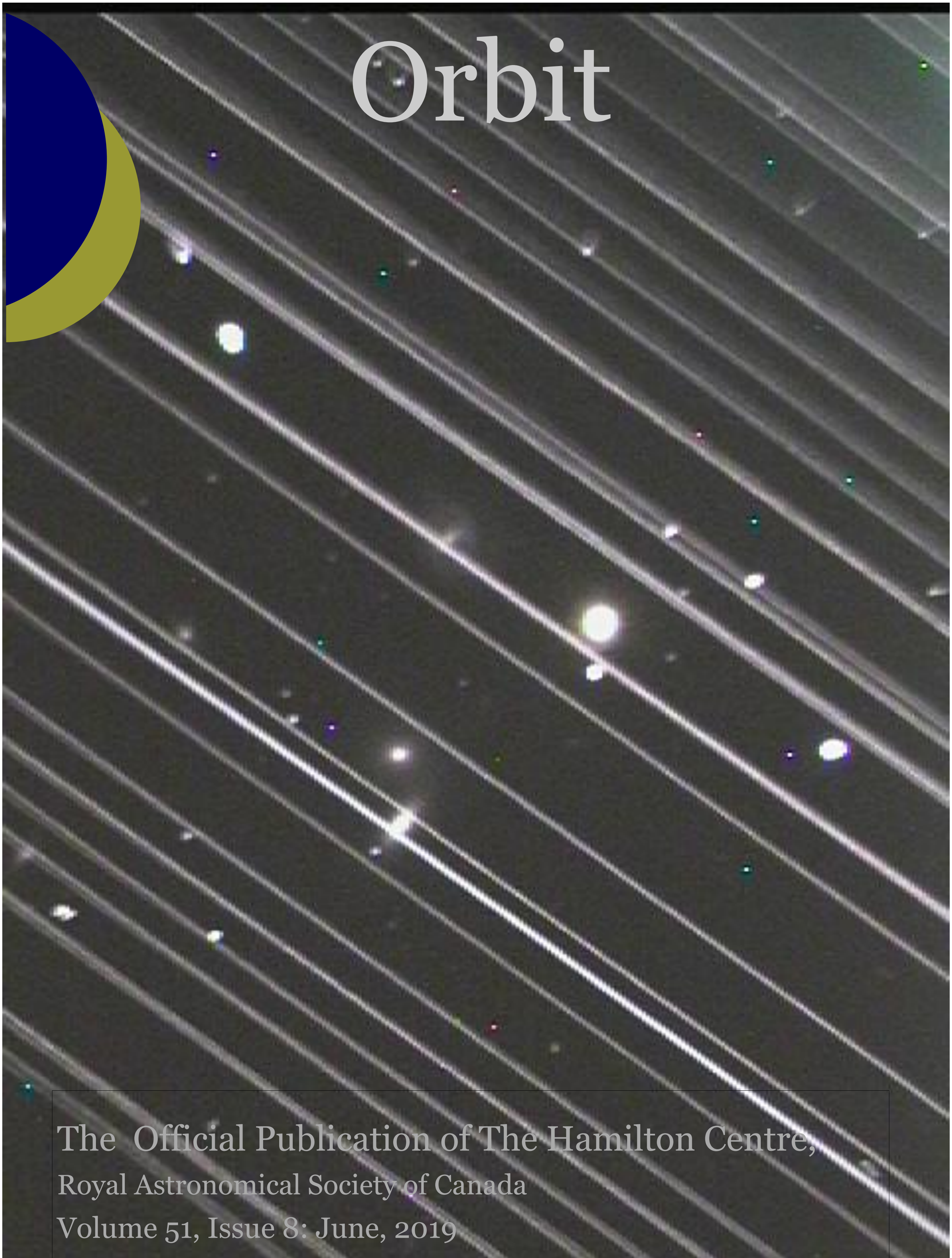

Orbit

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Issue Number 8, June, 2019

Roger Hill, Editor

Heavy Metul/Observatory Night in May saw Les Nagy and I have a nice chat, but that was all that happened. It was a shame because the Moon went through the Beehive cluster. Lunar occultations, particularly of bright (-ish) stars is always fun, and so the skies were disappointing. The Clear Sky Chart had indicated that we could expect a clearing trend in the evening, but looking out from the road at the Observatory showed clear skies well off to the west, with only a thin band of cloudlessness at the horizon. I had thought of trying one more night on June 14th, but the Sun won't set until 9pm, and the Moon will be 94% illuminated, so I don't think there will be anything worth seeing. The normal date for one would be September 13th, but that is Full Moon Night, so Friday, September 20th might be much better, when a last quarter Moon will rise after 11pm, with Saturn and Jupiter skirting the trees.

Summer is coming, which means mosquitoes, and since our Observatory borders on a swamp, the swarms of them can get quite fierce. The only thing that I've found that is actually effective is the one made by ThermaCell. It reportedly is capable of stopping the thirsty little blood-suckers getting within about 5 metres, which means if one of the units is put in the Chilton Building (the Roll-off roof), that you can observe fairly comfortably until well after midnight. This is normally sufficient.

However, I've seen reports that Marks Work Warehouse (full disclosure...I work for Canadian Tire, which owns Marks) no sells a line of clothing that repels mosquitoes, and will do for 50 to 50 washes. I have not tried it myself, so I remain skeptical, but if anyone has any reports, I'd love to hear them. Until then, I'll be taking a ThermaCell to the Observatory!

There's a lot of talk about the 60 satellites that Elon Musk has placed into orbit. At the moment, they're between 3rd and 6th magnitude, but Elon states that he expects them to drop below naked eye visibility once they have reached their target altitudes. The problem is, however, that he plans to put about 12,000 of them in orbit. Since the entire sky is some 41,000 square degrees, we can expect to see, on average, one satellite in a DSLR APS-C sensor if you're using a focal length of less that 700mm. Further, since they're moving, they'll leave a nice streak.

