Rochester Skies

Special Edition

Issue 34 | Spring Edition 2024

Rochester Astronomy Club | Est. 1997

Let me explain why this article is about something other than the greatest total solar eclipse. It is because that's another story we are probably more familiar with, and the story about the eclipse in second place is fascinating in itself and worth being told. Let's briefly review number one before we concentrate on number two!

Few would argue against which eclipse is number one. The scientific significance of the 1919 total solar eclipse resulted in a profound over-hauling of our understanding of the fundamental nature of nature. That total solar eclipse event was when Professor of Astronomy Sir Arthur Edding-ton of England and others measured, as precisely as possible in those times, that gravity warps the essence of space, validating Albert Einstein's four year old Theory of General Relativity. Sir Eddington accomplished this by measuring the gravid-tationally influenced "bend" of light emanating from stars positioned near the sun's edge during a solar eclipse. The amount of bending matched Einstein's predictions and forever shoved Newton's laws of physics aside.

So, let's get to the second-greatest total solar eclipse, which occurred on July 29, 1878. It was an interesting time in the United States, still healing from its Civil War wounds and adapting to the changes that occurred during Reconstruction. By the late 1870s, 38 states comprised the Union, and America was fresh off its 100th birthday celebration. It was a time of significant expansion, invention, and discovery in a land of seemingly unlimited resources. In many ways, the 1878 total solar eclipse was the perfect time to catapult America into a new era of science, technology, and culture.

As newspaper and telegraph services expanded across the country, popular news traveled quickly to the masses, and quite a buzz was stirring about the upcoming 1878 eclipse. The Union Pacific Rail Road company firmly established travel across the US, making transcontinental journeys more affordable. The 1878 path of totality, where the intervening

Spring Issue

RAC Rochester Astronomy Club

Events

Feb 16 ***Fri*** Public Presentation: TBA
Moon's age: 6.5 days
Sky Observing @ Oxbow Park 6:30-8:00 pm.

Mar 15 ***Fri*** Public Presentation: TBA
Moon's age: 4.9 days
Sky Observing @ Oxbow Park 7:30-9:00 pm

Apr 11 ***Thu*** Public Presentation: TBA
Moon's age: 2.4 days
Sky Observing @ Burnside Elementary School, Red Wing 8:45-10:15 pm.

Apr 12 ***Fri*** No Presentation
Moon's age: 3.3 days
Sky Observing @ Oxbow Park 8:30-10:00 pm

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moon completely covered the entire disc of the sun to cast a blackened shadow on the earth's surface, was to begin in Russia and sweep southward early in the afternoon of July 29, across the American wild west, cutting an 110 mile-wide wide swath through the Montana Territory, Wyoming, Colorado, and Texas.

The Chicago Times.

MONDAY MORNING, JULY 22, 1878.

THE PATH OF THE ECLIPSE.

Makeshift (and, for the most part, unsafe) solar eyeglass sales abounded, and newspapers everywhere printed articles about the significance of such an event. American scientists were particularly interested in this eclipse because it was at a time in history when their European scientific colleagues looked upon them as naïve and poorly trained, contributing little to the scientific field of knowledge. European astronomers have had a long history of traveling worldwide to observe and study our sun's total solar eclipses and were already planning trips to the US to record our upcoming eclipse. The US scientists also had grand plans for "new" science experiments beyond the traditional timing measurements that improved the precision of future eclipse predictions, intention or interest in providing much-needed funding for such follies. American researchers were left in a lurch.

What came to their rescue could be attributed to the planet Mercury, which happened to have a transit (crossing in front of the sun to our perspective) in May of 1878. An unexplainable disturbance in Mercury's orbit around the sun bothered many astronomers for years. Its oblong, non-circular orbit (all our planets orbit the sun in a slightly stretched circular path called an ellipse) advanced just a bit counterclockwise during every revolution around the sun. This annoying perturbation was unique to Mercury. However, there was one theory rapidly gaining support from American astronomers. There must be an undiscovered planet inside Mercury's orbit that dragged Mercury's orbit forward. Convinced this was the only reasonable explanation possible, America's most highly esteemed astronomer at that time, Professor James Craig Watson from the University of Michigan, was convinced and desperately wanted to be hailed as its discoverer. The upcoming total eclipse would be the only opportunity to scan the skies near the sun and find this new planet, already considered a monumental scientific feat. This argument finally convinced the US government to produce funding. However, only $8000 (about $300,000 in today's cash) was appropriated for deferring travel and accommodation costs for up to 8 expeditions. With almost no time to spare – about two months – the scientists frantically created plans to move our best scientists and their equipment to the wild, wild west.

And that's where the story of the second greatest total solar eclipse begins. The story is brilliantly researched and told in David Baron's 2017 book

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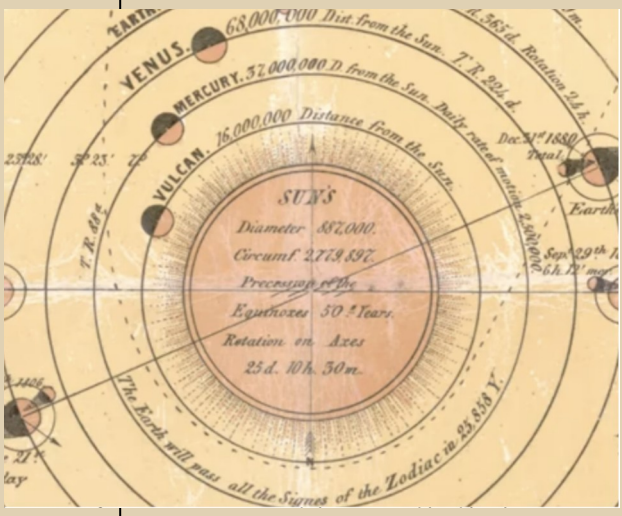
American Eclipse. In it, he describes many of the American expeditions. Still, he highlights three people who experienced the most interesting journeys: the astronomer mentioned above, James Craig Watson, Thomas Edison, a rising celebrity, and Maria Mitchell, the first American female professional astronomer. I will recap their stories, but in the end, their failures, not successes, were most impactful in shaping the new America.



