



**Nighttime photography techniques, like those used to capture this street scene, are also used to capture celestial objects in astrophotography.**

Photo by Bill Breeden, 35 second exposure at  $f/27$ , ISO 200.

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River Bend Astronomy club serves astronomy enthusiasts of the American Bottom region, the Mississippi River bluffs and beyond, fostering observation, education, and a spirit of camaraderie.

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Contacts

MAIL River Bend Astronomy Club
Jeff Menz
13721 Kayser Road
Highland, IL 62249-4619
WEB www.riverbendastro.org
EMAIL rbac@riverbendastro.org



Affiliated with the Astronomical League, dedicated to fostering astronomical education, providing incentives for astronomical observation and research, and assisting communication among amateur astronomical societies. www.astroleague.org



Check out our online calendar on the NASA Night Sky Network, a nationwide coalition of amateur astronomy clubs bringing the science, technology and inspiration of NASA's missions to the general public.

Monthly Meetings

Saturday, September 15, 2012 • 7:00 PM
Saturday, October 13, 2012 • 7:00 PM
Saturday, November 10, 2012 • 7:00 PM

For meeting locations, please see our calendar at www.riverbendastro.org.

Looked Up Lately?

Join River Bend Astronomy Club

Want to learn more about astronomy? The members of River Bend Astronomy Club invite you to join. You won't need expensive tools or special skills - just a passion for observing the natural world.

- Meetings offer learning, peeks through great telescopes, and fun under the stars.
You will receive the club newsletter, Current Astronomy, packed with news and photos.
Get connected with our member-only online discussion group.
Borrow from the club's multimedia library.
Borrow from the club's selection of solar telescopes.
And that's not all! Through club membership you also join the Astronomical League, with its special programs and colorful quarterly newsletter The Reflector to enrich your hobby.
We meet monthly, observe regularly, email news and quips constantly, and generally have a good time. Won't you join us?

Name \_\_\_\_\_
Address \_\_\_\_\_
City \_\_\_\_\_ State \_\_\_\_\_ Zip \_\_\_\_\_
Phone \_\_\_\_\_
Email address \_\_\_\_\_
Where did you hear of our club? \_\_\_\_\_

How long have you been interested in astronomy? \_\_\_\_\_
Do you have optical equipment? \_\_\_\_\_
Are you afraid of the dark? \_\_\_Yes \_\_\_No (just kidding)
I am submitted my application for:
\_\_\_\_\_Adult Membership(s) \_\_\_\_\_Youth Membership(s)
\$20/year each \$15/year each
(18 yrs. and up) (17 yrs. and under)
I enclose a check for \$\_\_\_\_\_ made out to:
Mike Veith, Treasurer, RBAC
Signature \_\_\_\_\_
Date \_\_\_\_\_

Mail to: River Bend Astronomy Club
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Questions? Contact us by email at rbac@riverbendastro.org.

## Nighttime Photography Techniques

By Bill Breeden

Taking pictures at night is nothing like taking pictures during the light of day. During the day, it can be as easy as point and click. At night, most people rely on their camera's flash capabilities to capture people or events at night, but these pictures seldom capture the true "feeling" of night time. Often, the photographs come out with a brightly-lit face against a very dark background.

In order to capture the "feeling" of nighttime in pictures, a little planning goes a long way. I have been slowly (but surely) learning my way around nighttime photography, so I am going to share what I have learned so far.

First, do not use the flash. Most digital cameras have a way to turn off the flash. Point-and-shoot cameras will automatically take longer exposures with the flash turned off, so you should use a tripod, or find a ledge to set the camera on. If you have exposure time settings, experiment with 30 second exposures for city nighttime scenes, and longer exposures in darker locations.

The photograph below approximates the nighttime scene on my street as my eye perceives it. Note that this exposure allows the sky to appear dark (with sky glow and light pollution apparent), and the street lights illuminating the street. Passing cars appear as streaks of light in this 30-second exposure.



This is my urban street looking eastward, 30 second exposure at f/19, ISO 200. Photo by Bill Breeden.

