A S T R O N O M Y

Rochester Skies

A publication of the Rochester Astronomy Club

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Three's Company

by President Randy Hemann

Three is an important number for us amateur astronomers. Most of our telescopes rely on the simplicity and stability of the three-legged mount we call a *tri*pod. I suppose this came to be only after early astronomers realized how frustrating it was using a bipod, and how much time they wasted leveling out a quadpod.

Three laws have defined most of our astronomical mathematics through the Newton era, and for just about all of our own natural experiences through life. That is, until Mr. Einstein ruined it. More on that later.

Let's look at Newton's 3 laws of motion quickly:

1. Inertia: a body in motion prefers to stay in motion – besides slowing down meetings at the workplace, this is why we should wear seat-belts.
2. Force equals mass times acceleration: stated another way, the bigger the object, the bigger the force needed to move the object – this is why it is more fun to kick a soccer ball than a dining table leg.
3. For every action, there is an equal but opposite re-action. This works extremely well in physics, but not always so well in poker, dodge ball, or global politics.

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I would say the next most notable set of 3 laws belong to Kepler. While Newton's laws show us where to accurately fire a cannon here on earth, Kepler tells us where to accurately fire a spaceship to the moon. Kepler's laws state:

1. Planets orbit in ellipses, not in circles. Are there any exceptions? If you have an accurate enough measuring stick, probably not.
2. The line connecting the Sun to a planet sweeps equal areas in equal times. This makes a planet speed up in its orbit when close to the sun i.e., it is "falling faster into the sun" and slow down slightly when it's away and gravity "pulls" less.
3. The square of the orbital period of a planet is proportional to the cube of the mean distance from the Sun, which basically lets us predict the distances of planets from the sun using distance ratios and not necessarily actual distances. This last law is used extensively these days by astronomers to estimate if recently discovered exoplanets lie in the habitable zone (earth-like distance) of its parent star.

Now if we are sending spaceships or probes to distant celestial bodies, aerodynamic flight is controlled by these 3: yaw, pitch, and roll. This is not the same as stop, drop, and roll when you catch on fire, but explains how to control your vehicle's orientation when you don't have 2 or 3 or 4 (average = 3) wheels on terra firma.

Finally, we have our 3 dimensions of space: length, width, and height which orientate our senses in space, allowing us to *tri*-angulate ourselves around the planet with some degree of certainty. But alas, this is where our 3s end, as relativity redefines our surroundings as not just space, but the 4 dimensions of space-time. So this means they had to program into our global positioning satellites the correction factor that accounts for time slowing down in a gravitational field. However, this is forgivable because now my car's GPS works better too.

The Solar System/Planetary Observer's Award - Part II

by Dean Johnson

The Solar System/Planetary Observers Club requires us amateur astronomers to complete at least 25 projects observing the different objects in the Solar System to attain a certificate and pin. Quite a few of these projects require repeated observations, are time sensitive, and can last for many months. Out of all the Observing Clubs I have participated in, this is the most challenging one I have yet completed, and one that I have been compiling some observations for without realizing at the time that those observations were crucial to attain that goal.

The SSPOC observing list is thirteen pages long, and in this article I will run through the part dealing with the Sun and the Moon. The list is divided into three parts: 1. The Projects for the Sun and Moon. 2. The Inner Solar System and 3. The Outer Solar System.

The first project for the Sun listed was to record the position of the Sun as it rises OR sets. Please note that it does not have to be

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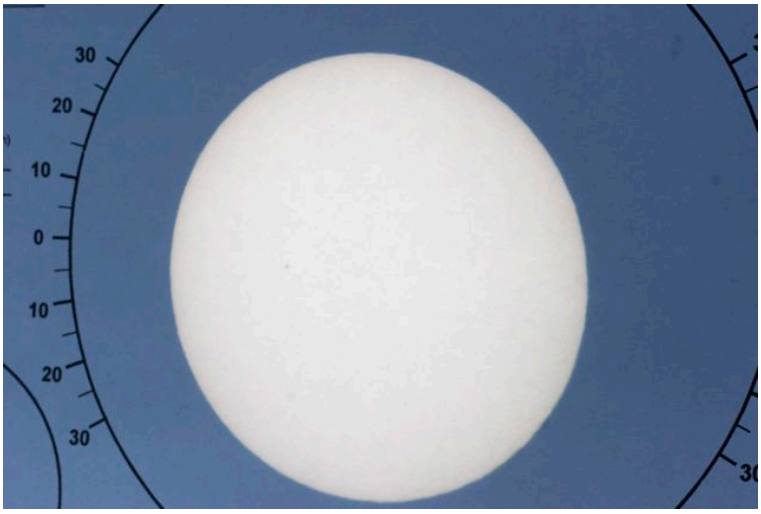
both. When I realized I had several of the observations needed for this club, I took the time to check out which ones I didn't have and this one was the first I noticed. During the summer of 2010 starting July 19th, I drove my trusty minivan down to the Flatin Farm to get my first observation. The Flatin Farm was a cornfield that year, so as the year went on and the corn got higher, I ended up sitting on the roof of my van to watch and record the position of sunset. There were many times the Bergsgaards and Ruds drove in and out of that dead end road where they live and they must have wondered "What the heck is Dean up to now?" An observer needs 6 to 8 observations in the summer or winter and 4 for the spring or fall. Since you need the time, day, month and year, I just drew a picture of the horizon and used the same page for each observation. Sure enough, the position of the Sun changes little by little with each observation.