Let's first continue with the "Vulcan finder" astronomer James Craig Watson. In the mid-1800s, his keen eye, hard work ethic, and even more magnificent ego led him to be one of the top-ranked astronomers in the US. His ability to seek and find new asteroids (asteroids were categorized as planets back then) brought him much acclaim and respect. However, he was continually bested by a Dutch-born and German-raised astronomer, C.H.F. Peters, who recently immigrated to the US and managed the Hamilton Observatory in upstate New York. By 1876, Peters led the asteroid discovery contest between them, his 25 asteroids to Watson's 19. This deficit thoroughly aggravated the narcissistic Watson, who soon declared that finding the planet Vulcan would score him the ultimate victory, and he would be renowned as the best asteroid/planet discoverer of all time.

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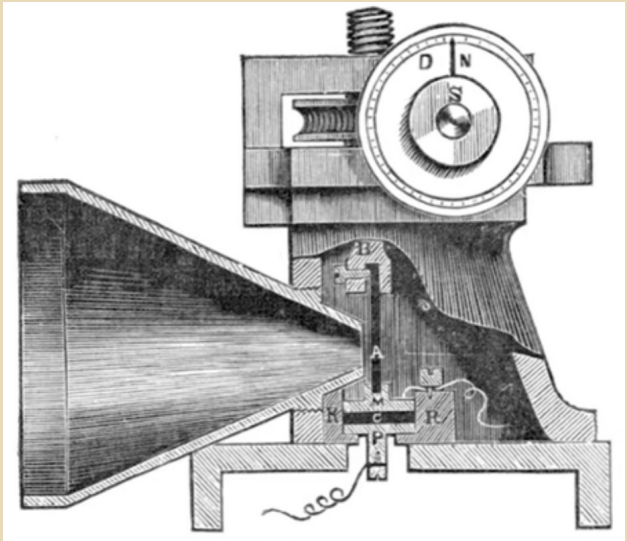
Watson's expedition to the eclipse in mid-July 1878 took him to Rawlins, Wyoming, via the Union Pacific Rail Road, where he ultimately moved his gear to Separation, Wyoming, just a few miles off of the center line of totality, but during his set up practice runs he found he left his setting circles (scales on the telescope that indicate its exact pointing position) back home. He jury-rigged pieces of cardboard and wood to his telescope, figuring he could use these empty placards to mark the telescope's position upon finding Vulcan and then reproduce the exact coordinates later. Watson had thoroughly memorized the location of existing stars around the sun and had backup star maps, so he was confident that if a new shiny object were to be spotted in a place without known stars, it undoubtedly would be Vulcan. When the 170 seconds of totality did occur, he scanned areas west and east of the sun. After several sweeps, he excitedly noted two new objects, one of which appeared unequivocally disk-like! With only a few

seconds to spare, he ran to implore them to swing their telescope to confirm his findings. Unfortunately, time ran out before the sun reappeared and washed the darkness away.

Nevertheless, news the next day spilled out of Wyoming proclaiming Professor Watson had discovered the lost planet of Vulcan. This acclamation quickly circled the globe through prestigious scientific journals and the popular press, proclaiming Watson the "most noted astronomical observer and discoverer in the world!" However, underlying this celestial celebration were many astronomers who were skeptical about the uncomfortable fact that no one else saw this object, and there were plenty looking for the same prize that afternoon in July. Eventually, an amateur astronomer from Rochester, NY, Lewis Swift, who was in Denver, Colorado, also looking for the mysterious planet, confirmed he saw a dim object where Watson did. But after further investigations of his data, Swift found his findings did not match Watson's coordinates and awkwardly proposed an explanation that perhaps there were two or even four planets that could be Vulcan. After finding that Watson used pencil marks on makeshift setting circles in the dim light of the eclipse, Watson's rival asteroid hunter, C.H.F. Peters, leaped into action to thwart Watson's incredible claim. He accused Watson of more likely introducing amateur errors into his calculations and suggested that Watson wished to see Vulcan more than actually seeing it. By then, Watson had already reaped his stardom's benefits and secured a more prestigious and lucrative academic post at the University of Wisconsin's new observatory. To preserve his reputation and honor there, he immediately began a project that, according to ancient stories dating back to Aristotle, suggests that if one observes the daytime sky from the bottom of a deep cylindrical hole dug into the earth, one should be able to see stars. Unfortunately, Watson died halfway through constructing this deep well observatory. His successor, being faithful to his mentor, finished the project. But in the end, it never worked and was pronounced "…entirely useless". The professor dug a hole in his reputation that he could not escape. More on this later.

The extremely popular Thomas Edison traveled in the same expedition party as Watson. He had already produced over 40 patents and was riding high off astounding the world with his phonograph invention. However, Edison felt his scientific reputation was still tarnished by his theory of the "etheric force" in 1876. Edison had been working with a magnet to improve telegraphy and noticed a nearby unconnected device suddenly spark to life. He interpreted this as a new force above and beyond Faraday's discovery of the electromagnetic force decades earlier. Other scholars and physicists denounced this phenomenon as an illusion and humiliated Edison as a non-scientist. Unfortunately, Edison unknowingly discovered radio waves. Radio waves were not fully understood until a decade later by German physicist Heinrich Hertz. Wanting so badly to be known as a creator and scientist, Edison continued inventing incredible things. In the spring of 1878, he presented the tasimeter (ta-sim-i-ter) to the public. This heat-detecting instrument



The Tasimeter.