At the moment, if you get a satellite streak in a sub-exposure, you can just not include it when you stack them together. The problem then becomes...what happens when every sub exposure contains one, or more, such streaks? Musk has fatuously suggested that astronomy should be space-based anyway, but it will be a very long time until there is more area collecting starlight in space than there is on Earth.

Now, we've faced this sort of issue before, when we thought that the Iridium satellite flares would cause massive problems, but that has not been the case. In fact, now that the satellites are being replaced, the chances of seeing such flares has dramatically diminished. In some cases, a couple of seeks can go by no before you'll find one being forecasted at Heavens-Above.com. However, this issue seems much more fundamental than seeing a flare every couple of days. And Musk is not the only one thinking of putting up such a large number of satellites—a couple of other such projects have been talked about. In a few years there may be one of these devices visible on an area of sky equivalent to the size of the Full Moon at all times.

For more information, please see page 5. Also, to see how bad this can be, the front cover of Orbit was taken by Victoria Girgis of Lowell Observatory on May 25. It is a 25 second exposure of the area around NGC5353, taken with a Mallincam, using (as best as I can determine) a 14" Planewave CDK.

See you in the dark,

Roger

Jupiter Shines in June

By David Prosper

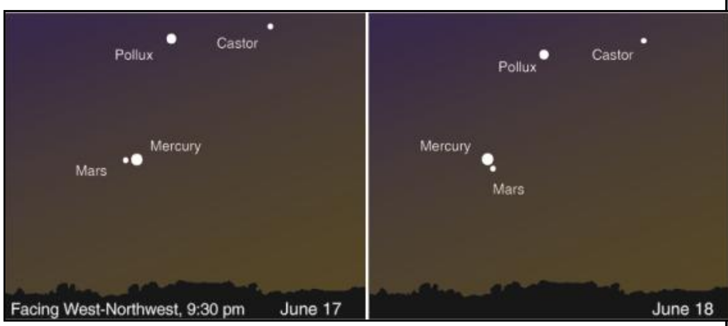
Jupiter stakes its claim as the king of the planets in June, shining bright all night. **Saturn** trails behind Jupiter, and the **Moon** passes by both planets mid-month. **Mercury** puts on its best evening appearance in 2019 late in the month, outshining nearby **Mars** at sunset.

Jupiter is visible almost the entire evening this month. Earth will be between Jupiter and the Sun on June 10, meaning Jupiter is at **opposition**. On that date, Jupiter rises in the east as the Sun sets in the west, remaining visible the entire night. Jupiter will be one of the brightest objects in the night sky, shining at magnitude -2.6. Its four largest moons and cloud bands are easily spotted with even a small telescope.

What if your sky is cloudy or you don't have a telescope? See far more of Jupiter than we can observe from Earth with NASA's **Juno** mission! Juno has been orbiting Jupiter since 2016, swooping mere thousands of miles above its cloud tops in its extremely elliptical polar orbits, which take the probe over 5 million miles away at its furthest point! These extreme orbits minimize Juno's exposure to Jupiter's powerful radiation as it studies the gas giant's internal structure, especially its intense magnetic fields. Juno's hardy JunoCam instrument takes incredible photos of Jupiter's raging storms during its flybys. All of the images are available to the public, and citizen scientists are doing amazing things with them. You can too! Find out more at bit.ly/JunoCam

Saturn rises about two hours after Jupiter and is visible before midnight. The ringed planet rises earlier each evening as its own opposition approaches in July. The **Moon** appears near both gas giants mid-month. The Moon's tour begins on June 16 as it approaches Jupiter, and its visit ends on June 19 after swinging past Saturn.

Mercury is back in evening skies and will be highest after sunset on June 23, just two days after the summer solstice! Spot it low in the western horizon, close to the much dimmer and redder **Mars**. This is your best chance this year to spot Mercury in the evening, and nearly your last chance to see Mars, too! The two smallest planets of our solar system pass close to each other the evenings of June 17-18, coming within just ¼ degree, or half the width of a full Moon, making for a potentially great landscape photo at twilight.



Caption: Mars and Mercury after sunset the evenings of June 17-18, 2019. Image created with assistance from Stellarium.

Caption: A giant storm in Jupiter's north polar region, captured by JunoCam on February 4, 2019. Image

This article is distributed by NASA Night Sky Network

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Astronomers Worry That Elon Musk's New Satellites Will Ruin The View—from NPR

Victoria Girgis was leading a public outreach session at the Lowell Observatory in Flagstaff, Ariz., when one of her guests noticed a string of lights moving high overhead.

"Occasionally, you'll see satellites, and they look kind of like shooting stars moving through the sky," Girgis says. "But this was a whole line of them all moving together."

The guest hadn't spotted a UFO invasion. Rather, it was the first installment of billionaire Elon Musk's vision for the future: a constellation of satellites known as Starlink that's meant to provide Internet to the entire planet.

On May 23, Musk's company SpaceX launched a rocket that carried 60 Starlink satellites into orbit. The 500-pound satellites fanned out like a deck of cards. From the ground, they looked like a glittering string whizzing across the arc of the sky.

The crowd watched as the satellites moved in front of the small telescope Girgis had trained on some distant galaxies. The bright satellites created over two dozen streaks across an image she was taking *(see front cover image—RH)* .

"My first immediate reaction was, 'That's visually kind of cool,'" she says. "But my second reaction was, 'Man you can't see a single galaxy.' "

The picture was useless.

In the days after the launch, similar images and videos began to pop up on social media. "All of those videos and pictures delighted the public," says Jessie Christiansen, an astronomer at Caltech. "But it horrified the astronomy community."

Professional astronomers are trying to take lots of pictures of really faint things far out in space. While they've had to contend with satellites in the past, Starlink is something different entirely, says Jonathan McDowell, an astronomer with the Center for Astrophysics at Harvard and the Smithsonian. The constellation will be made up of as many as 12,000 satellites. That's "potentially as many visible satellites moving around on a dark night as there are stars visible," McDowell says.