The second project is a total solar eclipse. This is where my excursion with the Spring Grove buddies to Winnipeg paid off handsomely. *(Editor's Note: See 1Q 2011 issue for Dean's description of this eclipse.)* My good friend Jerald Oakes takes lots of pictures and he is as meticulous about recording the events in his life as I am in journaling my astronomical observations. It was easy to recall the solar eclipse and with "Squibb's" pictures, this was no problem to re-create. Randy Shekeruk is a shoo-in for this aspect of the SSPOC list.

Recording sunspots is the third and final project for the Sun. Most of us that are die hard amateurs have a way of observing the Sun, and if you don't want to spend money on a solar filter, you can simply use the projection method. Full-disc drawings of the Sun with all visible Sunspots are required, along with the umbra and penumbra that show. I sent in about a half dozen of these. Later this summer, I'm going to tackle the



Sunspotters award, but you have to follow the Sun through two complete revolutions and as of yet, I haven't had the giddyup to track the Sun through 56 consecutive days.

The Moon has six categories of observations that need to be satisfied: Maria, Highlands, Crater Ages, Scarps, Occultations, and Lunar Eclipses. Since I have completed the Lunar 100 and am halfway through Lunar II, I had all of the categories completed and simply needed to copy them to satisfy this requirement. Most every amateur astronomer can tell the difference between the maria and highlands, and all you need to satisfy crater ages is to look for the craters that show bright ejecta from impact. If they show this, then those craters have occurred within the last 20 per cent of the Moon's history and not enough "space weathering" from micro-meteorite bombardment has occurred to dull the subsurface material to the color of the rest of the landscape. Craters such as Tycho, Copernicus, Kepler and Aristarchus are good examples of this.

Occultations are an interesting aspect of Lunar observing, and an amateur needs an occultation of a star and an occultation of a planet to satisfy this category.

I had a dandy of a star occultation when I witnessed the Moon occult Antares on March 3rd of 2005. This was less than a year after I joined the RAC in June of 2004. I had slept in the living room that night because I didn't want to wake my lovely wife Betty when I got up at 3:30 in the morning. I was going to go out to the Flatin Farm hayfield to witness the event, but I couldn't find my van keys! They had fallen out of my pants pocket and were buried deep into the couch and I needed to get my butt in gear and get set up. I went outside to the back yard, but didn't have a good line of sight because of the trees in front of our house and Betty's Dad's house which is right next door. But I figured out that if I set up my scope by

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Grandpa's mailbox, I could see under the trees to where the Moon and Antares were now drawing very close together.

The one drawback was that Grandpa's mailbox is right under a streetlight. So I grabbed my cloak, threw it over my head and sat low to watch the Moon cover Antares. The mount's legs were not extended so I could better see under the branches of the trees across the street. I must have looked like an old hunchback.

Lo and behold, I heard a car stop right by me. The lady that delivers the Winona Daily News was putting Grandpa's paper in his mailbox. It was now 4 a.m. I threw my cloak back off my head. "Hello", I said. "Hello", she said back, a little nervously and quickly jumped back in her car and took off. I bet she was wondering what the heck I was up to.

The Moon covered Antares at 4:35 a.m. and disappeared behind the Moon north of the crater Grimaldi and south of the crater Hedin. I now had 45 minutes to go back inside and warm up because it was REALLY cold! I didn't have my Air Force parka back in those days.

At 5:15, I set up my scope in the back yard because the Moon had cleared Grandpa's house by then. I started watching through the scope at 5:30 and about 5:45 I noticed a beautiful blue-white star appear. I thought, "That's not Antares!" Five seconds later BOOM!! Antares appeared and completely obliterated that blue-white star. But now I can say beyond all doubt that I am one of the few people to have seen Antares B. The pair exited the Moon just above and to the right of Mare Crisium.

