in northern Westchester. At least we're away from local lights. There's only one bulb, at the Ranger station, that's visible from the Meadow parking lot.



The cross marks Ward Pound Reservation

At a really clear, high dark sky site, like places in the American southwest, all you need to do to have a great astronomy experience is to lie on your back and gaze at the Milky Way with the naked eye or a pair of binoculars.

How You Can Help

The International Dark-Sky Association (IDA) is dedicated to finding ways to reverse the destruction of the night sky. IDA's mission is "to preserve and protect the nighttime environment and our heritage of dark skies through environmentally responsible outdoor lighting". It advocates for rational lighting technology and usage, endorses trespass-reducing lighting fixtures, designates lighting-friendly towns and cities and identifies and protects dark sky sites. It has a range of model civic lighting ordinances, informational materials and awareness campaigns. There are local chapters throughout the US and the world for local advocacy, and an office in the Washington, DC area to further contacts with the Federal government. Membership in IDA is a step you can take in the fight against light pollution.

And, make sure you are not contributing to light trespass yourself. Be smart about lights around your home, and replace any inefficient, upward-directed fixtures with IDA-approved models. When they're not needed, turn them off!

The Bortle Scale of Sky Brightness

John Bortle, *Sky & Telescope*, February 2001

Class	Title	Color key	Naked-eye limiting magnitude	SQM Reading (mag/sq arc-sec)	Description
1	Excellent dark-sky site	black	7.6–8.0	22.0-21.99	Zodiacal light, gegenschein, zodiacal band visible; M33 direct vision naked-eye object; Scorpius and Sagittarius regions of the Milky Way cast obvious shadows on the ground; airglow is readily visible; Jupiter and Venus affect dark adaptation; surroundings basically invisible.
2	Typical truly dark site	gray	7.1–7.5	21.99-21.89	Airglow weakly visible near horizon; M33 easily seen with naked eye; highly structured summer Milky Way; distinctly yellowish zodiacal light bright enough to cast shadows at dusk and dawn; clouds only visible as dark holes; surroundings still only barely visible silhouetted against the sky; many Messier globular clusters still distinct naked-eye objects.
3	Rural sky	blue	6.6–7.0	21.89-21.69	Some light pollution evident at the horizon; clouds illuminated near horizon, dark overhead; Milky Way still appears complex; M15, M4, M5, and M22 distinct naked-eye objects; M33 easily visible with averted vision; zodiacal light striking in spring and autumn, color still visible; nearer surroundings vaguely visible.
4	Rural/suburban transition	green / yellow	6.1–6.5	21.69-21.25 / 21.25-20.49	Light pollution domes visible in various directions over the horizon; zodiacal light is still visible, but not even halfway extending to the zenith at dusk or dawn; Milky Way above the horizon still impressive, but lacks most of the finer details; M33 a difficult averted vision object, only visible when higher than 55°; clouds illuminated in the directions of the light sources, but still dark overhead; surroundings clearly visible, even at a distance.
5	Suburban sky	orange	5.6–6.0	20.49-19.50	Only hints of zodiacal light are seen on the best nights in autumn and spring; Milky Way is very weak or invisible near the horizon and looks washed out overhead; light sources visible in most, if not all, directions; clouds are noticeably brighter than the sky.
6	Bright suburban sky	red	5.1–5.5		Zodiacal light is invisible; Milky Way only visible near the zenith; sky within 35° from the horizon glows grayish white; clouds anywhere in the sky appear fairly bright; surroundings easily visible; M33 is impossible to see without at least binoculars, M31 is modestly apparent to the unaided eye.
7	Suburban/urban transition or Full Moon	red	4.6–5.0	19.50-18.38	Entire sky has a grayish-white hue; strong light sources evident in all directions; Milky Way invisible; M31 and M44 may be glimpsed with the naked eye, but are very indistinct; clouds are brightly lit; even in moderate-sized telescopes the brightest Messier objects are only ghosts of their true selves. At a full moon night the sky is not better than this rating even at the darkest locations with the difference that the sky appears more blue than orange-white at otherwise dark locations.
8	City sky	white	4.1–4.5		Sky glows white or orange—one can easily read; M31 and M44 are barely glimpsed by an experienced observer on good nights; even with telescope, only bright Messier objects can be detected; stars forming familiar constellation patterns may be weak or completely invisible.
9	Inner-city sky	white	4.0 at best	<18.38	Sky is brilliantly lit, with many stars forming constellations invisible and many weaker constellations invisible; aside from Pleiades, no Messier object is visible to the naked eye; only objects to provide fairly pleasant views are the Moon, the planets, and a few of the brightest star clusters.