Like many of SpaceX's plans, the Starlink program is on an aggressive path. By the end of the year, Musk says, there could be hundreds of satellites in orbit.

"We should have been having these discussions 10 years ago," McDowell says. "This problem sort of snuck up on us much faster than we expected."

SpaceX is not the only company looking at developing a global constellation. Other companies, including Amazon, are planning similar constellations. Space is about to get much more crowded, and there's not a lot that astronomers can do about it. Although space companies are regulated by national governments, and the U.N. does have a treaty on the peaceful use of space, there's no obvious forum for this kind of issue.

"Space is still a little bit of the Wild West," Christiansen says. "We're still trying to figure out who owns it and who gets to make the rules."

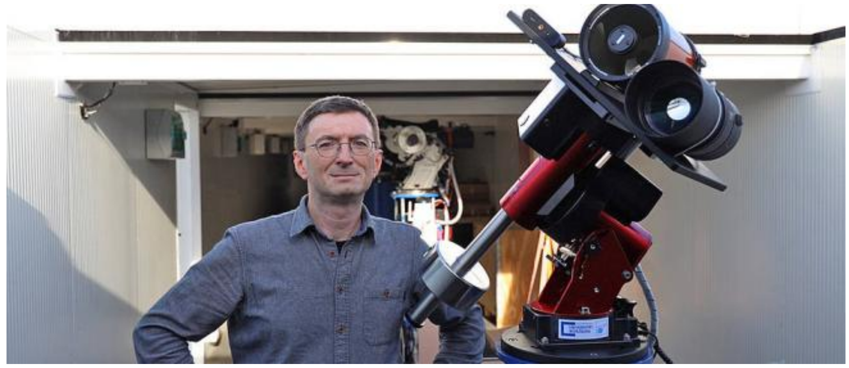
SpaceX says it expects the satellites to grow dimmer as they reach their final orbits, and it's looking into other ways to minimize the glare problem. The National Radio Astronomy Observatory says it has been working with SpaceX to minimize the impact. The International Astronomical Union, meanwhile, has encouraged national regulators to take the astronomical community's concerns into account.

McDowell says he's encouraged by the company's response. "I think there's room without regulation for a cooperative

Flashes on the Moon

On the moon flashes and other enigmatic light phenomena can be observed again and again. With a new telescope, a professor at the University of Würzburg wants to get to the bottom of these phenomena.

It happens several times a week. Sometimes it is only short flashes of light that appear on the surface of the moon. Other light phenomena on the Earth's satellite can last longer. And sometimes there are also places that darken temporarily.



Professor Hakan Kayal next to the moon telescopes. (Image: Tobias Greiner / Universität Würzburg)

Science does not know exactly how these phenomena occur on the moon. But it has attempts to explain them: the impact of a meteor, for example, should cause a brief glow. Such flashes could also occur when electrically charged particles of the solar wind react with moon dust.

"Seismic activities were also observed on the moon. When the surface moves, gases that reflect sunlight could escape from the interior of the moon. This would explain the luminous phenomena, some of which last for hours," says Hakan Kayal, Professor of Space Technology at Julius-Maximilians-Universität Würzburg (JMU) in Bavaria, Germany.

Moon telescope set up in Spain

Kayal is most interested in these appearances. "The so-called transient lunar phenomena have been known since the 1950s, but they have not been sufficiently systematically and long-term observed. This is currently changing, and the JMU professor wants to make his contribution.

As a first step, Kayal's team built a lunar telescope and put it into operation in April 2019. It is located in a private observatory in Spain, about 100 kilometres north of Seville in a rural area. Why Spain? "There are simply better weather conditions for observing the moon than in Germany," says Kayal.

The telescope is remote-controlled from the JMU campus. It consists of two cameras that keep an eye on the moon night after night. Only if both cameras register a luminous phenomenon at the same time, the telescope triggers further actions. It then stores photos and video sequences of the event and sends an e-mail message to Kayal's team.

Filing the intelligent software

The system is not yet completely finished – the software, which automatically and reliably detects flashes and other light phenomena, is being further refined. Kayal plans to use artificial intelligence methods, among other things: neuronal networks ensure that the system gradually learns to distinguish a moon flash from technical faults or from objects such as birds and airplanes passing in front of the camera. It is estimated that another year of work will be required before this can be done.

For Kayal, reducing the false alarm rate as much as possible is only the first milestone in this project. The system, which he is developing on Spanish soil, will later be used on a satellite mission. The cameras could then work in orbit around the earth or the moon. The professor hopes that this will lead to much better results: "We will then be rid of the disturbances caused by the atmosphere". What happens once the telescope has documented a luminous phenomenon? Kayal's team would then compare the result with the European Space Agency ESA, which also observes the moon. "If the same thing was seen there, the event can be considered confirmed." If necessary, further joint research could then be initiated.

New race to the moon

Interest in the lunar luminous phenomena is currently high. This is also due to a new "race to the moon" that is underway: China has started a comprehensive lunar program and at the beginning of January 2019 launched a probe on the far side of the moon. India is planning a similar mission. As a reaction to these initiatives US President Donald Trump spoke in May of a return of the USA to the moon and announced that he wanted to lead NASA back "to its old size".

Behind all these activities are prestige reasons and a striving for technological “supremacy" in space. China and other players such as Space X, however, are also considering the moon as a habitat for humans in the long term. In addition, there are raw materials on the moon – for example, rare metals that are needed for smartphones and other devices. "Anyone who wants to build a lunar base at some point must of course be familiar with the local conditions," says Professor Kayal. What if such plans should ever become concrete? By then at the latest, it should be clear what the mysterious flashes and luminous phenomena are all about.

From Scotch maid to innovative astronomer—Sue Nelson, Royal Astronomical Society

In 1879, Williamina Paton Stevens Fleming found herself pregnant, unexpectedly alone and far from home. The year before, together with her husband James, she had emigrated from Scotland to the United States. Abandoned in Boston at the age of 23 after just two years of marriage, she faced the prospect of being a single parent in a strange country, with no money and nowhere to live.