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was so sensitive it could differentiate one-millionth of a degree Fahrenheit, and if compared to a conventional thermometer, it would have to be built 15 miles high! He created the tasimeter in response to Samuel Langley, an astronomer and friend who requested a device to measure heat from stars. Such an instrument could conceivably measure a star's distance from us. A brief demonstration of the device before a crowd at an expo in New York astounded the public. Eventually, this device bought Edison's ticket to join Watson's team at the eclipse, and he intended to use the device to measure heat, if indeed there was any, from the sun's corona since its nature was still unknown.

Edison's experience at the eclipse was fraught with peril and difficulty. His assigned space to set up his telescope that pointed its eyepiece into the barrel of the tasimeter was in a rickety henhouse, still occupied by hens and continuously buffeted by heavy winds on the day leading up to and on eclipse day. He had only one night to test the device's capability of detecting starlight heat, which seemed to show it worked. Moments before totality ended, he finally found alignment between the telescope and the tasimeter. It achieved a reading but the needle spun wildly positive. Einstein was ecstatic that it proved the corona was hot, albeit it did not quantify the heat as the tasimeter was much too sensitive. Although the tasimeter did its job, in the end, it never found any actual use in future astronomical endeavors. However, this entire experience for Edison likely contributed to his greatest invention.

The last person highlighted in the book by Baron is the story of Maria Mitchell. A librarian and part-time nighttime observer, she discovered a comet in 1847, earning her a gold medal from the king of Denmark and a salaried position to measure celestial object locations for the US Naval Observatory (USNO). The exact locations of the stars and planet orbits were essential to determine the latitude and longitude of ships at sea. A decade later, she took tenure as the first professor of astronomy at the new all-female college, Vassar. Although a self-proclaimed introvert, she eventually pushed through her comfort zone and became a well-known public speaker for science, women in science, and women's rights. Despite being beloved by the public, she faced obstacle after obstacle trying to gain acceptance into the all-male exclusive club of "serious scientists." She was flatly denied by the USNO when asking for funds for her expedition to the 1878 eclipse. Probably not expecting any other answer, she collected a team of 3 former students, and they created their expedition. On a hill just outside the city of Denver, they set up their telescopes with the objective of producing timing measurements and precise drawings of the eclipse. They did include an artist as a member of their group, so their drawings were quite good, but the precision of their measurements was not. Because this expedition team was

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comprised the most unexpected scientists (women), they drew a lot of local and national attention.

The Vassar Expedition near Denver, CO

The underlying theme in all three stories shows how successes and failures are essential in science to move an idea or a nation forward. In the case of Professor Watson, energy and persistence were vital, but in the absence of reproducible proof and peer review, science can disastrously fail. Not finding an expected result is just as important to science as finding one. It took nearly four decades of science to explain Mercury's peculiar orbit when, out of nowhere, a brand-new science came along and predicted precisely how an enormous gravitational force (the sun) drags Mercury's orbit forward—no new planet required.

In the case of Thomas Edison, he was a victim of his inventive genius, often being ahead of scientific understanding. He could invent things before he could explain them. It had been reported that during the train ride out to Wyoming, he had time for in-depth conversations with other scientists who implored Edison to spend more time improving (he did not invent) the light bulb. There was a story, more likely a myth, about Edison accidentally dropping his fishing pole into the campsite fire while fishing a week later in Battle Lake near his eclipse viewing site. As the story goes, he noticed fibers of the bamboo fishing pole glowing in the embers for a long time, and it inspired him to produce the incandescent bulb's long-lasting bamboo filament. But the storyline doesn't hold together, as months later, following exhaustive work trying and failing with numerous filaments, Edison ultimately received acclaim for his patented carbon filament, not bamboo. Bamboo filaments were used in later refinements. The game-changing difference between Edison's carbon-based filament and all others was that other inventor's light bulbs lasted 5-6 hours, and his lasted 50 to 60 days. Despite the dubious fishing story, one can still half-heartedly credit the eclipse for his incandescent light bulb success.

As David Baron aptly stated in his book regarding Professor Maria Mitchell and her team's effort, "For this group of observers, however, viewing the eclipse was arguably less important than being viewed." Their presence was incredibly inspirational for others, showing women can do this type of work! At that time in history, the generally accepted theory regarding higher education for women was that infiltrating knowledge into female heads rendered their reproductive organs useless. (I'm not kidding). One could argue that in the subsequent 146 years, we have not achieved the progress we should have made with women's rights. Maria Mitchell made her mark supporting and inspiring women during America's adolescence. She directly and indirectly worked with Susan B. Anthony and notable others, tirelessly promoting women's rights and the end of women's suffrage. Maria Mitchell should be remembered as one of the best promoters of science and equality for all.

In conclusion, the people and events surrounding the 1878 total solar eclipse had lasting effects on America during its formative years. Even today, its legacy gives us something to reflect on, appreciating the frailness of science's imperfections, the spirit of American persistence, and the importance of collaboration and inclusiveness, all culminating in why the 1878 eclipse is the second(?!) most important total solar eclipse of recent times.

All images used in this article are credited to the appropriate source by David Baron in his book *America Eclipse – A Nation's Epic Race to Catch the Shadow of the Moon and Win the Glory of the World*.

(Other sources follow)

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For more information check NPMAS[LINK] or Northern Lights[LINK]

ALCON 2024 will be in Kansas City. Registration coming soon. Check ASKC.ORG[LINK]

North Central Region of the Astronomical League

RAC is a member of the North Central Region of the Astronomical League NCRAL[LINK]. I invite you to check the regional newsletter, **Northern Lights**[LINK], vational programs, the latest astronomical news from the north-central states, essential updates from the Astronomical League, and so much more that you won't find anywhere else.

Astronomical League

RAC is also a member of the Astronomical League. For information on the national organization go to AL[LINK]

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Inside this issue of *Northern Lights*

Add Your Email Address to the NCRAL Member Database

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See **Northern Lights**[ink] for information.