Colors refer to the World Atlas of Artificial Night Sky Brightness

A Chilean Astronomical Experience: Combining the Best of the Southern Night Skies with Tours of World Class Observatories
By Scott Nammacher - December 2011

Ever since, at a very young age, I inadvertently walked into a star party in a park near my home in Minneapolis, I've had an interest in astronomy. It was not until 2003, when Mars was closest to the Earth, that I bought a self-tracking Meade LX90 8" scope and re-engaged my interest in the stars. More recently, I built an observatory in upstate New York to pursue astrophotography as a serious hobby.

As with many post-college students, my daughter Katherine had been traveling for several months, in her case throughout South America. She invited me to hike with her in southern Chile (the "Circuit" at Torres del Paine) towards the end of her travels. Though she was thinking about the mountains and their vistas, I thought about the clear Chilean night-time skies, the world-class observatories there, and the unique astronomic treasures one never sees or photographs from the northern hemisphere.

With limited time to plan, I contacted the three major facilities located near La Serena (north of Santiago): Gemini South, SOAR (which stands for Southern Observatory for Astrophysical Research), and Cerro Tollolo Interamerican Observatory (CTIO). CTIO was in a maintenance mode so a visit was not possible.

SOR (left) and Gemini (R), courtesy Gemini/AURA

The other two offered very limited visits and are generally not available for tourism. However, a part of their missions is to promote the field of astronomy to the public and they occasionally make exceptions for groups of amateur astronomers or organized non-profit tours. Both are located in the Elqui Valley, on a mountain called Cerro Pachon, about 300 meters from each other. We did receive permission for daytime visits to both SOAR and Gemini South (there are no night time tours).

In order to see the wonders of the Chilean night time skies, we visited two "tourist" observatories. Observatory Mamalluca was just north and outside of Vicuna, a town east of La Serena. It affords people the ability to look through a Meade 16" ACF scope along with a number of smaller Orion 8" Dobsonian scopes, with multiple "tour" guides (depending on group sizes) to help find different objects. In between viewing sessions, we visited their video theater where they discussed the constellations and some of the unique aspects of the southern skies. "Claudia" handled reservations at Observatorio Mamalluca via email (you can reach them at mamalluca@munivicuna.cl). On the way there our group's van overheated and we had to be shuttled to another van, much to their embarrassment, but more on overheating later.

The second tourist observatory, Observatory del Pangue, is located south of Vicuna at a higher elevation, above some of the night dust and atmospheric moisture. It is owned and operated by Eric Escalera, a Ph.D. astronomer by training, and his colleague Cristian Valenzuela, a night sky guide and astrophotographer. He can be reached at astronomicasur@gmail.com, with more information available on their web site.

They offer a 16" Meade LX200 ACF scope, a piggy backed 3" scope, a 12" Orion SkyQuest scope and a very tall 25" Obsession Dobsonian scope as well. Their focus is on catering to smaller (maximum of 16 people), more sophisticated groups. We scheduled a "Tour Extreme" with them, which is essentially an all night session. Since it turned out we were the only guests that night, my daughter and I had the whole place and both Eric and Cristian to show us the wonders of the night sky. The first half of the night the moon was up at about 50% so we did mostly observing of brighter objects. Once the moon set, I proceeded to try my hand at some very elementary DSLR photography, first through the 3" scope and then by piggy-backing my Canon DSLR camera (with a 70-300 mm zoom lens) on the 16" scope (tracking was not good enough to shoot through the 16"). While the

facility was not set up to cater to photography, the two astronomers were very helpful in accommodating my requests as best they could.