It was both an exciting and dangerous time to be in America. The Sioux nation had recently defeated Lt Colonel Custer at the Battle of Little Bighorn. In Deadwood, a travelling buffalo hunter had shot Wild Bill Hickok as he played poker. The Brooklyn Bridge and the Washington Monument were works in progress and this relatively new country had only 38 states.

But 1879 was special. In that year, Thomas Edison invented the first functioning light bulb and Williamina Fleming took her first steps towards shining her own light on the science of astronomy.

Within 30 years, Fleming had catalogued more than 10 000 stars and discovered 310 variable stars, 10 novae, 52 nebulae and the hot dense stars known as white dwarfs. Long after her death, when the Hubble Space Telescope unveiled the Horsehead Nebula in unprecedented detail, history had already noted that Williamina Fleming was the first to identify the nebula's unusual shape (figure 2).

Edward Pickering and his "harem" of computers circa 1890, with Williamina Fleming standing and Annie Jump Cannon far right. (Havard College Observatory)

A section of the image on which Fleming first identified the Horsehead Nebula (bottom left). (Havard College Observatory)

The Scotch maid

In 1879, when she was probably at her lowest ebb, Fleming applied for a job as a maid and housekeeper at the Harvard College Observatory. This must have been a difficult adjustment for a former schoolteacher from Dundee. Fleming was one of nine children and had been teaching since the age of 14 while she was still a pupil, to contribute to the family income. Yet this simple act of necessity was life-changing.

The director of the observatory, Edward C Pickering, was a professor of astronomy who employed low-paid "computers", primarily men, to examine photographic plates. Each glass plate, about the size of an old 78 rpm record sleeve, contained images of stars taken with Harvard College Observatory telescopes. They appeared as hundreds of fine grey or black spots. On the spectral plates, where the starlight had first been spread by a prism, the images resemble smudged pencil marks.

The computers used magnifying glasses to catalogue the stars' brightness as well as calculating – computing – their positions. For the spectral plates, information such as chemical composition, colour and temperature of the stars could be gleaned from each millimetre-long spectrographic "barcode".

At first glance it appears as if Pickering wasn't overly impressed by the computers – he apparently declared the work so easy that even his "Scotch maid" could do it. Women were paid less than men at that time, so there was a financial gain in employing women. But I suspect that his disingenuous remark reveals that he knew Fleming was more than a match for his male computers and, within two years, he promoted his housekeeper to a full-time Harvard Observatory staff member.

Fleming was soon put in charge of hiring the computers and, as she recruited more women, "Pickering's harem" took shape. It contained women like Fleming, who had no formal astronomical training and were not expected to think, but who applied intelligence and insight to their work.

Computing was repetitive, painstaking and paid little – even the factory girls at the nearby Lowell mill were paid more – but it offered mental stimulation. Women then began arriving at the observatory from the fledgling women's colleges. These women were more educated and keen to observe, classify and research the heavens, searching for patterns within the data.

By 1890, a photograph of the computers at work reveals a Victorian-style drawing room filled with women in long dresses, high-necked shirts and long hair coiled upon their heads (figure 1). Fleming stands upright at the back, petite with dark hair and a tight waist-fitting jacket. Her mentor, Edward Pickering, is in the corner. He may be in charge but it is obvious that the women in the room are her domain.

There are books, mahogany tables, flowered wallpaper and framed pictures on the wall. Several of the women computers look as if they are doing embroidery, but on closer inspection their samplers are photographic plates. These women are not sewing: they are stargazing.

The Horsehead Nebula

A million or so of the glass plates are still stored at Harvard, in their brown cardboard sleeves. One of them was taken by Pickering and is numbered B2312. It was on this plate that, two years after it was taken, Fleming discovered the Horsehead Nebula. She described it as "a semicircular indentation 5 minutes in diameter 30 minutes south of Zeta (Orionis)".

Fleming rewarded Pickering's faith in her intelligence and ability. She established the first photographic standards of magnitude that were then used to measure the brightness of variable stars. She also developed a new Pickering–Fleming system to classify stars by their spectra alphabetically, A, B, C and so on, according to the strength of the star's hydrogen spectral line.

Within a decade she had studied and classified more than 10 000 stars – most of those visible to the naked eye – for the Draper Catalogue of Stellar Spectra (1890). The catalogue was funded by Anna Draper, in memory of her late husband Henry Draper, a doctor and amateur astronomer from New York who pioneered the use of photography in astronomy. Anna established the Henry Draper Memorial to support photographic research; the catalogue is still in use today. Although Pickering did not name Fleming as co-author, he credited her work and her contribution was recognized among astronomers. At first, Fleming was also unaccredited for the Horsehead Nebula, but this was amended in the second version years later.

Pickering also encouraged the women computers to attend conferences and present papers, allowing them to flourish professionally. In fact, his forward thinking must have been anathema to his contemporaries. Much later, in 1901, the director of Yale Observatory, William Elkin, said: "I am thoroughly in favour of employing women as measurers and computers. Not only are women available at smaller salaries than are men, but for routine work they have important advantages. Men are more likely to grow impatient after the novelty of the work has worn off and would be harder to retain for that reason."

The novelty for many of the women never did wear off. The computers Fleming hired included Antonia Maury, Henrietta Swan Leavitt and Annie Jump Cannon, all astronomers who made significant contributions to the field (Cannon's work is described by Bowler on page 3.14 in this issue).

In 1898, Fleming became the first woman curator of the observatory's astronomical photographs. Some of her journal pages from 1900 reveal the range of her work. "Before lunch I found time to examine a few southern spectrum plates and marked a fourth type star and a gaseous nebula, both probably known. Later in the afternoon I noted a few more interesting objects, among these two fourth type stars, one gaseous nebula, and several bright line stars. Some of these may be new."