Spring: M95, M96, M105, M53, M64, M85, M88, M91, M98, M99, M100, M49, M58, M59, M60, M61, M84, M86, M87, M89, M90, M104, M3, M51, M63, M94, M106, and M68 (28 objects)

Records must include the name, email, and mailing address of observer and/or ALCor for sending the certificate and pin.

RAC Members Receive Honors from the Astronomical League

Jim Martin, *RAC*'s webmaster, was awarded the **G.R. (Bob) Wright Service Award** for his exceptional volunteer work with the Astronomical League. Carroll Iorg, the President of the Astronomical League, expressed his appreciation and presented the award to Jim in recognition of his valuable contributions. Carroll also acknowledged Jim's remarkable achievement of redesigning and launching the Astronomical League website ahead of schedule. We extend our congratulations to Jim for his outstanding accomplishments and his ongoing dedication to *RAC*.

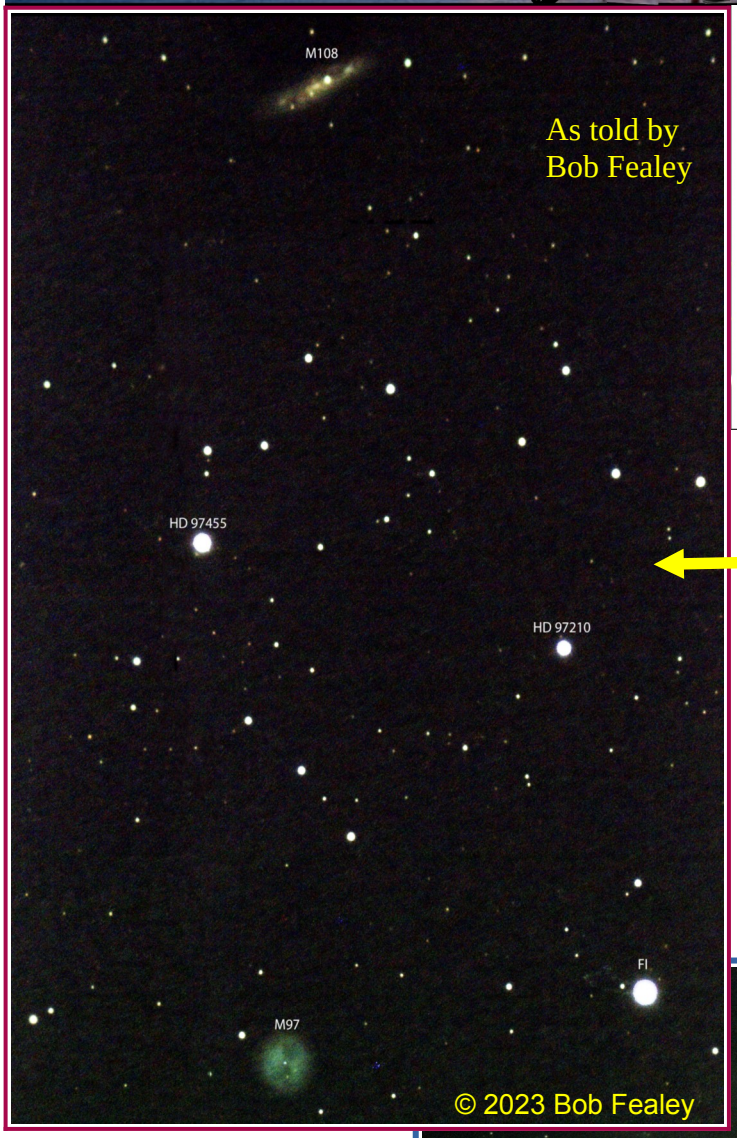
Carroll Iorg presents Jim Martin the G.R. (Bob) Wright Service Award.

Front Row: Carroll Iorg, Thérèse Bauer and Julie Gawarecki. Back Row: Kirk Severson, Randy Hemann and John Attewell

Thérèse Bauer, also of the Rochester Astronomy Club, was honored with the Horkheimer/O'Meara Journalism Award by Carroll Iorg. This prestigious award is exclusively available to Astronomical League members aged 8 to 14 who have demonstrated excellence in science writing. The award includes a plaque and a $1,000 cash prize for the winner, while the runners-up receive prizes of $500 and $250.

Sirius Scouts, *Rochester Skies'* second quarter 2008 issue.

Rick Murray and the Girl Scouts of Pine Island enjoyed observing the clear skies through a 12-inch Dobsonian telescope.