We were determined to spend as much time looking at and photographing objects like the Large and Small Magellanic Clouds, the Tarantula Nebula, Eta Carina, and the other unique treasures we don't get in upstate New York. The tracking was only set for an observing level of quality so the best exposure times available were between 30 seconds and a minute without noticeable trailing. However, I took enough shots to stack and create some rudimentary pictures and some great memories. This was my first time using a DSLR for astrophotography. Several of my shots are shown below. Of course, these are nothing like the typical long-exposure DSLR or CCD camera results, but it was fun to have done them.

Observing at the Observatory del Pangue above

The Chilean skies around Vicuna from about 5,000 feet are spectacular! The Milky Way was beautiful. The detail one could see of different nebulae, the Tarantula and Eta Carinae in particular, was amazing, especially through the 25" scope. While not the technical highlight of our visits, this was certainly the emotional height.

In between visiting these two "tourist" observatories we visited Gemini and SOAR. Both are extraordinary facilities providing cutting edge tools for research astronomers around the world.

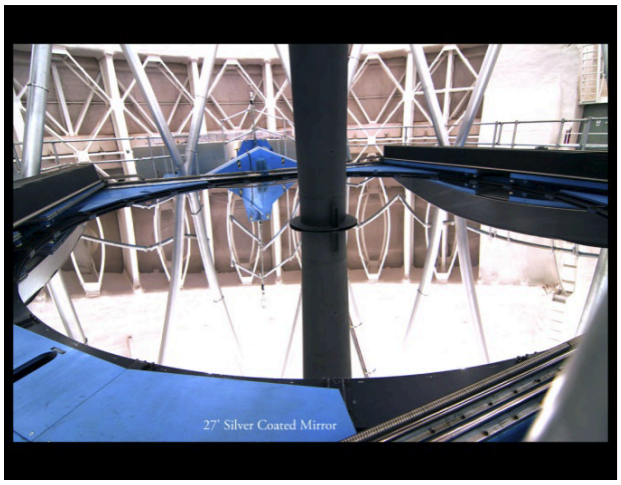
Permission for the observatory visits took a couple months to get, so it was exciting to finally be in Chile, arriving at to the gate-house entrance and getting final clearance from the guard to begin our journey. And a bit of a journey it was. It was a curiosity to us that we signed documents related to safely driving to the site. One of them discussed not hitting animals, what to do if you break down, emergency phones, and other road dangers. It turned out, much to our dismay, that the observatories were another roughly 50 kilometers up a relatively steep dirt road. It

meandered around the various foothills and gradually moved up to the observatories' 8,900-foot elevation. Our rental truck, however, was not up to the task. As we got to about the 8,000 foot level it unexpectedly overheated, leaving us on the very abandoned dirt road late for our appointments. Luckily a short while later observatory staffers driving to work picked us up and took us to the top.

Once at Gemini we were met by our very understanding guide Manuel Paredes. He was very gracious and gave us a full tour of Gemini, from the dome room to the recoating room to the control room, and more.

Gemini South is an 8.1-meter (26.6 foot) scope focusing on visual and, more importantly, the near- and mid-infrared spectrums. The telescope itself stands 71 feet above the observing floor and weighs 418 tons. It saw first light in 2000. The top of the dome itself stands about 151 feet from the ground and is bigger on the inside than the photos here show. Its thermal vents (the large ring like structures around the outside) open to a 10 meter wide gap all around the dome to allow for pre-session cooling of the scope and dome area. A maintenance crew of 15 people services the instrument. Between the two Gemini scopes, there are over 150 people involved at the various offices and sites.

Mr. Paredes is involved in their outreach program. He can be reached at mparedes@gemini.edu. He was particularly helpful in enhancing our understanding all that was going on there.



The silver-coated Gemini mirror

One of the aspects of Gemini that makes it unique is that its mirror is coated with silver, rather than the more common aluminum. This gives Gemini a strong advantage over other scopes in the near- and mid-infrared spectrum.

Below the observing floor is a maintenance area with a full mirror re-coating facility. About every six years the mirror's silver coating is completely replaced. The old coatings are stripped down to the Corning glass base and five new coatings, including the silver, are applied using a gaseous method. Then the surface is sealed. According to Manuel, it takes about a Coke can's content of silver to coat the entire surface.