Dedicated to the stars

The entries also give an insight into her dedication and sheer workload. "Looking after the numerous pieces of routine work which have to be kept progressing, searching for confirmation of objects discovered elsewhere, attending to scientific correspondence, getting material in form for publication, etc, has consumed so much of my time during the past four years that little is left for the particular investigations in which I am especially interested."

Fleming had returned to Scotland to give birth to her son, but came back to continue working at the observatory, leaving her son with her mother and grandmother. She named him Edward Charles Pickering Fleming – either a simple act of gratitude or possibly signifying that her relationship with the observatory director was more than employer–employee.

By 1907, Fleming had been appointed an honorary fellow in astronomy at Jump Cannon's alma mater , Wellesley College, and was the first American woman to be elected an Honorary Member of London's Royal Astronomical Society. In 1910, Fleming published her discovery of stars that have almost exhausted their nuclear fuel. These small stars have expelled their outer layers, creating a planetary nebula and leaving an extremely dense hot core. They were called white dwarfs because the first few discovered were white.

Fleming died in Boston of pneumonia, aged 54, on 21 May 1911. She left Dundee as a young woman and, at a time when a woman's place was in the home, departed the world as a Harvard Observatory astronomer, the discoverer of white dwarfs and countless new stars.

Magnification Guide.

Magnification is not the be-all-and-end-all of telescopes!

You can see a surprising amount with relatively modest magnifications - If you were to pin me down and say I could only have ONE eyepiece , I would choose one which gave about 150x magnification. Not 200x or 300x or even the fantastic 525x magnification - Just 150x. Useful magnifications vary with the size of the telescope. The larger the telescope, the higher the maximum magnification, but this is always dependent on the 'seeing' or atmospheric turbulence.

For general viewing around the heavens using 'entry level' size telescopes (Up to 150mm diameter) you will require several magnifications:
A fairly low power for wide field views (30x – 50x)
A medium power around (80x - 100x)
And a higher power for normal viewing nights (150x - 175x).
Above this the image deteriorates due to the atmosphere on all but the calmest nights where you might be able to employ 200x - 220x magnification.

Generally you will find that you will use magnifications in the region of 50x - 150x most of the time regardless of the size of your telescope!

Examples:
I have used the 9" (225mm) Refractor at the Godlee Observatory, Manchester University. We had excellent views of Jupiter at 175x magnification.

I used the 30" (750mm) Newtonian at the Amateur Astronomy Centre Nr. Bacup. And, once again, we had some lovely views of Jupiter, at 200x magnification. (See Pic. at top)

The best view I ever had of the globular cluster M13 was in a 22" (550mm) amateur owned Newtonian, at just 200x magnification.

So, to make my point:
Even 'huge' telescopes utilise 'reasonable and usable' magnifications.
If the telescope at the top of this page only needs to use 200x, why would a tiny 60mm refractor need 525x?
The answer is that they're appealing to the 9 year old inside you that thinks that they'll get a great view at huge magnifications! This is not the case.

Why Do We Need Different Magnifications?
The objects we look at are of different sizes and sometimes we want to see the whole, and sometimes the detail.
This means that we need to be able to 'close in' on something. For instance, if we want to look at the whole of the star cluster "The Pleiades" (Seven Sisters) a 6"/150mm f6 reflector would need a magnification of only 35x to fit them all in to the view - To view Alcyone, the bright multiple star of the cluster, you would require a magnification of around 100x - 120x to show the stars to their best advantage.

Likewise, if you're interested in planetary detail, you'll want magnifications from about 80x to the maximum your telescope and the atmosphere will allow. If you want to observe the moons of Jupiter and Saturn, you will only need to use 60x - 100x to fit them in the field of view.

The main consideration is the atmospheric turbulence. If the atmosphere is unsettled, then you will need a lower magnification to see detail. The higher magnifications can only be used effectively when the atmosphere is calm and 'quiet'.

How do we work out magnification?

Each eyepiece (The small lens you look through) has it's own focal length (Usually printed on the side) If you know the focal length of the telescope object glass or mirror, then all you need to do to find the magnification is divide the focal length of the telescope by the focal length of the eyepiece.

Eg1. 900mm / eyepiece 15mm = 60x magnification.

Magnification is a big selling point for telescope sellers so you have to accept that they will throw in an eyepiece that is virtually useless just to give that 525x magnification claim. As long as they give other eyepieces that cover the 50 - 100 range and the 100 - 150 range you'll be OK.

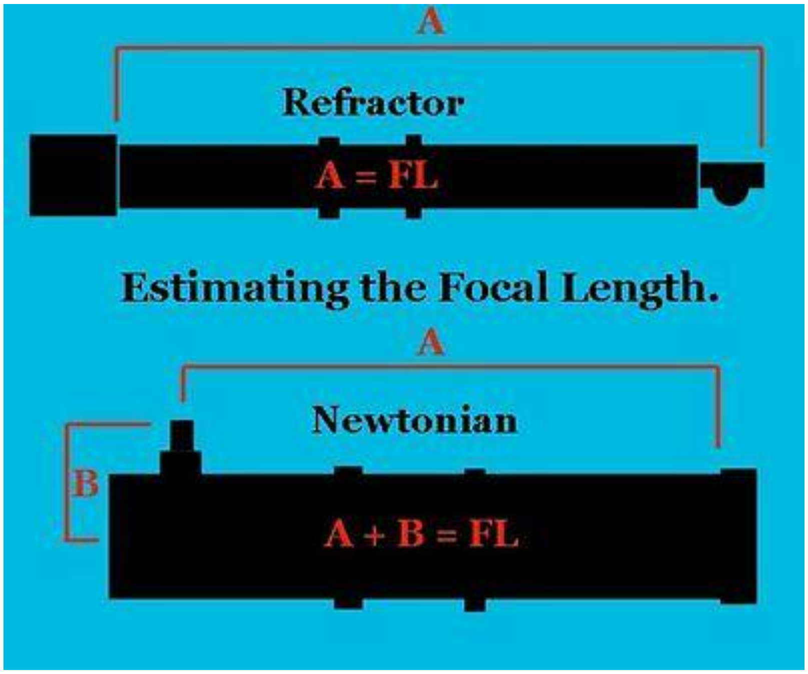
But do you know what? I have noticed that once you get away from the ridiculously small telescopes manufacturers tend to give more reasonable magnifications! Quite often a 76mm Newtonian (too small for astronomy) will come with 525x (useless), but a 150mm Newtonian (Entry level size) will more likely have 300x as it's 'best' magnification (One that could actually be used on the best viewing nights).