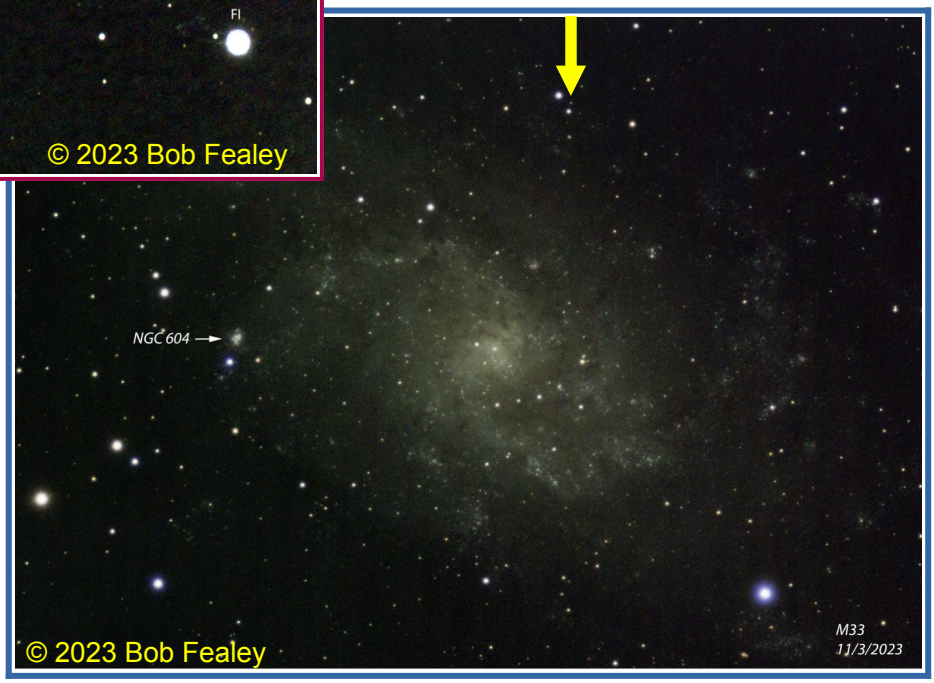


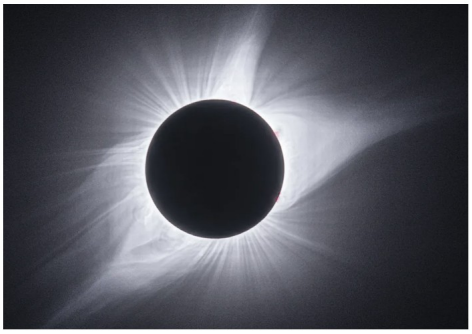
As told by
Bob Fealey

Sketch of M51 © 2010 by Howard Banich. Photo of M51 © 2009
Fort Lewis College - Dept of Physics & Engineering

A tale of two Messiers: **M97** (Owl Nebula) and **M108** (a starburst galaxy also known as the Surfboard Galaxy) are within a degree of each other in Ursa Major. The image was taken with the AT80ED refractor and ZWO 183MC camera on 12/7 at midnight (or so). I used Stellarium as a source for the star labels.

Must say I am obsessed with the galaxy M33 in Triangulum especially the structural detail one can obtain using a small refractor (AT80ED) and live stacking images taken with a modest astronomy camera (ASI ZWO183MC) and an accurate, polar aligned tracking mount (Sky Watcher Star Adventurer Gti). In the image (a live-stack of 501, 5 second frames) many star-forming regions are visible in the spiral arms including the huge nebula NGC 604 (white arrow), about 1,500 light years in diameter!). I would next love to obtain a hydrogen alpha filter and then obtain images highlighting the star forming areas better.

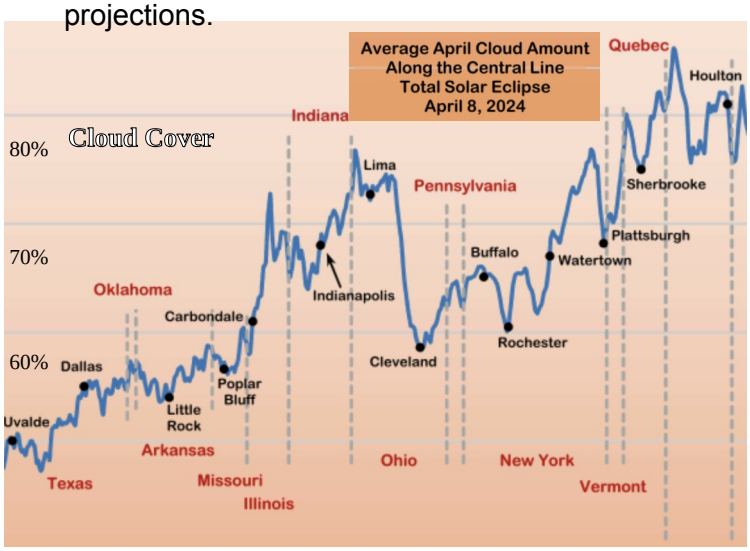




The United States has recently witnessed a memorable annular solar eclipse and a total solar eclipse within seven years. The next Great North America Eclipse will occur on April 8th. It is noteworthy that the opportunities to witness the remarkable astronomical events after April 8th have come to an end. At least until 2042 when the next total eclipse within the contiguous United States will occur in Montana and Western North Dakota, approximately 18 years from now.

This eclipse occurs soon after the spring equinox and weather patterns may pose some difficulties in planning for the event. While Texas can expect pleasant weather, the onset of tornado season in the Midwest and the prevalence of late winter weather and overcast skies in Illinois, Indiana, and northeastern regions may create unfavorable conditions. It remains to be seen if the weather will be conducive to the event.

A bonus of totality will be six planets, with Venus the brightest at magnitude -3.9, located about 15° southwest of the Sun. On the opposite side of the eclipsed sun, some 30° northeast of the Sun, will be Jupiter at a magnitude -2. Jupiter can be a helpful guidepost to locate **Comet 12P/Pons-Brooks**, as it is positioned 6° west of Jupiter and approximately 24.5° northeast of the Sun. This falls within the binocular field of view of the gas increases the likelihood of successful detection. However, there is a limited window of opportunity before this option is no longer viable. The projected magnitude of the comet is 5, but given the proximity of the corona's brightness, observing it may prove challenging. It is worth noting that comets are unpredictable, and their actual behavior can differ significantly from projections.



Astrolabe
by Bill Davidson

Canes Venatici, The Hunting Dogs

Our previous article explored the characteristics of two hunting dogs, Canis Major and Canis Minor, found in the Lepus constellation. Astrolabe will shift its focus on two other hunting canines, Asterion and Chara. They are memorialized in the Canes Venatici (*CANE-eez ve-NAT-iss-eye*) constellation, best observed during spring and summer in the northern hemisphere. It stands apart from many others because it does not have roots in ancient Greek or Roman mythology. It was instead introduced in the 17th century by a Polish astronomer named Johannes Hevelius, who was well-known for creating detailed celestial charts (Figure 1). In his depiction of Canes Venatici, Hevelius presented the constellation as two hunting dogs, Asterion and Chara. They are being held on a leash by Boötes, the neighboring constellation representing a herdsman. Unfortunately, this was not how Ptolemy had presented this specific region in the dark sky.