Gemini mirror recoating chamber

Interestingly, when the telescope was being built the mirror, being nearly 27 feet wide, was difficult to get through the highway tunnel leading through the mountains to Vicuna. An even larger LSST scope is in the works on a nearby mountain-top; its mirror will be even a bigger challenge to transport when it is brought up later in the decade (assuming funding becomes available to complete the scope).

Scott and Katie in the Gemini control room

Gemini is operated by an international partnership that includes the US, UK, Canada, Chile, Australia, Brazil, and Argentina. Any astronomer can apply for time on Gemini, which is allocated in proportion to the amount of financial support provided by each country.

Gemini is unique in that it has a virtual twin located in the Northern Hemisphere, on Mauna Kea Mountain in Hawaii at an elevation of 13,824 feet.

Katie and Gemini

The facilities operate by a queue system and have plans for just about every weather or atmospheric condition imaginable. So, depending on the weather or quality of seeing or status of the moon (and many more factors), the best projects for those conditions come to the forefront to be run, always allowing a full plate of nightly activities just about no matter what the outside conditions are. Their instrumentation packages are mounted under the primary mirror and any one of them (four or so) can be utilized at any time during the night.

One of the unique aspects of Gemini South's capabilities is its recent installation of an orange sodium laser adaptive optics (AO) system called the Laser Guide Star system or LGS. This device is fairly unique since it actually projects not one but a grid of five artificial stars around its target, four at each corner of a square and one in the center. It is able to make nearly instantaneous adjustments to the data coming in, compensating for atmospheric fluctuations. The system has a single 50 watt laser that is broken up into five 10 watt beams, making this one of the most powerful laser systems in use. Typically observatories have only one laser to perform this task, in the 10-15 watt range. Gemini North has a single 14 watt beam.

Whenever this system is going to be used, the observatory is in contact with the Chilean equivalent of the FAA and the "Laser Clearing House," to check for aircraft flights or satellites (respectively) coming through the target area. Additionally, the Gemini Aircraft Spotter Program stations people outside the dome who are specially trained to watch for planes and satellites throughout the night.

The Gemini Laser Guide Star System in operation

The LGS system is in its testing and calibration stages and is expected to be operational at a high functioning level in 2012. Most interesting to this arm-chair astronomer is the fact that the adjustments actually take place after the light/data comes through the scope to a mirror that directs it into something called CANOPUS (the actual AO equipment). There it hits three deformable mirrors

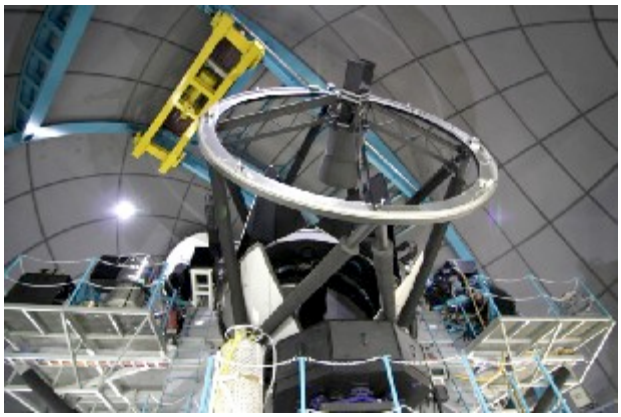
that allow computer determined adjustments to be applied. The result is a very marked improvement in the quality of data coming from the scope, which will allow a much wider field of view to be surveyed in a given period, potentially 16 times that of a single laser AO system.

One of the major emphases of the research is the hunt for exoplanets. Gemini staff expect to install additional equipment in the future that will strengthen their already notable efforts in this area.

From Gemini we went down the road to SOAR, where we met Mr. Eduardo Serrano, the Site Manager of the facility. In spite of our being quite late, he was very gracious and gave us a full tour of the facility. For information, contact Marcela Urquieta at murquieta@ctio.noao.edu.

SOAR is a 4.1 meter telescope with a focus on infrared and remote operation. It attains a median image quality of 0.7 arc-seconds at 0.5µm. Its f/16.6 focal ratio provides a 14.4 arc minute zero-vignetting field diameter.

It is operated by a group of organizations including the Integrated National Astronomical Observatory (NOAO), University of North Carolina at Chapel Hill, Michigan State University and the Ministry of Science, Technology and Innovation of Brazil. SOAR was dedicated in 2004.