Working it Out!
If you don't know your primary focal length you can measure the outside of your telescope to approximate (to about 1cm) the focal length.
Remove the eyepiece, wind the focuser right in, measure exactly as shown in the diagram.

Once you know this length in millimetres, you can find magnifications easily.

Don't forget you can always buy more eyepieces to get the usable magnifications you require.
So... Following my advice further it stands to reason that to utilise the higher magnifications to the full larger telescopes are essential!

A five inch (130mm) Newtonian can manage 250x on an excellent night, but a six inch 150mm Newtonian could stand 300x magnification on the same night.



Logically, then: If you buy smaller than a 130mm Newtonian Reflector, or an 80mm Refractor you won't see the detail that's available. You can really only expect to use magnifications up to 50x per inch of aperture for Newtonians, and 100X for refractors. (To be 'scientific' let's use millimetres!)

<u>THE MAXIMUM USEABLE MAGNIFICATION</u> on a very good seeing night is:
About 2x per millimetre diameter for Newtonians (Half that on a normal night!)
About 3.75x per millimetre diameter for Refractors. (Half that on a normal night!)

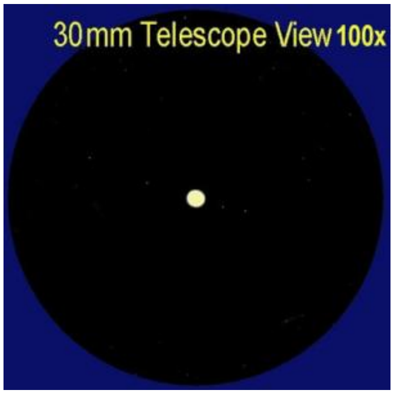
ATMOSPHERIC CONSIDERATIONS.
The atmosphere is a major player in the 'What's the highest magnification I can use?' debate. The rule is to use the highest magnification that still shows a steady clear image.

Sometimes the atmosphere is really steady and you can use the highest magnification your telescope will allow. But, more often, there will be warm and cold currents churning up the view. In that case you have to moderate your magnification so you can see the best view you can get. This usually means that you have to use a maximum magnification of about 150x on a 150mm Newtonian telescope, one that boasts a maximum of 300x.

When I went to live in Lanzarote, I was looking forward to 300+ clear nights a year, but what I didn't realise was that the atmosphere would boil from sunset until four a.m. The views before midnight were nearly always rubbish! The best viewing was before dawn once the ground had cooled down.

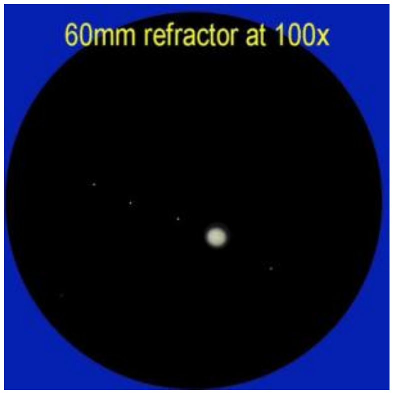
In temperate latitudes we have it a bit better. The atmosphere in the UK is usually good after the Sun's been down an hour, getting very good after midnight any time of year. Once the atmosphere is calm you can regularly use half your telescope's maximum magnification. On really clear and still nights you can observe at the max.

You Want Me To Demonstrate It?
There is a lot written about magnification not having as much relevance as aperture regarding detail in the image - But I've not seen many examples of it in print or on the web. To the novice it would seem obvious that magnifying more would bring out more detail.
This section aims to redress the balance and sort out this misconception with some examples of the expected visual view through the scope of the familiar astronomical object - Jupiter.
Left: An astronomical photograph by an expert (Paul Money). The 180PRO is one of the best planetary telescopes available.
Astro photographs are made up of many individual exposures and are 'stacked' and processed to bring out the best possible image. They are not 'fake', they do show the actual detail available. However, visually, you have to wait for the atmosphere to calm down and occasionally you get a glimpse of detail approach-



30mm refractor

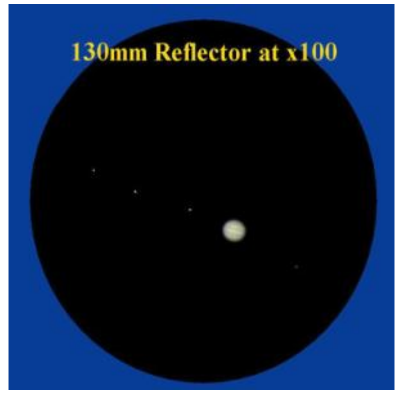
Jupiter is usually a whiteout with no detail and a lot of flaring of the disk.
The moons are pinpoint specks.



60mm refractor

In better quality telescopes Jupiter begins to show some detail.

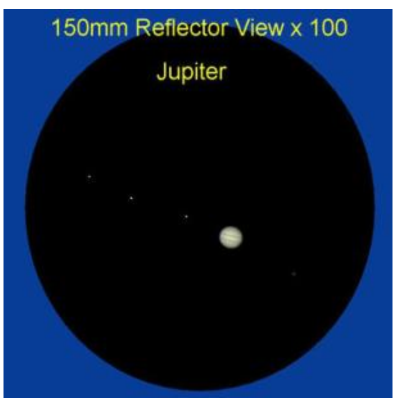
The moons are pinpoint specks.



130mm reflector

Slightly more detail.