The occultation of a planet was the Venus occultation in daylight for North America on April 22, 2009. At 4 a.m. the sky was completely clear, a beautiful spring morning. The Moon and Venus glowed brightly together above my neighbors house across the street. I packed up my gear and went out to my favorite nephew's farm to show Matthew and his kids the occultation. This was a difficult one to pull off. By 7:30 a.m. the Moon and Venus were nearly impossible to see naked eye, and I could only see contact at 7:38 through my telescope. But see it and record it I did.

I had seen the Moon eclipse Venus at Christmastime in 1978 and I saw the Moon occult Saturn when I worked out at Shooting Star Native Grasses on the graveyard shift with my little 70mm Meade telescope. I think that was in the late 90's or early 2000's. But I did not journal either of those two. I saw Mars a couple of degrees above the Moon in 2005, but have never seen an occultation of the Red Planet or Jupiter. I'd really love to see a Jupiter occultation.

For lunar eclipses, I had a dandy set of three, each one a little different. On March 3rd, 2007 almost exactly two years after the Antares occultation, I saw the Moon rise on the eastern horizon while coming out of total eclipse. It was another brutally cold evening,

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but to see the Moon rising as a slim cresent during that time of the day was very special. Also special was that I saw the "green flash" just above the Sun's disc as it set into the western horizon. That's an "extra credit" for the SSPOC list if you are wondering. Northern lights, gegenschein and zodiacal light also fall into this category.

The second of the three eclipses was the morning of August 28, 2007. This eclipse started about 3 a.m., but it was very hard to tell exactly when because the atmosphere held so much moisture and made precise timing difficult. The first 30 degrees of sky from the horizon to the zenith was murky, and only directly above was the transparency really good. I watched the Moon darken and by 3:42, the umbral shadow started to march across the lunar surface. By 4:45 the Moon had a "Cheshire Cat" smile to it, and at 4:55 was totally eclipsed. I watched it until sunrise and went home. It wasn't the best eclipse I've ever seen, but I was glad I saw it.

The third of the three lunar eclipses was the total eclipse of the Moon for February 20th, 2008. This was the one that broke "The Winter of Astronomical Discontent", for the winter of 2007-2008 was a particularly cold, cloudy and bitter time that allowed few chances for stargazing. However, the night of Feb. 20, while very cold (-15F), did not have any wind. The Moon rose at 5:28 p.m., was obviously in the penumbral shadow by 7:20 p.m. and the umbral shadow touched the Moon near Grimaldi at 7:40 p.m.

Grimaldi was covered by 7:45, Copernicus at 8 p.m., Plato at 8:05, Tycho at 8:27 and Mare Crisium (midpoint) was at 8:35 p.m. Totality set in at 9 p.m.

I got good looks at Saturn, which with Regulus in Leo were bracketing the Moon. Mars was a treat to look at and I nabbed three Binocular Deep Sky objects (NGC's 1662, 1807 and 1817) while totality was going on. The Moon began emerging from the umbral shadow at 9:50 p.m. I stayed with it until the umbral shadow left the Moon at 11:10 p.m. and then packed up and went home to thaw out.

That third eclipse was the best one that I recorded and I'm pretty sure that got me over the hurdle on Lunar eclipses. The next installment of the Solar System/ Planetary Observers Club will deal with the inner Solar System.

Until then, Clear Skies!