You can vary the exposure time to increase or decrease the brightness of the image. You can also vary the aperture, but I found that medium to small aperture settings (f/12 to f/27) seemed to give me the right balance of clarity and exposure time. You can also try different ISO settings. ISO 800 is probably most common for astrophotography, but I chose a lower ISO since my street is brightly lit. Lower ISO's are typically used for daytime pictures.



Surprise! A longer exposure (40 seconds) at f/9.5 (more open aperture), results in over-exposure. ISO remained at 200. Photo by Bill Breeden.

I hope this little tutorial encourages you to try some nighttime picture taking, the first step toward astrophotography! **RBAC**



## Wide Field Astrophotography with the Vixen Polarie

By Joe Lopinot

Like many others, my first steps into AP were with my Canon DSLR on a photo tripod. I learned to compose star trail shots, constellations and conjunctions with interesting foregrounds, and wide angle swaths of the summer Milky Way. More importantly, I began to understand about the interaction between focal ratio, ISO settings, exposure times and how they conspire with local light pollution conditions to limit what can be accomplished with such a basic setup.

After a few months I tried my hand at constructing a DIY barn door tracker with instructions I snagged from the internet. It took me about two hours one evening to put it together from 1x2s, a piano hinge, a ¼ 20 lag screw, a rubber band and a few bolts. The tracker mounted to my tripod and I purchased a small sight scope to lay along the piano hinge and manually polar align the hinge to the north celestial pole. I mastered moving the screw (which moved the camera at the sidereal rate) based upon the focal length of the lens being used. My 20 second shots with a 20mm lens on the tripod only could now go 1 to 2 minutes with the barn door tracker, and still yield round stars. At 200mm, the alignment became more critical and the tracking more difficult, although I could still get 30 seconds at this focal length if all went well. Without the tracker, 2-3 seconds at 200mm is the limit before stars begin to streak on the image.

I had finally saved my pennies and purchased an Orion Atlas EQ mount and a 4" Astro Tech apochromatic refractor; I had a whole new universe of skills to learn and problems to solve and left the tracker to gather dust. I occasionally put the wide angle lens or the 200mm Canon on the Atlas, but if I was going through the hassle of setting everything up, I generally was shooting through the AT106 or my 65mm AT refractor. I was hoping for a better solution to do wide angle AP, one that I could travel with easily and setup in a few minutes. I read up on the AstroTrac, but it seemed cumbersome and not easy to tote around. Then along came Vixen and their Polarie Star Tracker.



Polarie with Polar Scope. Photo by Joe Lopinot.

The Polarie weighs a little over 3 pounds and is not much bigger than your hand. It is very solidly constructed and will run for over two hours on two AA batteries, although I usually have it running through a USB port on the Netbook I use in the field. A sight hole in the upper right corner allows for rough alignment with Polaris and an illuminated tilt meter helps set your latitude and center the North Star. An optional polar scope fits in the middle of the Polarie and is necessary when imaging with lens bigger than 50mm, although the rough alignment is sufficient with wide angle lenses. Dials on the scope allow you

to set the day and time, set the offset to the standard time meridian for your time zone, and level the scope within the Polarie; the reticle will then be positioned correctly for the current hour angle of Polaris. Moving the Polarie to center the North Star on the positioned reticle can be tricky and takes some practice. The literature indicates a ball head on the photo tripod works well with the Polarie to make the minute adjustments required to align, but I prefer the pan and scan head that came with my tripod.

The mode dial allows selection of sidereal, lunar and solar rates, and also includes an option for tracking at half sidereal rate. This is especially handy when framing a shot that includes buildings or landscapes in the foreground, helping to minimize the smearing that occurs as the unit tracks the stars. A second ball head attaches to the silver dial on the front of the unit and holds the camera body and lens, tracking at the selected rate. Once the tracker is aligned, roughly through the site hole and/or accurately with the polar scope, one must be careful not to bump the tripod and exercise care when attaching the camera and lens to the front of the Polarie. The lock on the camera ball head is then released and the camera / lens is carefully moved to the target; I have found that a green laser comes in very handy to determine exactly where the camera is pointed and make final adjustments to the target.