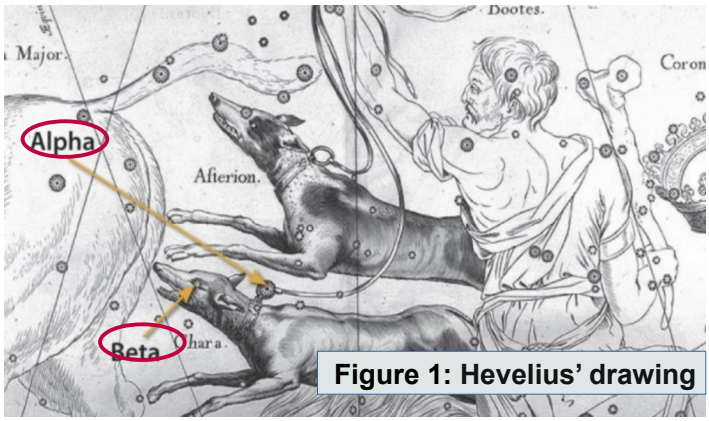


Figure 1: Hevelius' drawing

Initially, Ptolemy included Canes Venatici as part of Ursa Major. However, some of the stars that were supposed to belong to Boötes (Figure 2) were later misidentified. While translating, a linguist came across a perplexing Greek term. The term referred to a staff with a hook (a weapon), but the translator mistakenly identified it as 'kilāb,' which means 'dogs' in Arabic. As a result, the translation read 'spear-shaft having dogs' (Hastile habens canes).

The dogs' depiction differ from when Hevelius first drew them on many modern atlases. In particular,

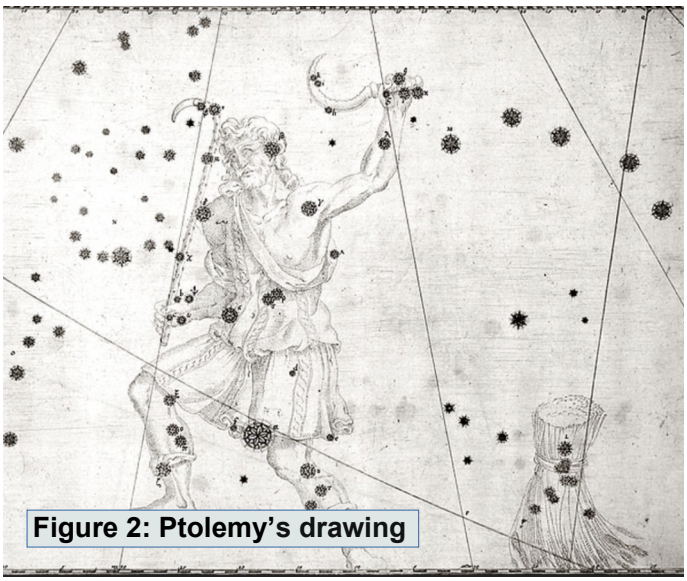


Figure 2: Ptolemy's drawing

Beta Canum Venaticorum (**β Cvn)** is no longer called **Asterion,** but **Chara,** and what was **Chara** became **Col Caroli** (more later). The once prominent **Asterion** has disappeared. Instead, **Asterion's** region has now become an insignificant and empty void. Without your keen attention to detail, the original artistry of Hevelius may be lost and forgotten.

Alpha Canum Venaticorum (α Cvn) is a wide double star orbiting a common center of mass with a period of over 8,000 years. The primary has magnitude 2.9 and the secondary 5.6. The primary is 101 times more luminous than the Sun and is roughly 110 ly from Earth. Sir Charles Scarborough, mathematician and physician to King Charles the Second, named **α Cvn, *"Col Caroli Regis Martyri"*** ('the heart of Charles the martyred king') in honor of Charles I, who was executed after the English Civil War in 1649. Today it is known as ***Col Caroli***, the heart of Charles.

Five Messier objects are contained within Canes Venatici:

M3 globular cluster

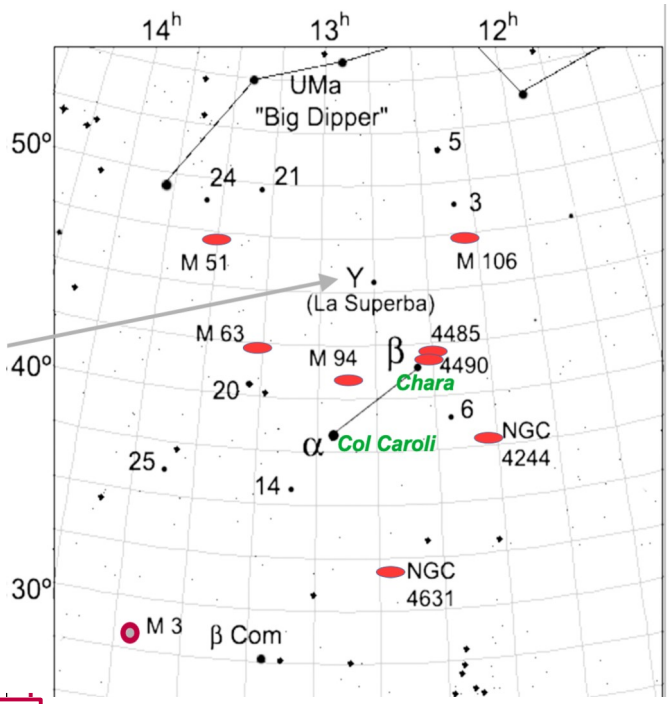
M51 the Whirlpool Galaxy

M63 the Sunflower Galaxy

M94 the Cat's Eye Galaxy

M106 a spiral galaxy

La Superba, Y Canum Venaticorum, is a red giant star classified as a carbon star and a semi-regular variable. Y CVn is notable for its striking red color. It is one of the reddest stars known and one of the brightest giant red carbon stars in the sky, with an apparent magnitude that varies from 4.86 to 7.32. La Superba is relatively faint and often invisible to the unaided eye. It lies at a distance of 760 light-years from Earth.