SOAR with mirror baffles opened

SOAR is designed to carry up to a total of 9 instruments, on three instrument platforms under the telescope. Any of these boxes can be swung into position and ready to operate in a matter of minutes. SOAR has two 16 million pixel imagers (one a spectrograph) and two near-infrared imagers (one also a spectrograph). An adaptive optics module was installed in April. It utilizes a single laser guide star model to significantly improve image quality.

Scott and Katie at the base of SOAR

As with many of the newer scopes, including Gemini, the primary mirror has adjustment cylinders (movable axial supports) under it to keep the mirror in its ideal curvature as the scope slews across the sky.

Back of SOAR – movable axial supports

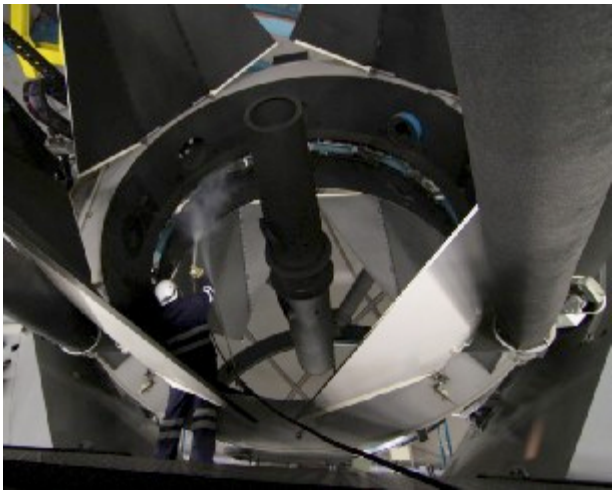
The weight of the mirror and supporting equipment normally bends and warps the mirror slightly as it

goes from being flat (facing straight up) to being closer to horizontal (facing the horizon).

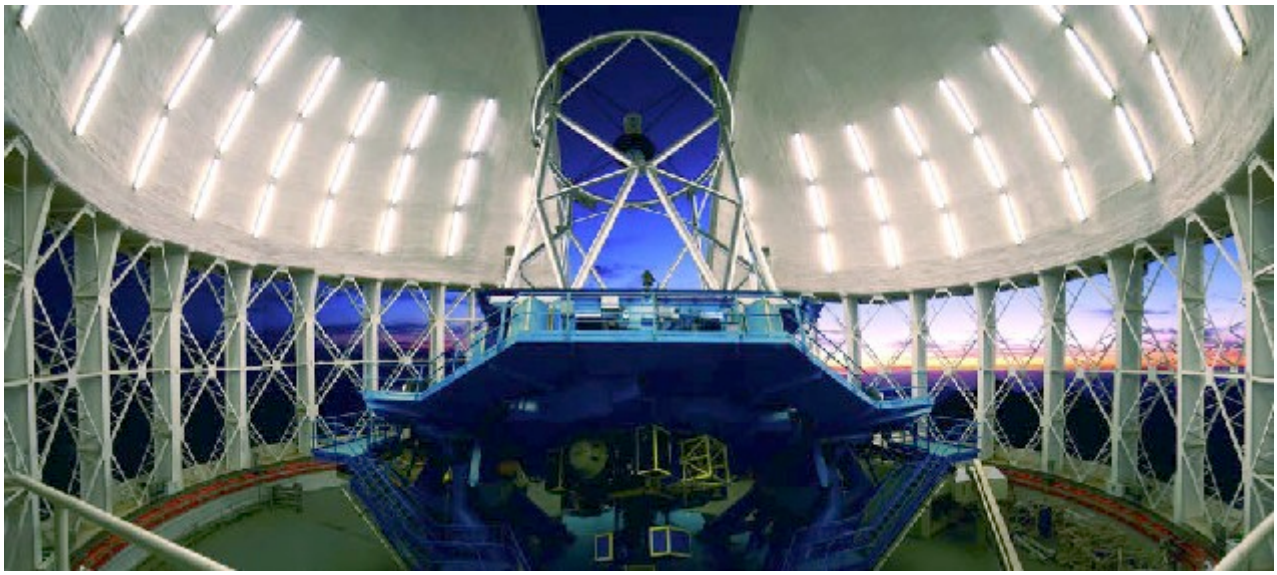
We happened to arrive just in time to watch the weekly air blast cleaning of the primary and secondary mirrors with a CO_2 air machine. First, the protective mirror baffles were opened and the scope was tilted to approximately a horizontal targeting level. Then the mechanic proceeded to clean the mirror with a long cleaning tube shooting out a CO_2 jet stream to blow dust away. The mirror is formally washed once every 6 months. This was an interesting twist to our visit to SOAR. Gemini does their cleaning in a similar manner, with an air cleaning weekly to remove dust and a full mirror wash every six months.