Although for quickies I use the batteries in the camera and the Polarie, I prefer to connect both to my Netbook and hook into a 12v battery or home current and not worry about power running out. This also allows me to use the excellent Canon

control software *Backyard EOS*, a great help in framing and focusing the selected target. The length and number of exposures, as well as the ISO and f stop, can be controlled by *Backyard EOS*, allowing walk away imaging sessions when all is set up and good to go. I can go from setup to automated imaging in about 15 minutes, a bit longer with the 200mm lens on a dim target to fine tune the finding and framing. Depending on the focal length and the location of the target - those near the celestial equator require very accurate alignment at longer focal lengths - I can easily get 3 minute exposures at 200mm and 10 minutes or more with a wide angle 20mm lens. Lightweight, compact, easy to use and amazingly accurate, the Polarie has proven to be exactly what I was looking for.



This beautiful Andromeda (M31) image is fifteen 3 minute exposures on a night when I nailed the alignment, the stars are perfectly round to the edge of the image. Photo by Joe Lopinot.

The pictures with this article include a shot of the Polarie and the polar alignment scope, with the date and time dials showing on the backside of the scope. The very deep Milky Way shot is sixteen 5 minute exposures at 20mm; the beautiful Andromeda image is fifteen 3 minute exposures on a night when I nailed the alignment, the stars are perfectly round to



The very deep Milky Way shot is sixteen 5 minute exposures at 20mm.  
Photo by Joe Lopinot.

the edge of the image. I was lucky to get both of these images under absolutely clear and pristine skies in Manitoba, on a fishing trip Mary and I took in August. Both images were stacked with Maxim DL and include calibration with dark frames, although I did not use flat frames as I typically do with my refractors. *Photoshop CS5* was used to process the images, along

with noise reduction software and sharpening in *Photoshop* with a high pass filter. With a little practice and patience, it is clear the Vixen Polaris is an excellent platform for the amateur wide field astrophotographer, and can yield fine images of celestial gems with a minimum of equipment and setup time. RBAC



## Have You Looked at your Tripod Lately?

By Mike Veith

So you put big money into that dream telescope of yours and loaded it down with good-quality eyepieces and accessories. You carefully clean the optics and may even polish the tube once in awhile. You really baby that thing, don't you? But, do you pay much attention to the condition of the tripod? If one of the legs fails, you could be out thousands of dollars when your baby hits the patio bricks!

Many of the telescopes offered today come with tubular-legged tripods which have plastic ferrules on each end of the non-extendable legs. The upper ferrule attaches the tubular leg to the tripod base plate and the lower ferrule acts to hold the thumbscrew for locking the extendable leg in place. The thumbscrew, when screwed in, pushes a metal strip against the extendable leg, holding it in place by friction.

In the Fall of 2010, while setting up my telescope for an outreach program, I set the tripod in place and put my weight on it to press the leg spikes into the soil. One of the extendable legs gave way and I nearly flipped over the tripod. I had firmly screwed in the thumbscrews and thought the legs were locked in place. However, the plastic ferrule was cracked on both sides of the threaded bushing, through which the thumbscrew passes, and as pressure was put on the extendable leg the

plastic pushed out reducing the needed friction (see figure 1). The other two legs also had damaged ferrules.



Fig.1. The plastic ferrule was cracked on both sides of the threaded bushing, through which the thumbscrew passes. Photo by Mike Veith.

The repair I decided to try was the use of stainless steel hose clamps from Home Depot. The thumbscrews were removed from each ferrule to allow the cracked plastic to return to the un-tensioned position. Hose clamps were then positioned above and below the threaded bushing of each ferrule and firmly tightened (figure 2). The repair has been in place for nearly two years and no further damage has been noted.



Fig. 2: The thumbscrews were removed from each ferrule to allow the cracked plastic to return to the un-tensioned position. Hose clamps were then positioned above and below the threaded bushing of each ferrule and firmly tightened. Photo by Mike Veith.

Another problem found while repairing the cracked ferrules was a failure of the glue used to attach the upper and lower ferrules to one the tubular legs. It appeared that the glue had dried out or shrunk and was no longer bonded to the metal leg. I decided to use Gorilla Glue™ for the repair because it expands during the curing process and I thought that might increase the bonding area. Care was needed while applying the glue to avoid it running into the extendable leg component and bonding the wrong parts.