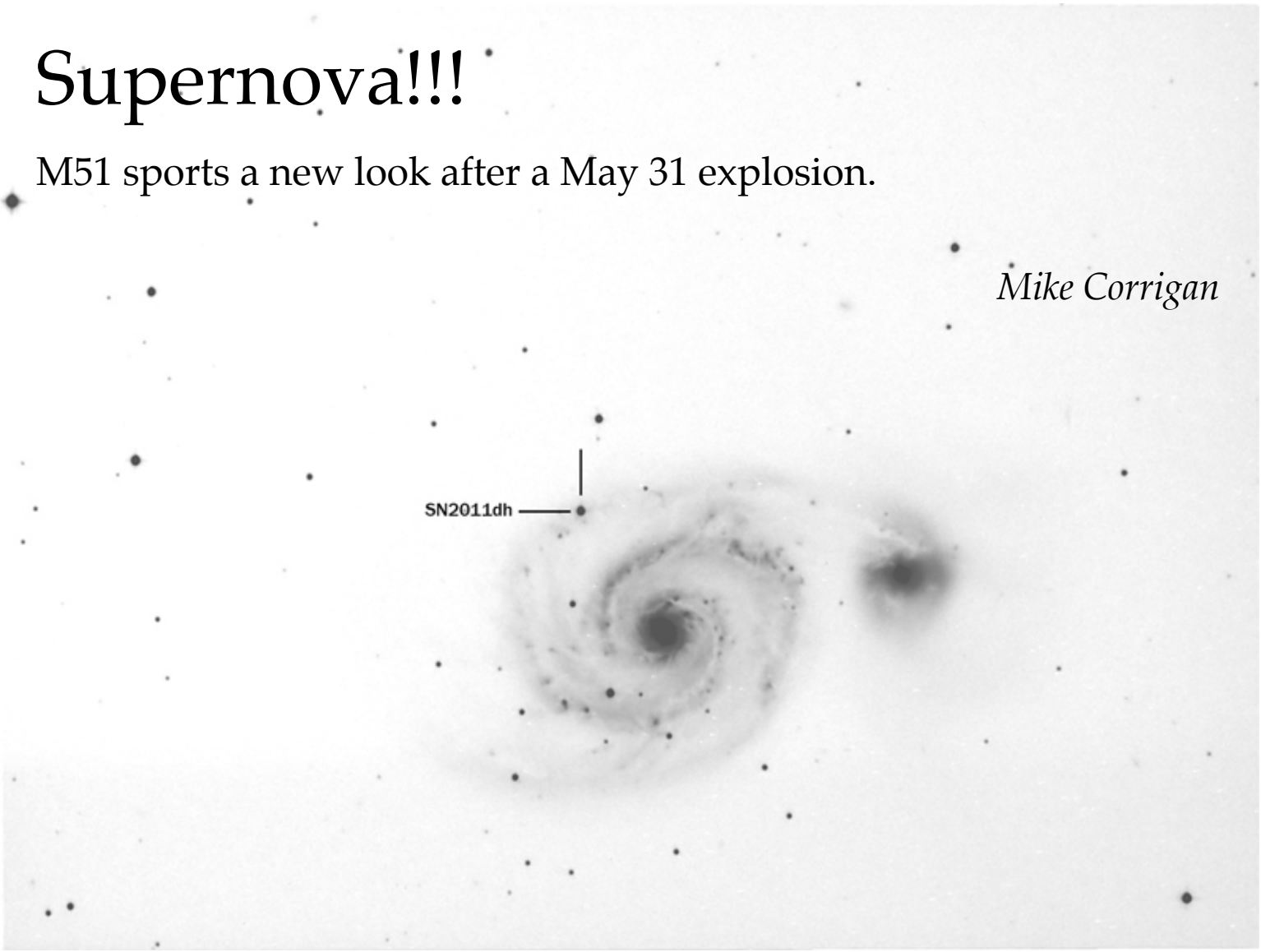
Mini-Gallery

Luka Bajzer took this excellent photo of the Leo Triplet, M65, M66 and NGC 3628. M65 and M66 are visible from within Rochester on a good night in a 4.5" telescope. NGC 3628 remains invisible under city lights even in a 10". However, once you get out of the skyglow of Rochester, this trio is a wide-field delight.

Supernova!!!

M51 sports a new look after a May 31 explosion.

Mike Corrigan



On May 31st, a bright supernova appeared in the nearby Whirlpool galaxy (M51). It was discovered right away because M51 is a bright, interesting galaxy and is constantly being imaged. It does not appear on images taken on May 30th, but is easily seen as a 14th magnitude star on the 31st. This supernova is the third supernova to appear in M51 in the last 17 years, which is an unusually high frequency of supernovas as most galaxies average one supernova about every 50-100 years. There have been no supernovas in the Milky Way (that we know of) since 1604, more than 400 years ago. Of course, none of these supernovae actually blew up in the last few years. Since M51 is about 23 million light years away, these supernovae blew up in the distant past, a time when Sabre-tooth cats and 40 foot Megalodon sharks were roaming the earth.

At the June astronomy club meeting Randy commented that the supernova appeared brighter in the images that I took on June 11th compared to the image he took on June 5th. He was quite right. In fact, the supernova (now known as SN2011DH) brightened from about magnitude 14 when discovered to about magnitude 12.5 by June 21st. Since then it has started to dim and was down to about magnitude 13 by June 28th. The brightening is easy to see in the comparison photo on the next page, which has pictures taken on June 4th and June 10th. The light curve (Graph-1) shows the magnitudes as computed by many astronomers both amateur and professional over the last month.