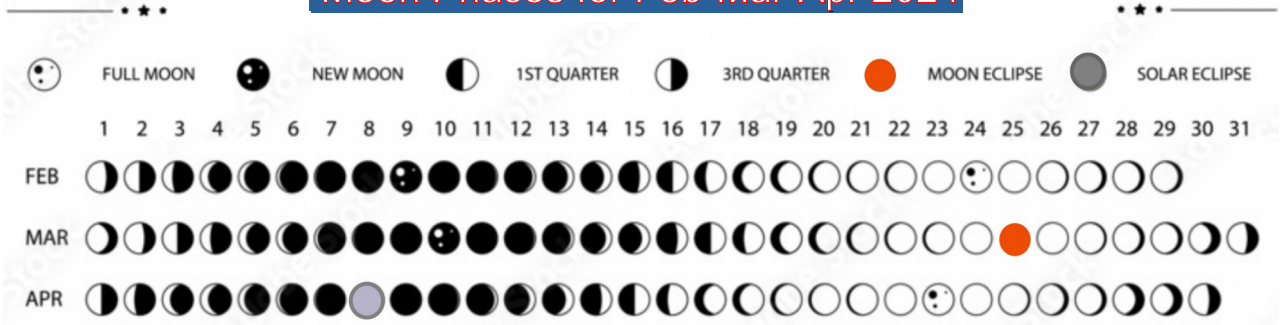


NGC 4244 (CALDWELL 26): *Galaxy*, mag. 11
NGC 4631 (CALDWELL 32): *Whale Galaxy*, mag. 9.3
NGC 4485: *Galaxy*, mag. 11.9
NGC 4490: *Cocoon Galaxy*, mag. 9.8
NGC 4485 and 4490 are interacting galaxies

Pencil drawing of Cocoon Galaxy by Michael Vlaskov of deepskywatch.com

Astrolabe **is a series of articles that delve into the lesser-known and often overlooked constellations, exploring their abundance of astronomical information. The primary objective is to expand the observer's familiarity with the night sky by providing in-depth technical details and analysis.**

Moon Phases for Feb-Mar-Apr 2024



Rochester's Sky

February

7th Conjunction of the Moon, Venus and Mercury in the morning constellation of Sagittarius.

9th New Moon. Great time for deep sky observing.

14th/15th Conjunction of the Moon and Jupiter.

24th Full Moon

March

10th New Moon

13th Conjunction of the Moon and Jupiter with a separation of 3½ degrees.

19th Vernal Equinox at 22:04 CDT

24th Mercury Highest Altitude and Greatest Elongation East. Watch the horizon after sunset when twilight is darkening.

25th Full Moon and **Penumbral Lunar Eclipse**, maximum at 02:13 CDT.

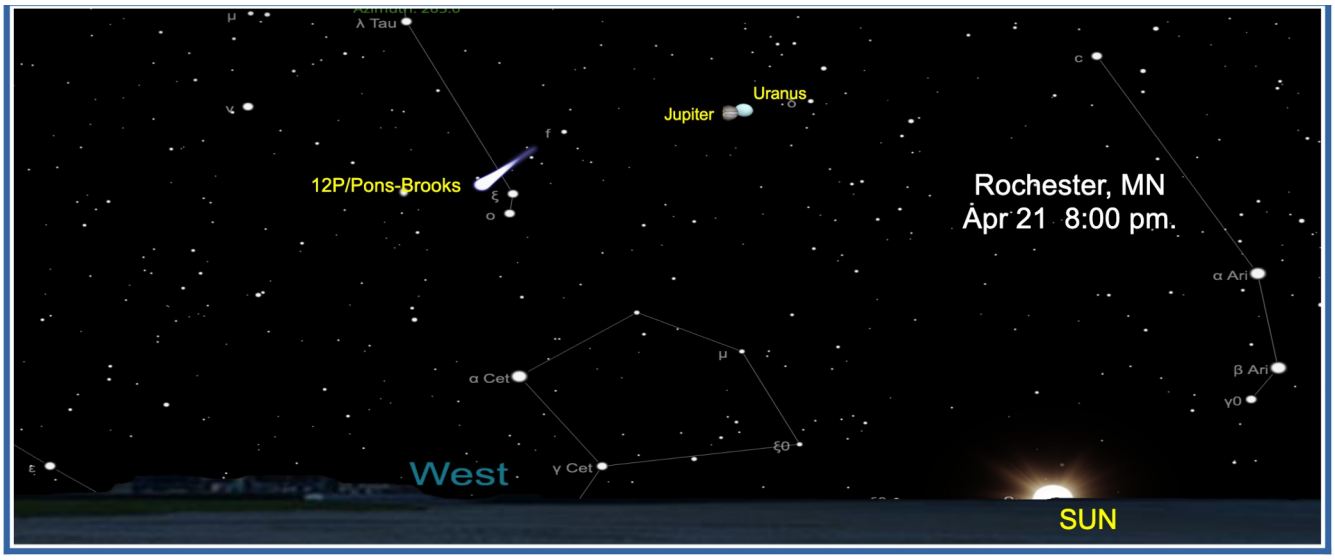
April

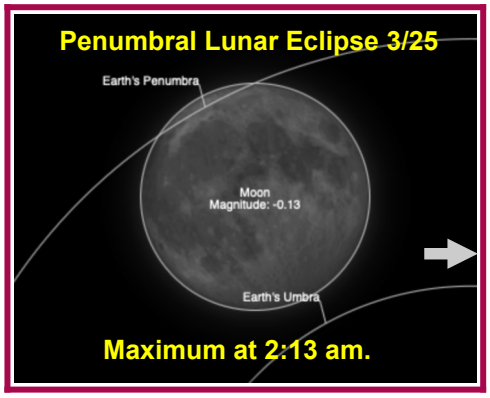
8th Total Solar Eclipse of North America (see below for Rochester's view).