A moist cloth was used to wipe off the excess glue as it expanded out of the ferrule to leave a thin, exposed bead (figure 3). I now regularly check the other two legs for glue failure.



Fig. 3: A moist cloth was used to wipe off the excess glue as it expanded out of the ferrule to leave a thin, exposed bead. Photo by Mike Veith.

You take great care to protect and keep your telescope optics in pristine condition. Don't forget about the integral part your tripod plays in enjoying those optics. RBAC





## A Brand New Age: Queue Observing at Mt. Paranal

By Dr. Marc J. Kuchner

First a caravan of white observatory cars arrives, winding up the narrow road to the 2600-m- (~8500-foot-) high summit. Then the shutters around the domes open, and rays from the setting sun alight on colossal mirrors and metal struts. It's the beginning of another busy night at Mt. Paranal, Chile, where I am learning about new, more efficient ways of managing a modern observatory.

I stepped into the observatory's control room to soak up some of the new, unfamiliar culture. Here, under florescent lights and drop ceilings are banks of computer screens, one bank to control each of the four big telescopes on the mountaintop and a few others too. At each bank sits two people, a telescope operator and an astronomer.

The layout of this workspace was not unfamiliar to me. But the way these Mt. Paranal astronomers work certainly was. When I was cutting my teeth at Mt. Palomar observatory in California, I would only go to the telescope to take my own data. In stark contrast, everyone observing at Mt Paranal tonight is taking data for someone else.

The Mt. Paranal astronomers each spend 105 nights a year here on the mountain performing various duties, including taking data for other astronomers. The latter, they call "executing the queue." Headquarters in Germany decides what parts of the sky will have priority on any given night (the queue). Then the Mt. Paranal astronomers march up the mountain and carry out this program, choosing calibrators, filling the log books, and adapting to changing conditions. They send the data back to

headquarters, and from there it makes its way out to the wider astronomical community for study.

This new way of working allows the Mt. Paranal astronomers to specialize in just one or two telescope instruments each. Surely this plan is more efficient than the old-fashioned way, where each of us had to learn every instrument we used from scratch—sifting through manuals at 3:00 AM when the filter wheel got stuck or the cryogen ran out, watching precious observing time tick away. Here at Mt. Paranal, much of the work is done in a big room full of people, not off by yourself, reducing some dangers of the process. Also, queue observing cuts down on plane travel, an important step for cutting carbon emissions.

It's a brand new age, I thought as I watched the giant domes spin in the silent, cold Chilean night. And maybe with queue observing, some of the romance is gone. Still, my colleagues and I couldn't help saying as we stared out across the moonlit mountains: I can't believe how lucky we are to be here.



European Southern Observatory at Mt. Paranal, Chile.

*Dr. Marc J. Kuchner is an astrophysicist at the Exoplanets and Stellar Astrophysics Laboratory at NASA's Goddard Space Flight Center. NASA's Astrophysics Division works on big questions about the origin and evolution of the universe, galaxies, and planetary systems. Explore more at <http://www.science.nasa.gov/astrophysics/>. Kids can explore these topics at <http://spaceplace.nasa.gov/space>*

*This article was provided by the Jet Propulsion Laboratory, California Institute of Technology, under a contract with the National Aeronautics and Space Administration.*

## Doing Science with a Spacecraft's Signal

By David Doody

Mariner 2 to Venus, the first interplanetary flight, was launched August 27 fifty years ago. This was a time when scientists were first learning that Venus might not harbor jungles under its thick atmosphere after all. A Russian scientist had discovered that atmosphere during the rare Venus transit of 1761, because of the effects of sunlight from behind.

Mariner 2 proved interplanetary flight was possible, and our ability to take close-up images of other planets would be richly rewarding in scientific return. But it also meant we could use the spacecraft itself as a "light" source, planting it behind an object of our choosing and making direct measurements.

Mariner 4 did the first occultation experiment of this sort when it passed behind Mars as seen from Earth in July 1965. But, instead of visible light from the Sun, this occultation experiment used the spacecraft's approximately 2-GHz radio signal.