Because M51 is relatively close to us at about 23 million light years, supernova SN2011DH reached an apparent magnitude of 12.5. This puts it within the capability of many

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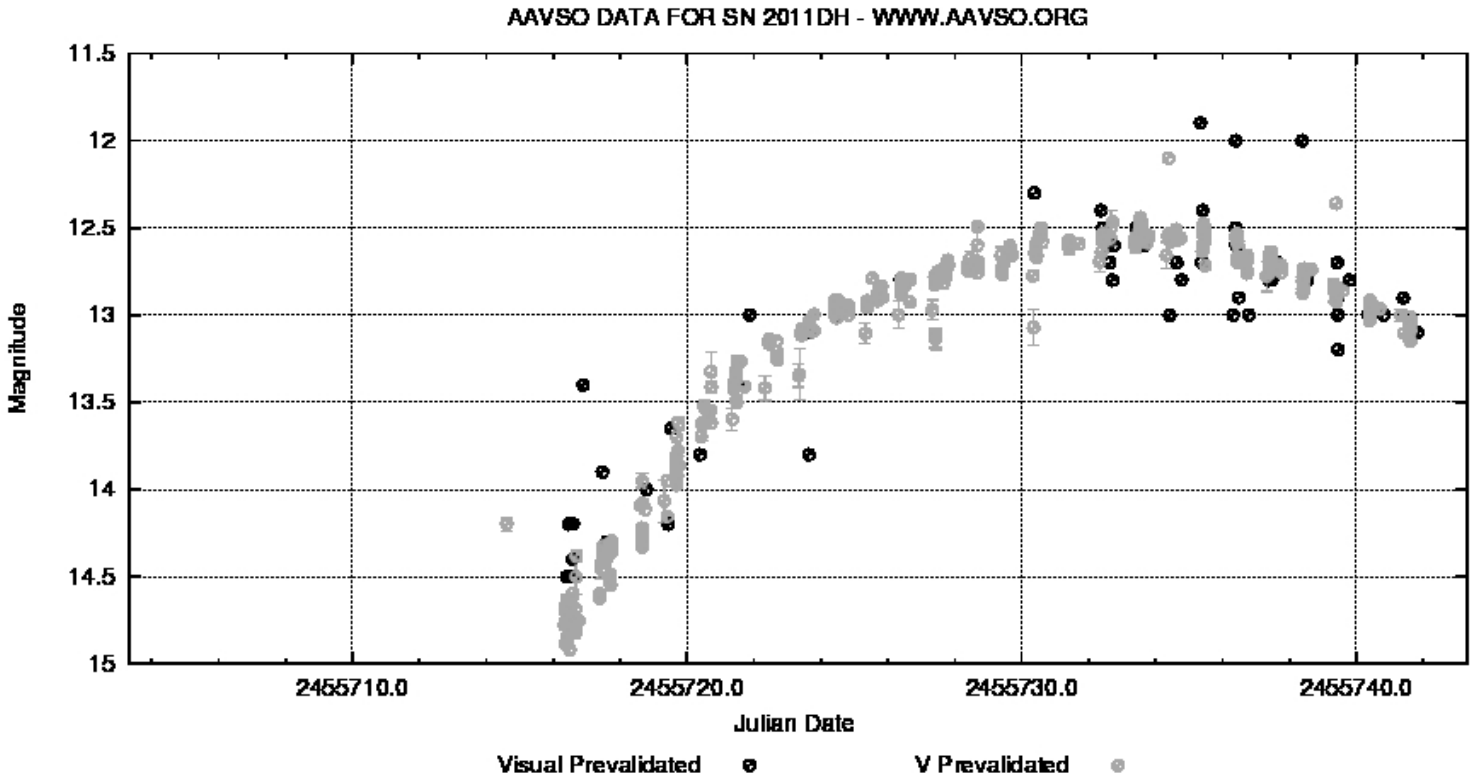