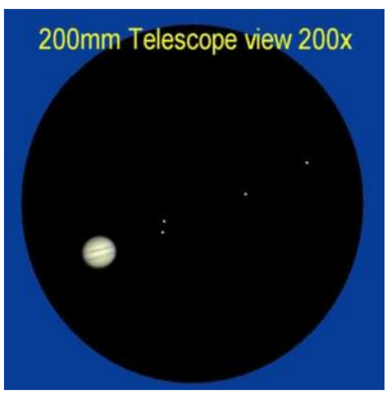
The moons are pinpoint specks, but Io shows a slight yellow/ orange tinge.



150mm Reflector

Jupiter shows some detail in the belts. The Great Red Spot can be visible when it's dark in colour.

The moons are pinpoint specks, but Io shows a distinct yellow/

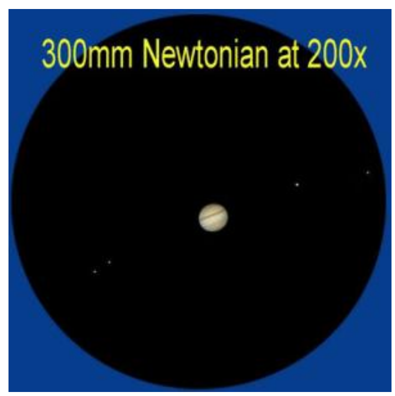


200mm reflector

Here we have increased the magnification too.

There is lots of detail on Jupiter. The Great Red Spot is usually visible when it's on the earth-facing side of the planet.

The moons are still specks, but begin to show some hint of their planetoid nature.



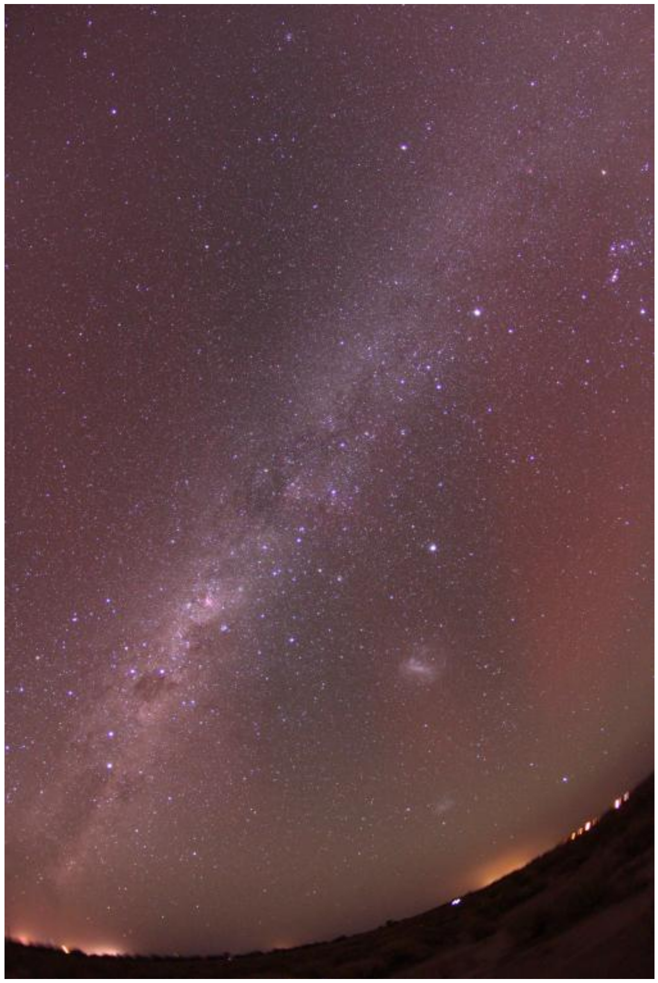
300mm reflector

Loads of detail on Jupiter. Detail even seen in the poles with multiple bands and belts. Great Red Spot clearly visible at times (Not seen on this picture).

The moons show disks on favourable nights. Io is clearly yellow/orange.

Here's What You're Missing In The Night Sky
By Brandon Finnigan, The Federalist, August 7, 2015

The electric era has changed our lives in many good ways, but it has had an unforeseen consequence: the slow yet steady elimination of night.



When was the last time you stared into the eternal? I can tell you: it was on a lonely stretch of Route 66, near the abandoned town of Amboy. Until this trip, I had never ventured much further than the Cajon Pass, so the Los Angeles light dome had washed out much of my observing. I had been attempting to really break in my telescope, and picked a rough day to do that: rainstorms rolled in throughout the night, and the temperature dropped into the 30s, freezing for a spoiled Californian.

After taking a nap in the car, I awakened to a sight that disappointed me at first: yet another cloud, stretched across the sky. But this wasn't an earthly condensation of water. It was the shimmering light of billions of suns: our home galaxy. It was so bright, it cast shadows on the ground. I could read by its light. The feeling, witnessing this? Indescribable.

This feeling is so overwhelming because such a sight is rare. The electric era has changed the lives of humans in many incredible, life-sustaining, and enhancing ways, but it has had an unforeseen consequence: the slow yet steady elimination of the night. While we have been fighting darkness as a survival tactic for as long as we have been a species, we also needed the darkness for rest, contemplation, meditation.

Restoring the Night Sky

Consider the night-time prayer of Jesus in the garden of Gethsemane. Such a moment comes not in the midst of hustle and bustle, but under the eternal light of the heavens above, in the glorious, cleansing silence of the night. Our very civilization was dependent, at one time, upon a careful observation of the comings and goings of the stars. Think bigger than astrological influences on kings and sultans: agriculture would have been exceptionally difficult without regular signs to foretell seasonal changes.