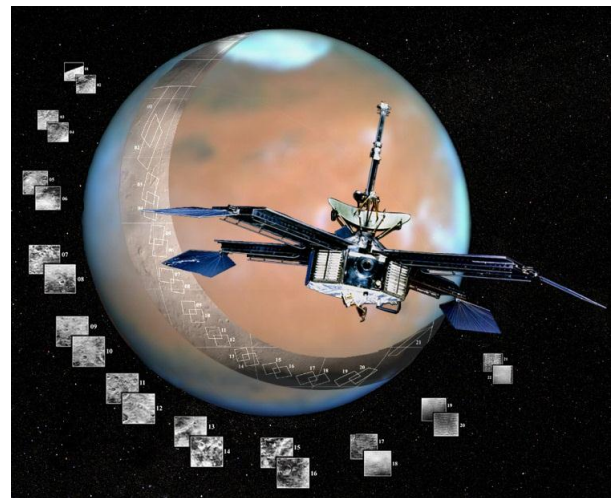
The Mariner 4 experiment revealed Mars' thin atmosphere. Since then, successful radio science occultation experiments have been conducted at every planet and many large moons. And another one is on schedule to investigate Pluto and its companion Charon, when the New Horizons spacecraft flies by in July 2015. Also, during that flyby, a different kind of radio science occultation experiment will investigate the gravitational field.

The most recent radio science occultation experiment took place September 2, 2012, when the Cassini spacecraft carried its three transmitters behind Saturn. These three different frequencies are all kept

precisely "in tune" with one another, based on a reference frequency sent from Earth. Compared to observations of the free space for calibration just before ingress to occultation, the experiment makes it possible to tease out a wide variety of components in Saturn's ionosphere and atmosphere.

Occultation experiments comprise only one of many categories of radio science experiments. Others include tests of General Relativity, studying the solar corona, mapping gravity fields, determining mass, and more. They all rely on NASA's Deep Space Network to capture the signals, which are then archived and studied.

Find out more about spacecraft science experiments in "Basics of Space Flight," a website and book by this author, <http://jpl.nasa.gov/basics>. Kids can learn all about NASA's Deep Space Network by playing the "Uplink-Downlink" game at <http://spaceplace.nasa.gov/dsn-game>.



*In this poster art of Mariner 4, you can see the parabolic reflector atop the spacecraft bus. Like the reflector inside a flashlight, it sends a beam of electromagnetic energy in a particular direction.  
Credit: NASA/JPL/Corby Waste.*

## RBAC's Monthly Observing Lists

These lists include brighter deep-sky objects that transit near 10:00 PM each month.



### September Observing List

Prepared by Bill Breeden

#### Double Stars (Astronomical League's Double Star List)

- \_\_\_\_\_ 87. 31 Cygni SAO 49337 Const. CYG Type DS RA 20 13.6 Decl. +46° 44' Mag. 3.8 6.7 4.8
- \_\_\_\_\_ 88. Alpha Capricorni SAO 163422 Al Giedi Const. CAP Type DS RA 20 18.1 Decl. -12° 33' Mag. 3.6 4.2
- \_\_\_\_\_ 89. Beta Capricorni SAO 163481 Dabih Const. CAP Type DS RA 20 21.0 Decl. -14° 47' Mag. 3.4 6.2
- \_\_\_\_\_ 90. Gamma Delphini SAO 106475 Const. DEL Type DS RA 20 46.7 Decl. +16° 07' Mag. 4.5 5.5
- \_\_\_\_\_ 91. 61 Cygni SAO 70919 Const. CYG Type DS RA 21 06.9 Decl. +38° 45' Mag. 5.2 6.0
- \_\_\_\_\_ 92. Beta Cephei SAO 10057 Alfirk Const. CEP Type DS RA 21 28.7 Decl. +70° 34' Mag. 3.2 7.9
- \_\_\_\_\_ 93. Struve 2816 SAO 33626 - Const. Type DS RA 21 39.0 Decl. +57° 29' Mag. 5.6 7.7 7.8
- \_\_\_\_\_ 94. Epsilon Pegasi SAO 127029 Enif Const. PEG Type DS RA 21 44.2 Decl. +09° 52' Mag. 2.4 8.4