Once we completed our tour at SOAR, we returned to Gemini, where Mr. Paredes had located a water container and vehicle to take us back to our rental truck. It took 4 liters of water, indicating it likely was quite low when we rented it. We were not sure whether it would be operational, but since I had not overheated it to the point of heavy steam loss or engine damage, it started up and ran without a problem. The lack of coolant likely resulted in overheating as we drove up the steep mountain.

We headed back to Vicuna and civilization, leaving the truly fascinating worlds of the Gemini South and SOAR observatories. From there it was on to Torres del Paine and the hike of a lifetime…but that is another story!



Cleaning of the primary and secondary mirrors of SOAR



Wide angle view of Gemini with the air baffles open to cool the dome area. Courtesy of Gemini Observatory/AURA

The Hidden Power of Sea Salt, Revealed
By Dauna Coulter

Last year, when NASA launched the Aquarius/SAC-D satellite carrying the first sensor for measuring sea salt from space, scientists expected the measurements to have unparalleled sensitivity. Yet the fine details it's revealing about ocean saltiness are surprising even the Aquarius team." We have just four months of data, but we're already seeing very rich detail in surface salinity patterns," says principal investigator Gary Lagerloef of Earth & Space Research in Seattle. "We're finding that Aquarius can monitor even small scale changes such as specific river outflow and its influence on the ocean."

Using one of the most sensitive microwave radiometers ever built, Aquarius can sense as little as 0.2 parts salt to 1,000 parts water. That's about like a dash of salt in a gallon jug of water. "You wouldn't even taste it," says Lagerloef. "Yet Aquarius can detect that amount from 408 miles above the Earth. And it's working even better than expected."

Salinity is critical because it changes the density of surface seawater, and density controls the ocean currents that move heat around our planet. A good example is the Gulf Stream, which carries heat to higher latitudes and moderates the climate.

"When variations in density divert ocean currents, weather patterns like temperature and rainfall are affected. In turn, precipitation and evaporation, and fresh water from river outflow and melt ice determine salinity. It's an intricately connected cycle."

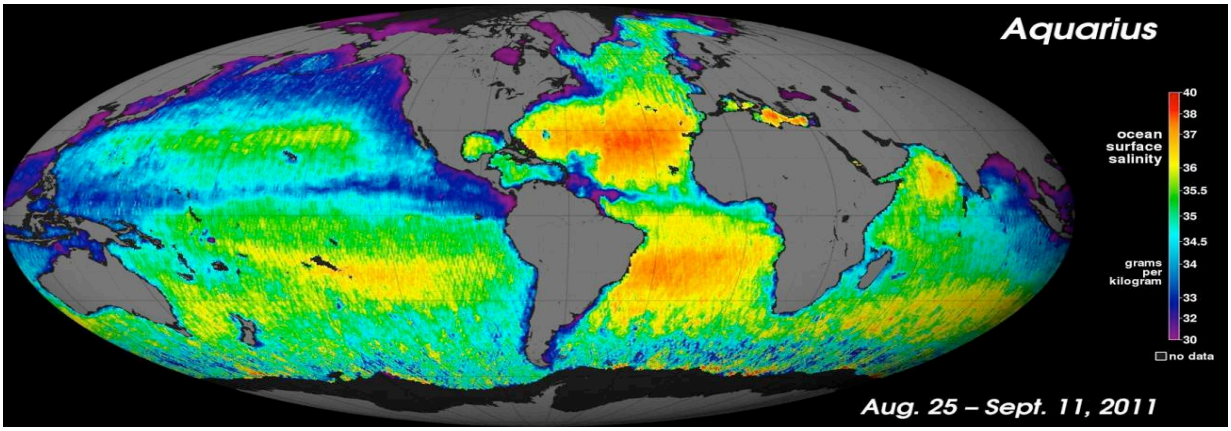
The atmosphere is the ocean's partner. The freshwater exchange between the atmosphere and the ocean dominates the global water cycle. Seventy-eight percent of global rainfall occurs over the ocean, and 85 percent of global evaporation is from the ocean. An accurate picture of the ocean's salinity will help scientists better understand the profound ocean/ atmosphere coupling that determines climate variability.