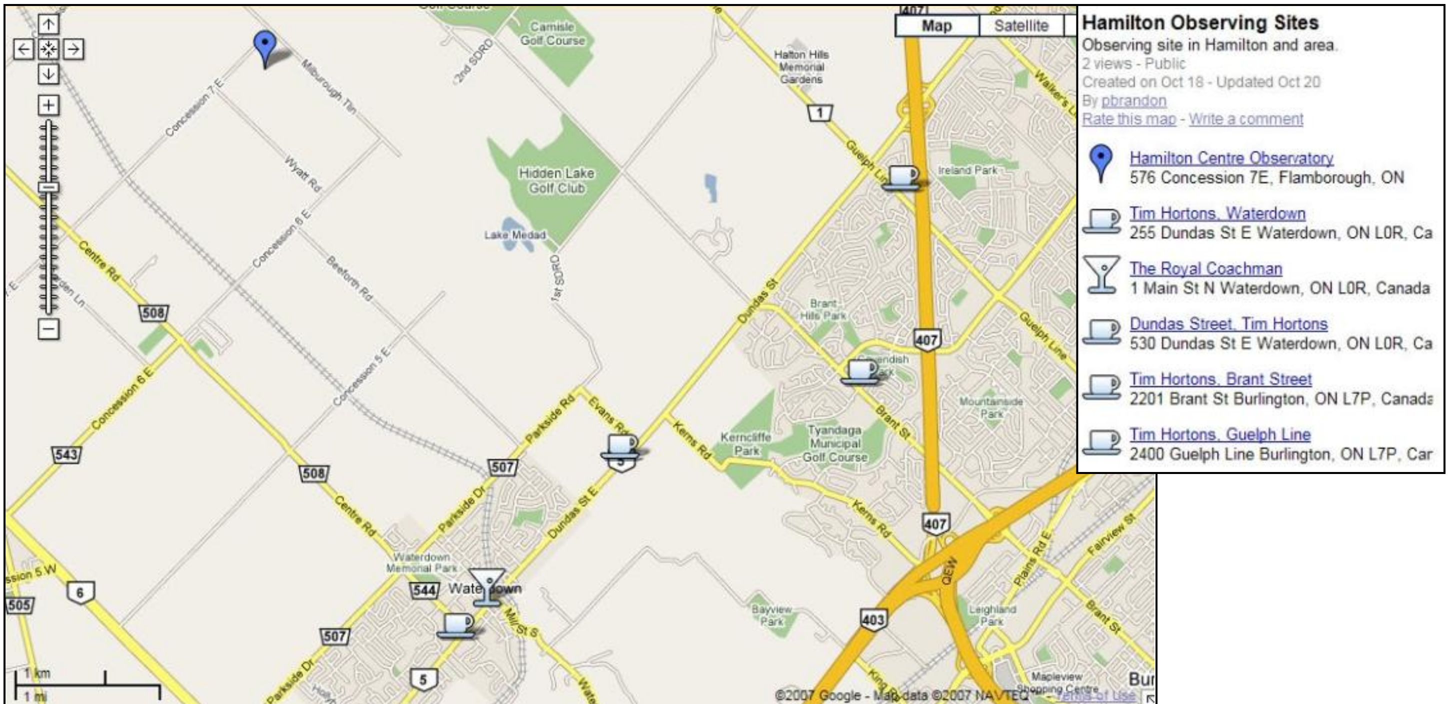
Slowly, the light that had guided us out of tribal wandering bands and into settlement, civilization, and high technology has been snuffed out by that very recent stage, though not everywhere. There are still plenty of places where the stars still shine brilliantly, where we can enjoy and contemplate the spiral arms of our home island in the universe.

The efforts of countless rural residents, astronomers, naturalists, wilderness enthusiasts, and town councils have held, and in some places reversed, this slow creep: in the town of Charleston, Rhode Island, just 40 miles from Providence, the zodiacal light has returned. In West Texas, Bill Wren of the McDonald Observatory has actively worked with an unlikely ally: the rig operators of the Permian Basin Petroleum Association. Their goal? Reconsider lighting so the observation of space and the drilling boom can co-exist without additional regulation.

Go for Contemplation, Not Coercion

The dark-sky movement has its more environmentally passionate side, and this is where I diverge from them: I don't want to shut down businesses and bully people. I want to persuade them of smarter ways to illuminate their necessary businesses and lives so that we can all appreciate something our ancestors took for granted for thousands of years. We should all have an opportunity to experience this. It is a part of who we are as a species and as a civilization.

The sky above holds certain timelessness: the light emanating from Antares left that star when the Byzantine Empire was about to fall. They are a way to contemplate ourselves, our accomplishments, our ancestors, and even those in more recent memory. When the light left Procyon, my grandmother was still alive. When it left Vega, my great-grandparents were still with us. These stars, which shine down upon us, shined down upon those we have recently lost. They will shine for some time on those not yet born. Whether or not we brighten our own patch of sky, there those shimmering balls of fusion will be.



576 Concession 7 East, Flamborough ON
N43° 23’ 27” W79° 55’ 20”
RASC Hamilton, P.O. Box 969,
Waterdown, Ontario L0R 2H0

Email: hamiltonrasc@hamiltonrasc.ca
Facebook: RASC Hamilton Centre - Amateur Astronomy Club
Or fb.me/RASCHamilton
Forum: http://hamiltonrasc.ca/forum/index.php
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I took this picture was taken on June 5, 2012. The black(-ish) spot is Venus.

It was taken from the boat ramp in Port Weller, near where the Welland Canal meets Lake Ontario. I’d used Google Maps to find a spot where I could watch the Sun set into the lake, just as I’d watched the Sun rise 8 years earlier with the impossibly large black spot of Venus etched into it.

I had not expected to see the rough edge of the escarpment interrupting the shimmer on the lake and the brightness of the sun. I should have foreseen that the shape of Venus would match the shape of the Sun, though.

It was a very bittersweet moment, watching the Sun and Venus descend toward the distant Niagara Escarpment, knowing that this was a sight I’d never see again, since the next transit of Venus will be in December, 2117. If there is anyone reading this that actually may be able to see that transit, then please make all possible arrangements to see it. - Roger Hill