#### Carbon Stars (Astronomical League's Carbon Star List)

- \_\_\_\_\_ 80. V1469 Aquilae SAO 125356 RA 20 01 03 Decl. +09 30 51 Mag. 8.4 – 8.7 Per. 98 Class C4 (N0v)
- \_\_\_\_\_ 81. BF Sagittae GSC 1629:945 RA 20 02 23 Decl. +21 05 24 Mag. 8.5 – 10.0 Per. 177 Class C4 (N3)
- \_\_\_\_\_ 82. X Sagittae HD 190606 RA 20 05 05 Decl. +20 38 51 Mag. 7.0 – 9.7 Per. 196 Class C6 (N3)
- \_\_\_\_\_ 83. SV Cygni GSC 3563:462 RA 20 09 30 Decl. +47 52 17 Mag. 8.5 – 8.7 Per. ? Class C5 – C7462 (N3)
- \_\_\_\_\_ 84. RY Cygni GSC 2683:3082 RA 20 10 23 Decl. +35 56 50 Mag. 8.5 – 10.3 Per. Irr. Class C4 – C6 (N)
- \_\_\_\_\_ 85. RS Cygni SAO 69636 RA 20 13 23 Decl. +38 43 44 Mag. 6.5 – 9.5 Per. 417 Class C8 (N0pe)
- \_\_\_\_\_ 86. RT Capricorni GSC 6340:1015 RA 20 17 06 Decl. -21 19 04 Mag. 7.0 – 8.1 Per. 393 Class C6 (N3)
- \_\_\_\_\_ 87. U Cygni SAO 49477 RA 20 19 36 Decl. +47 53 39 Mag. 5.9 – 12.1 Per. 463 Class C7 – C9 (Npe)
- \_\_\_\_\_ 88. V Cygni SAO 49940 RA 20 41 18 Decl. +48 08 28 Mag. 7.7 – 13.9 Per. 421 Class C5 – C7 (Npe)
- \_\_\_\_\_ 89. CY Cygni SAO 50053 RA 20 46 50 Decl. +46 03 06 Mag. 7.9 – 8.4 Per. ? Class C5 (M2p)
- \_\_\_\_\_ 90. SAO 106516 (Delphinus) GSC 1651:1359 RA 20 48 36 Decl. +17 50 23 Mag. 7.9 – 8.1 Per. ? Class C1

(R0)

- \_\_\_\_\_ 91. NSV 13571 (Vulpecula) SAO 89499 RA 21 09 59 Decl. +26 36 54 Mag. 8.1 – 8.2 Per. ? Class C1 (Kp)
- \_\_\_\_\_ 92. S Cephei SAO 10100 RA 21 35 12 Decl. +78 37 28 Mag. 7.4 – 12.9 Per. 487 Class C7 (N8e)
- \_\_\_\_\_ 93. V460 Cygni SAO 71613 RA 21 42 01 Decl. +35 30 36 Mag. 5.6 – 7.0 Per. 180 Class C6 (N1)
- \_\_\_\_\_ 94. RV Cygni SAO 71642 RA 21 43 16 Decl. +38 01 02 Mag. 7.1 – 9.3 Per. 263 Class C6 (N5)
- \_\_\_\_\_ Mu Cephei (not carbon) RA 21 43 30 Decl. +58 47 48 Mag. 3.4 - 5.1 Per. Class
- \_\_\_\_\_ 95. RX Pegasi HD 208526 RA 21 56 22 Decl. +22 51 39 Mag. 7.7 – 9.5 Per. 629 Class C4 (N3)

#### Messier Objects

- \_\_\_\_\_ M2 NGC7089 Const. AQR Type GC RA 21 33.5 Decl. -00 49 Mag. 6.3
- \_\_\_\_\_ M15 NGC7078 Const. PEG Type GC RA 21 30.0 Decl. +12 10 Mag. 6
- \_\_\_\_\_ M29 NGC6913 Const. CYG Type OC RA 20 23.9 Decl. +38 32 Mag. 7.1
- \_\_\_\_\_ M30 NGC7099 Const. CAP Type GC RA 21 40.4 Decl. -23 11 Mag. 8.4
- \_\_\_\_\_ M39 NGC7092 Const. CYG Type OC RA 21 32.2 Decl. +48 26 Mag. 5.2
- \_\_\_\_\_ M72 NGC6981 Const. AQR Type GC RA 20 53.5 Decl. -12 32 Mag. 9.8
- \_\_\_\_\_ M73 NGC6994 Const. AQR Type A RA 20 58.9 Decl. -12 38 Mag. 9
- \_\_\_\_\_ M75 NGC6864 Const. SGR Type GC RA 20 06.1 Decl. -21 55 Mag. 8