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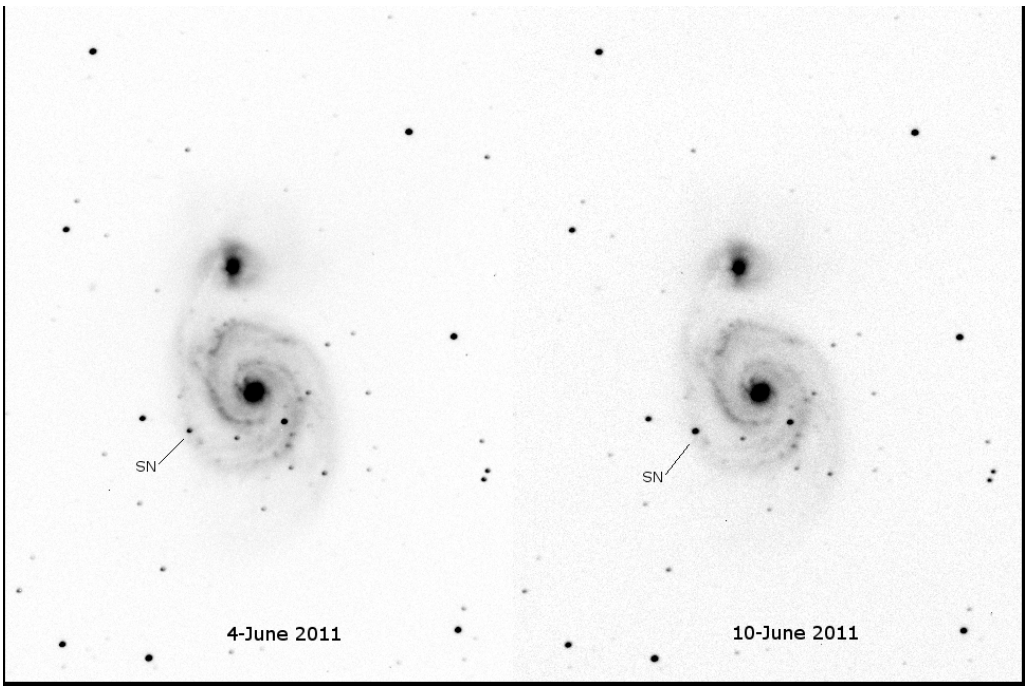
of our scopes to observe visually. While many supernovae are discovered every year, most are much farther away and few ever reach this apparent magnitude. Any of our visual observers who are interested in seeing it need to act quickly before it fades too far.

While the supernova may be dimming now, it is still unbelievably bright in absolute magnitude. Computing the absolute magnitude from a peak apparent magnitude of 12.5 and a distance of 23 million light years gives an absolute magnitude of -16.7 (The absolute magnitude is what the apparent magnitude would be if the star were at a distance of ten parsecs - 32.6 light years). With an absolute magnitude of -16.7, this supernova is as bright as 425 million stars like the sun - in visible light alone. In fact, less than 10% of the energy liberated by a supernova appears as photons (infrared, visible light, ultraviolet, xrays, gamma rays). About 90% of the energy is emitted as neutrinos, which are very difficult to detect.



Supernovae are divided into two main categories, Type I and Type II, based on their spectra. If the supernova's spectrum contains lines due to hydrogen then it is a Type II, otherwise it is Type I. Type I supernovae are due to white dwarf stars accumulating

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mass from nearby companions until they reach a limiting mass where their cores either collapse to a neutron star or blow up due to rekindled nuclear fusion of the white dwarf core material. Type Ia (a subset of Type I) supernovae are the ones that can be used as standard candles and represent the principle evidence for dark energy. Type II supernovae are massive stars (> 20 times the mass of the sun) which have run out of fuel in their cores and can no longer produce energy to resist the gravitational collapse of the core. Depending on the mass of the star, the core may collapse to form a neutron star or may collapse all the way to form a black hole. The spectrum of SN2011DH shows that it is a Type II supernova and there are Hubble images that show what is believed to be the star before it blew up. From these images, it has been estimated that the progenitor star was a yellow giant of between 20 and 40 times the mass of the sun. In all likelyhood the supernova explosion has left behind a neutron star.

I wonder if the fact that M51a has had a recent interaction with M51b (estimated to have happened 50-100 million years ago) has anything to do with the a higher rate of supernova explosions in this galaxy. The interactions between M51a and M51b are believed to have generated shock waves and compression of the gas and dust in the spiral arms of M51a, causing large areas of star formation, including formation of many massive stars. This shows up as bright, blue areas in the spiral arms. Massive stars have relatively short lifetimes and perhaps the stars blowing up now are among those formed 50-100 million years before.

The World's Longest Messier Marathon

by Scott Regener

We should have done this one first", Charlie would always say, holding up the last package of cheese to be packed away for the night at my summer job during college.

"Why's that, Charlie?"

"Because then we'd have been done."

There's a certain amount of madness in Charlie's thinking, but I think he was right about completing observing awards. I should have observed M83 first. It would have reduced the time I spent completing the observation of 110 Messier objects by six months.

Little did I know when I started with M44 on April 17th, 2006, that it would be nearly five years later before I would log my last first in the Messier list. Along the way, I learned a lot about a little, and a little about a lot. But on March 15th, 2011, I logged M83 at last, and my marathon was complete.