"Ocean salinity has been changing," says Lagerloef. "Decades of data from ships and buoys tell us so. Some ocean regions are seeing an increase in salinity, which means more fresh water is being lost through evaporation. Other areas are getting more rainfall and therefore lower salinity. We don't know why. We just know something fundamental is going on in the water cycle."

With Aquarius's comprehensive look at global salinity, scientists will have more clues to put it all together. Aquarius has collected as many sea surface salinity measurements in the first few months as the entire 125-year historical record from ships and buoys.

"By this time next year, we'll have met two of our goals: a new global map of annual average salinity and a better understanding of the seasonal cycles that determine climate."

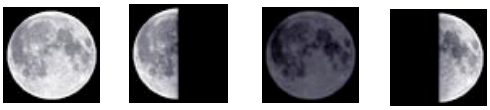
This article was provided by the Jet Propulsion Laboratory, California Institute of Technology, under a contract with NASA.



Aquarius produced this map of global ocean salinity. It is a composite of the first two and a half weeks of data. Yellow and red represent areas of higher salinity, with blues and purples indicating areas of lower salinity.

Almanac

For March 2012 by Bob Kelly



Mar 8 Mar 14 Mar 22 Mar 30

There are so many bright planets to see this March, but let's start with the couple that last month seemed destined to be together. In March, they come very close, but Jupiter races right by Venus and doesn't even give her a sideways glance. Venus, being very bright, gets the hint and will go and visit her Seven Sisters, the Pleiades, next month for consolation. I think they will give her bad advice and, in despair, Venus will plunge into the Sun. But don't worry, Venus' orbit will keep her out of the fire, and we'll get to see her passing right in front of the Sun in June. She'll show the King of the Planets that this is her year!

But, in the meantime, on any March evening, you can check out all the bright planets. In the beginning of the month, Mercury peaks at magnitude -1.0 on February 27th and is about 7-½ arc seconds wide when it gets to its maximum of 18 degrees out from the Sun on March 5th. This is a good time to watch Mercury's phase decrease rapidly as it dims precipitously approaching solar conjunction on the 21st.

Venus gets furthest out from the sun on March 27th at 46 degrees away. Venus is stunning at magnitude -4.4 and 23.6 arc seconds wide even while its phase shrinks from two-thirds lit to one-half this month. Jupiter, at magnitude -2.1 appears lower in the sky each day, but a good telescope will reveal its bright moons and cloud belts on its 35 arc second-wide disc. Get a look before it goes into the solar glare!

Jupiter and Venus get close enough together to excite the center focus area of our eyes from the 10th through the 15th. The meeting of the two brightest planets will be 'intuitively obvious to even the most casual observer'* and it's an opportunity for the general public to see how easy it is to see the bright planets and how they move though our skies. How small a camera can get a usable photo of this meeting? iPhones? Cell phones? Photos make great souvenirs of the great, bright pairing.

The moon joins the party a bit late, but makes great photo ops with Jupiter, Venus and the Pleiades on the 25th, 26th and 27th, respectively.

Next up is Mars. This is the time to check for details in a moderate-sized telescope as we make our closest approach on the 5th. Mars' size and brightness peaks at 13.9 arc seconds and – 1.2, diming and shrinking quickly as we pull away from Mars in our faster, inner orbit. The Northern Polar Cap is tipped toward us, but Dave Butler reports that the white cap is hard to find, but the dark areas are more clearly defined. This is not surprising as a Mars has its northern summer solstice at the end of March, with the polar cap wilting in the summer sun. Since Mars was at its furthest distance from the sun in February, we don't get closer than 63 million miles away, nearly twice as far as the 35 million mile approach back in 2003. Even light (and radio signals from the Opportunity rover) takes five minutes to cross the void between us and Mars this month.