#### Caldwell Objects

- \_\_\_\_\_ C4 NGC7023 Const. CEP Type BN RA 21 01 48.00 Decl. +68 12 00.0 Mag. 6.8
- \_\_\_\_\_ C12 NGC6946 Const. CEP Type SG RA 20 34 48.00 Decl. +60 09 00.0 Mag. 9.7
- \_\_\_\_\_ C19 IC5146 Cocoon Nebula Const. CYG Type BN RA 21 53 30.00 Decl. +47 16 00.0 Mag. 10



\_\_\_\_\_ C20 NGC7000 North America Nebula Const. CYG Type BN RA 20 58 48.00 Decl. +44 20 00.0 Mag. 6  
\_\_\_\_\_ C27 NGC6888 Crescent Nebula Const. CYG Type BN RA 20 12 00.00 Decl. +38 21 00.0 Mag. 7.5  
\_\_\_\_\_ C3 NGC6992/5 East Veil Nebula Const. CYG Type SN RA 20 56 24.00 Decl. +31 43 00.0 Mag.  
\_\_\_\_\_ C34 NGC6960 West Veil Nebula Const. CYG Type SN RA 20 45 42.00 Decl. +30 43 00.0 Mag.  
\_\_\_\_\_ C37 NGC6885 Const. VUL Type OC RA 20 12 00.00 Decl. +26 29 00.0 Mag. 5.7  
\_\_\_\_\_ C42 NGC7006 Const. DEL Type GC RA 21 01 30.00 Decl. +16 11 00.0 Mag. 10.6  
\_\_\_\_\_ C47 NGC6934 Const. DEL Type GC RA 20 34 12.00 Decl. +07 24 00.0 Mag. 8.9  
\_\_\_\_\_ C55 NGC7009 Saturn Nebula Const. AQR Type PN RA 21 04 12.00 Decl. -11 22 00.0 Mag. 8.3

Royal Astronomical Society of Canada Objects

\_\_\_\_\_ 1. NGC7009 Saturn Nebula Const. AQR Type PN RA 21 04.2 Decl. -11 02 Mag. 8.3  
\_\_\_\_\_ 98. NGC6888 Const. CYG Type SNR? RA 20 12.0 Decl. +38 21 Mag.  
\_\_\_\_\_ 99a. NGC6960 West Veil Nebula Const. CYG Type SNR RA 20 45.7 Decl. +30 43 Mag.  
\_\_\_\_\_ 99b. NGC6992/5 East Veil Nebula Const. CYG Type SNR RA 20 56.4 Decl. +31 43 Mag.  
\_\_\_\_\_ 100. NGC7000 North America Nebula Const. CYG Type EN RA 20 58.8 Decl. +44 20 Mag. 6  
\_\_\_\_\_ 101. NGC7027 Const. CYG Type PN? RA 21 07.1 Decl. +42 14 Mag. 10.4  
\_\_\_\_\_ 106. NGC6940 Const. VUL Type OC RA 20 34.6 Decl. +28 18 Mag. 6.3  
\_\_\_\_\_ 107. NGC6939 Const. CEP Type OC RA 20 31.4 Decl. +60 38 Mag. 7.8  
\_\_\_\_\_ 108. NGC6946 Const. CEP Type G-Sc RA 20 34.8 Decl. +60 09 Mag. 8.9  
\_\_\_\_\_ 109. NGC7129 Const. CEP Type RN RA 21 44.4 Decl. +66 10 Mag.