21st Comet 12P/Pons-Brooks is predicted to be visible to the naked eye. A near-full Moon will dim the event, though.

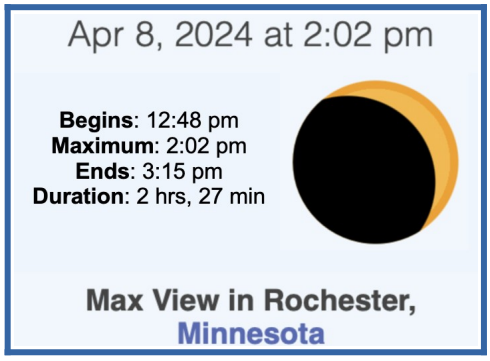
14th/15th Conjunction of the Moon and Jupiter.

23rd Lyrid Meteor Showers peak in the morning, but the **Full Moon** joins us in the viewing.





The Moon traverses the Earth's penumbra, which is a faint outer region of the planet's shadow. The Moon undergoes a minor reduction in brightness, which can be challenging to detect.



Jupiter • Rochester's Sky

All the times mentioned below are in local time and have been adjusted for any necessary CDT and CST corrections. It is important to note that the listed times represent the early occurrences of the event and not necessarily the start time. The data provided has been collected using SkySafari 6 Pro. The asterisk (*) symbol is used to indicate events that are currently in progress, and any bold text is used to denote the occurrence of two or more events near the same time.

GRS: Giant Red Spot **I**: Io **E**: Europe
G: Ganymede **S**: Shadow **T**: Transit

FEBRUARY

Date	GRS Transit	Transit of Moon	Date	GRS Transit	Transit of Moon	Date	GRS Transit	Transit of Moon
1	21:47		**11**	20:14		**21**	18:47	ET 21:22
2	18:07		**12**			**22**		
3			**13**	22:00	IT 18:30 IS 19:40	**23**	20:25	
4	19:18	IT 23:00 IS 23:15	**14**	18:30*	ET 18:50 ES 21:20	**24**		
5			**15**			**25**		GT 20:18
6	21:19	IS 18:24*	**16**	19:26		**26**	18:10	
7	18:15*		**17**			**27**		
8	22:50		**18**	21:12	GS 20:52	**28**	19:25	
9	18:39		**19**	18:42*		**29**		IS 19:00*
10			**20**		IT 20:27 IS 21:32			

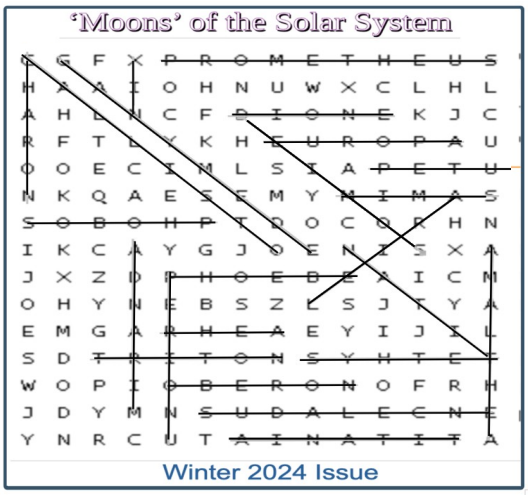
MARCH

Date	GRS Transit	Transit of Moon	Date	GRS Transit	Transit of Moon
1	21:20		**11**	20:22	
2			**12**		
3			**13**		
4	19:00*		**14**		IT 21:52
5			**15**		
6	20:30		**16**	19:47	
7		IT 18:58 IS 20:00	**17**		ES 20:02
8			**18**	21:12	
9	19:15*				
10	19:43*	ES 19:23*			

Jupiter will rise May 26th at sunrise but will be observable early July for those early risers.

Valuable Resources

- Rochester's Observing Conditions[LINK]
- Time and Date dot com for Rochester[LINK]
- The Sky Above[LINK]
- Create Your Own Atlas[LINK]
- Field of View Calculator[LINK]
- Night Sky Network[LINK]



Eclipses on My Mind

CORONA
TASIMETER
SYZYGY
PENUMBRAL
PROMINENCE
ANNULAR
FILTER
DIAMOND RING
PARTIAL
VASSAR
EXPEDITION
MARIA
BAILYS BEADS
UMBRA
VULCAN

Y	R	G	Y	R	V	N	A	R	I	N	N	E	U	T
S	C	N	A	E	P	A	U	M	B	R	A	S	A	S
B	R	I	E	N	E	B	S	R	O	A	N	E	A	Z
Y	E	R	C	O	N	T	L	S	E	S	O	A	A	T
G	S	D	N	I	U	U	X	S	A	L	O	A	B	R
U	I	N	E	T	M	D	L	M	S	R	T	A	N	R
U	A	O	N	I	B	M	X	A	E	M	I	S	E	A
I	E	M	I	D	R	A	T	T	R	L	A	T	R	N
M	L	A	M	E	A	R	L	A	Y	N	E	L	T	O
I	A	I	O	P	L	I	S	S	D	M	N	O	M	R
E	I	D	R	X	F	A	B	G	I	R	L	E	N	O
I	T	B	P	E	R	E	A	S	U	A	E	D	V	C
A	R	M	P	B	A	N	A	C	L	U	V	B	A	M
O	A	R	D	D	A	T	I	S	Y	Z	Y	G	Y	L
D	P	N	S	R	P	B	A	N	I	P	R	D	I	A

Last edition's answers found on page 15.

Words can go in any direction. Words can share letters as they cross over each other.

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