After earning a few observing awards, I can say with certainty that there is a rhythm to earning an award. At first, the objects to be found are new, and there is plenty of "low-hanging fruit" out there - objects that are relatively easy to spot, identify, and enjoy. Then there is the middle time where many of the objects are more mundane, harder to locate, and the time between objects stretches out. Somewhere around the last ten percent, however, the list becomes difficult. Most of the objects that are left are there for a reason. Either they are tricky, or the timing of locating them is inconvenient. It can't always be a perfectly clear, early March night

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with unobstructed horizons and perfect transparency.

I may have developed a bit of a reputation in the club as the urban astronomy guy. I have an above-average sensitivity to light, which is a blessing at the telescope, but a horrible condition for driving home from dark skies at night. Headlights from oncoming vehicles virtually blind me. On familiar roads, this is rarely a problem, as I mastered the skill of memorizing roads to cope with late-night drives as a teenager. I once proved this by driving home at 55 mph through a dense fog where the front of the hood was almost obscured. With age comes wisdom, however, and I rarely venture out after dark anymore, even on roads I know well. What this means is that I spent almost all my observing time in my back yard.

M83, image from the ESO

Although I have been in and out of this hobby a few times before it finally "took," I wasn't looking at my back yard from an astronomical viewpoint when I selected it. At that time, clear horizons and few trees were low on my list of priorities. Somehow, the house I selected has a better-than-average location, literally right outside my back door. With careful placement, I can avoid all but one streetlight, and thanks to the sideways eyepiece orientation of a Newtonian telescope, my back is frequently to that light. It is not what I would call dark; however, I can't read a newspaper with available light.

In spite of being well within city limits, I have light domes in some directions, and some darker areas in others. Selecting times and places for observing objects allows me to avoid the worst of the light pollution and work quite deep into the sky.

Under light polluted skies, transparency becomes the second-most important factor, right after cloud cover. When the moisture levels in the air are high, the city lights aimed to the heavens bounce around and the entire sky becomes a bright glow. In its extremes, I have seen a clear night where magnitude 2 stars are all but obscured by skyglow. Yet when the Milky Way is overhead on a night where transparency is excellent, it takes direct vision well.

As has been reported elsewhere and often, Messier's famous list was never intended as a deep-sky training ground. Messier hunted comets, and over time he catalogued "impostors" that he mistook for comets again and again. By cataloguing them, he was able to quickly discount them when his scanning would stumble upon them. This leads to a few oddities. M40, for instance, is not a deep sky object, but a double star. Worse for us, M102 is unknown - Messier himself later claimed it was a duplicate entry for M101. The Astronomical League's rules state that while M102 must be observed for the award, it is up to the observer to select one of the alternate possibilities.

For some, the worst requirement by far of the Messier award is that no computer guidance can be used. The observer must located each object manually. I

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suppose setting circles would be acceptable, but digital ones are prohibited. As an urban observer, even showcase objects are usually not much to write home about, so the hunt is what it is all about for me. Finding an object and identifying it provides hours of fun, even on nights where looking at the objects themselves isn't all that thrilling.

At the beginning of my Messier hunt, finding objects truly was a challenge. I hunted in vain three separate nights before I found M13. Complicating my search was a straight-through finder on a telescope that barely reached three feet above the ground. Laying on the ground while hunting around "Dobson's Hole" is not a posture I recommend. Once I found M13, my mind remembered it and I wasn't even looking for it a few nights later when I saw it easily in the finder. What had proved so elusive to me in the telescope became easy once I knew what I was looking for.

I found my first 48 Messiers using that 4.5" telescope, most within the confines of my backyard. A few objects really wowed me, like the famous Orion Nebula and M37, but most were just faint patches of cloud.

In Feburary of 2007, I bought a used Orion XTi ten-inch Dobsonian, and the world opened up to me. Objects like M42 looked like I'd never seen them before. Objects like M84 and M86, galaxies in Virgo, were within grasp from my backyard. I've never checked, but I suspect that even on the best nights, my 4.5" would be insufficient within Rochester.

The narrow "window of opportunity" for M83. Daylight photo shows the view. M83 was approximately 2 degrees above and to the left of the tree.

As time wore on, I finished the Urban Club, the Lunar Club, and then the Binocular Messier Club, which I mostly completed in my backyard. Being able to pick the brightest and easiest objects let me knock off that club in no time at all. Then, in 2008, I logged my 70th Messier, which qualifies for a certificate award. It was then that the rule about doing the hardest work first started to apply. It took three more years to finish off the remaining 40.