## October Observing List

Prepared by Bill Breeden

### Double Stars (Astronomical League's Double Star List)

- \_\_\_\_\_ 95. Xi Cephei SAO 19827 Kurhah Const. CEP Type DS RA 22 03.8 Decl. +64° 38' Mag. 4.4 6.5
- \_\_\_\_\_ 96. Zeta Aquarii SAO 146107 - Const. AQR Type DS RA 22 28.8 Decl. -00° 01' Mag. 4.3 4.5
- \_\_\_\_\_ 97. Delta Cephei SAO 34508 - Const. CEP Type DS RA 22 29.2 Decl. +58° 25' Mag. 3.9 6.3
- \_\_\_\_\_ 98. 8 Lacertae SAO 72509 - Const. LAC Type DS RA 22 35.9 Decl. +39° 38' Mag. 5.7 6.5
- \_\_\_\_\_ 99. 94 Aquarii SAO 165625 - Const. AQR Type DS RA 23 19.1 Decl. -13° 28' Mag. 5.3 7.3

### Carbon Stars (Astronomical League's Carbon Star List)

- \_\_\_\_\_ 96. RZ Pegasi GSC 2724:1872 RA 22 05 52 Decl. +33 30 24 Mag. 7.6 – 13.6 Per. 439 Class C9 (Ne)
- \_\_\_\_\_ 97. RU Aquarii SAO 165676 RA 23 24 24 Decl. -17 19 08 Mag. 8.5 – 10.1 Per. 69 Class C6 (M5e)
- \_\_\_\_\_ 98. ST Andromedae GSC 2778:765 RA 23 38 45 Decl. +35 46 21 Mag. 7.7 – 11.8 Per. 328 Class C4 – C6 (R3e)
- \_\_\_\_\_ 99. TX Piscium SAO 128374 RA 23 46 23 Decl. +03 29 12 Mag. 4.8 – 5.2 Per. Irr. Class C7 (N0)
- \_\_\_\_\_ 100. SAO 128396 (Pisces) GSC 592:649 RA 23 49 05 Decl. +06 22 56 Mag. 8.5–8.8 Per. ? Class C3 (R3)

### Messier Objects

- \_\_\_\_\_ M52 NGC7654 Const. CAS Type OC RA 23 24.2 Decl. +61 35 Mag. 7.3

### Caldwell Objects

- \_\_\_\_\_ C9 Sh2-155 Cave Nebula Const. CEP Type BN RA 22 56 48.00 Decl. +62 37 00.0 Mag. 7.7
- \_\_\_\_\_ C11 NGC7635 Bubble Nebula Const. CAS Type BN RA 23 20 42.00 Decl. +61 12 00.0 Mag. 7
- \_\_\_\_\_ C16 NGC7243 Const. LAC Type OC RA 22 15 18.00 Decl. +49 53 00.0 Mag. 6.4
- \_\_\_\_\_ C22 NGC7662 Const. AND Type PN RA 23 25 54.00 Decl. +42 33 00.0 Mag. 9.2
- \_\_\_\_\_ C30 NGC7331 Const. PEG Type SG RA 22 37 06.00 Decl. +34 25 00.0 Mag. 9.5
- \_\_\_\_\_ C44 NGC7479 Const. PEG Type SG RA 23 04 54.00 Decl. +12 19 00.0 Mag. 11
- \_\_\_\_\_ C63 NGC7293 Helix Nebula Const. AQR Type PN RA 22 29 36.00 Decl. -20 48 00.0 Mag. 6.5

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- \_\_\_\_\_ 2. NGC7293 Const. AQR Type PN RA 22 29.6 Decl. -20 48 Mag. 6.5
- \_\_\_\_\_ 3. NGC7331 Const. PEG Type G-Sb RA 22 37.1 Decl. +34 25 Mag. 9.5
- \_\_\_\_\_ 4. NGC7635 Const. CAS Type EN RA 23 20.7 Decl. +61 12 Mag. -
- \_\_\_\_\_ 5. NGC7789 Const. CAS Type OC RA 23 57.0 Decl. +56 44 Mag. 6.7
- \_\_\_\_\_ 11. NGC7662 Blue Snowball Const. AND Type PN RA 23 25.9 Decl. +42 33 Mag. 9.2

**Happy Observing!**