Saturn is majestic (rings tipped open almost 15 degrees toward us) but tiny (18 arc seconds). Magnitude +0.4 Saturn is higher in the morning sky, but if you wait until later in the evening to view Mars when it is easier to see details, Saturn will come up as a bonus treat.

The extended eastern elongations of Venus and Mercury in early March will draw daring devotees of daytime observing. Avoiding the damaging light of the sun will be easier since the sun precedes these planets as they appear to move across the sky. Are there any details visible other than the shape of these planets as their phases change? Observers report that gray markings are visible on Mercury at high power with steady seeing. Venus' hot surface glows in infrared, and may be visible on its night side, dimmed by thick clouds; perhaps visible only in photographs. Observers can look for 'ashen light' on the night side, but it is hard to tell if this is real or due to artifacts in the telescope's optics.

Watch out for the effects of the shift to Daylight Time on Sunday, March 11th. Sunrise will jump

forward from 6:14 to 7:13am, but with most of the planets lining up in the evening sky, there's not as much to see in the morning. Even the moon passes low in the morning sky this month, making it harder to get a close look though our tree-lined suburban skies. Sunset time moves from 5:57 to 6:58pm, so the bright sky moves later into the evening according to our clock time. But details on Jupiter and Venus are easier to view in a bright sky, so an early start can be very rewarding. I think it's a little harder to see the equal day/equal night on the Equinox (occurring 1:14am on the 20th) when sun rise/set times are closer to 7am/pm than 6am/pm.

Comet Garradd, running about 7th magnitude, is an interesting target for binoculars or wide-field telescopes as we make our closest pass at a distance of 120 million miles. The dust and gas tails of the comet are pointing in different directions. Can we see them, or are they both only visible in photographs? Moonlight interferes when it is a few degrees from the Guardians of the Pole in the Little Dipper in the first eight days of March, but it crosses an imaginary line from the pointer stars of the Big Dipper and Polaris around the 17th- 18th , making it easier to find during moondark times.

Bob Kelly

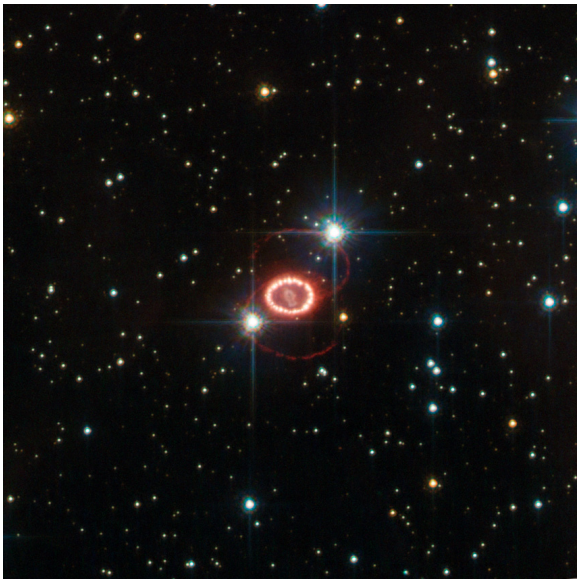
Check out Bob's Blog.

---

* Quote from my high school geometry textbook whenever the author reached a part of the proof that seemed obvious, but would take a long time to explain. I found geometry difficult no matter how casually I observed it!

Call for Astrophotos

The WAA newsletter is always looking for member Astro-photos for display in SkyWAAtch. Forward the photo to tom.boustead@westchesterastronomers.org. Include a caption describing the subject, the equipment used and how it was processed.



◀ Mystery Rings

What's causing those odd rings in supernova 1987A? Although large telescopes including the Hubble Space Telescope monitor the curious rings every few years, their origin remains a mystery. Pictured above is a Hubble image of the SN1987A remnant taken last year. Speculation into the cause of the rings includes beamed jets emanating from an otherwise hidden neutron star left over from the supernova, and the interaction of the wind from the progenitor star with gas released before the explosion.

Credit: ESA/Hubble, NASA