In 2010, I realized I only had 5 to go, and I grabbed most of them at Flatin Farm during the StarBQ. But M83 simply wasn't in the picture when I turned into my tent at 2:30. Then in March, the moment arrived. I got up early, and at 4:15, I hopped my way to M83. Part of what makes M83 so difficult is its southerly declination (-30 degrees) which means that it never gets higher than 15 degrees above the horizon here in Minnesota. Worse, my garage and some elm trees beyond block my view due south, and even if those obstacles disappeared, the worst of the downtown skyglow is in that direction. On the worst of nights, the "teapot" in Sagittarius is invisible. But the skies cooperated, the timing was perfect, and I caught M83 as it drifted further west, clearing the worst of the skyglow so my 10" could capture it.

Hopping to M83 is no picnic in polluted skies, as few bright stars are around. And with such a narrow window to work with, hopping to M83 had defeated me several times. A year ago, though, I became an

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Backyard tree view, North to the left, South to the far right.

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"expert" star hopper. After years of struggling with a stock 8x50 straight-through finder, I bought a 9x50 RACI (Right-Angle, Correct-Image) finder and a Rigel Quikfinder unit finder. The pair allow me to easily center a bright star in the unit finder, and then switch to the RACI. Bending over, and especially craning my neck, cuts off circulation to my eyes, with an immediate decline in ability to see dim objects. That plus mental gymnastics kept me from being able to use my finder effectively. The RACI gives the same view as my binoculars, doesn't shake, and allows the intuitive motions that make starhopping easy. The combination has truly changed my life, making starhopping trivially easy. I say I became an "expert" starhopper, but the tools really made a difference. I cannot recommend the pair highly enough.

That same night, I moved my telescope and spent a fair bit of time on Saturn. Two objects, one night, but one of those had been a long time coming.

There is something to be said for persistence. Astronomy awards do not have to be a race against the clock. I don't regret a moment I spent over the past five years completing the Messier list. Many of those objects have become my favorites. Some may never see my telescope again.

So what is next? I've been hard at work for most of the past five years on the Herschel 400, and am only 150 objects through. I don't know which one will be the last yet, but I'm sure when I figure it out, I'll wish I had done it first.

RAC Rochester Astronomy Club

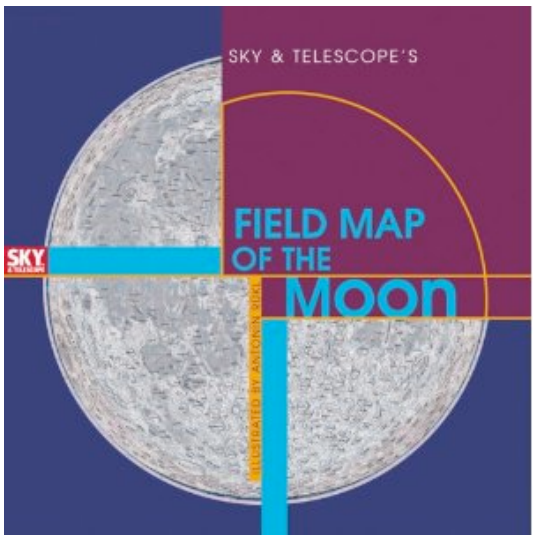
Moon Maps

by Scott Regener

When life hands you lemons, you make lemonade. How many times have we heard that? For any deep-sky lover, the Moon is the enemy, the curse, the plague. We plot our observing sessions to avoid that photon wiper. Yet the Moon has much to offer, if we take a little time to observe it. In fact, there is more detail to be seen on the Moon than in a hundred deep-sky objects. The Moon is bright, so it takes high magnification well. But for those of us used to navigating dim, diffuse glows, how do you find your way around?

Two guides serve me well. The first is Sky & Telescope's Field Map of the Moon. This $10 accessory should be in every observer's case. At a glance, you can find plenty of details. The other is Rukl's Atlas of the Moon, which has sadly been out of print for a decade and fetches a high price used. However, the same charts are available on the used market in a smaller form in a book called, "Moon, Mars and Venus" by Rukl. For under $10 on abebooks.com or amazon.com, this is a keeper.

RAC Rochester Astronomy Club



Rochester Skies

Upcoming Events

July 29/30	-	Dark Sky Weekend at Eagle Bluff*
July 31-Aug 5	-	Nebraska Star Party
Aug 9	-	Monthly Meeting, @ RCTC
Aug 13	-	Perseid Meteor Shower Peak (Moon conflicts)*
Aug 26-27	-	4th Annual StarBQ*
Sept 13	-	Monthly Meeting @ RCTC
Sept 30/Oct 1	-	Dark Sky Weekend at Eagle Bluff*
Oct 1	-	Astronomy Day*
Oct 11	-	Monthly Meeting @ RCTC

* Events subject to change due to weather. Check Rochesterskies.org for updates

Rochester Astronomy Club
P.O. Box 513
Rochester, MN 55903-0513