POLARIS

Royal Astronomical Society of Canada
London Centre Newsletter
June 2009

Our Closest Star

Patrick Whelan

Of course I am talking about the Sun. It seems very huge to us, but really it is just a rather ordinary star. It is a normal G2V main-sequence star. We are in the Milky Way galaxy and there are more than 100 billion other stars in our galaxy.

The diameter of the sun is 1,390,000 km and has a mass of 1.989×10^{30} kg.

The temperature at the surface is 5,800 K and at the core it is 13,600,000 K. (Zero degrees Kelvin is equivalent to -273 degrees Celsius and Kelvin and Celsius degrees are the same size)

The Sun creates energy by a process known as nuclear fusion. Hydrogen is converted to Helium with a release of energy. Every second about 700,000,000 tons of hydrogen are converted to about 695,000,000 tons of helium and 5,000,000 tons ($=3.86 \times 10^{33}$ ergs) of energy, mostly in the form of gamma rays. Boy, that is a lot of energy! In other words, the energy created is about 9.15×10^{10} megatons of TNT per second. The gamma rays released in fusion reactions are absorbed very quickly by the solar plasma and then re-emitted again, so it takes a long time for radiation to reach the Sun's surface. Estimates of the "photon travel time" range between 10,000 and 170,000 years. Wow! It takes that long for light to get out of the sun! Each gamma ray in the Sun's core is converted into several million visible light photons before escaping into space.

We get to see different kinds of solar eclipses on Earth. Because the Sun and Moon have almost identical apparent size and also because the distance to the Moon and Sun vary throughout the year we get to see 3 kinds of eclipses. Partial eclipses are caused by the moon not being perfectly aligned with the Sun so we see the Sun as if there were a 'bite' taken out of it. That is the kind of eclipse you can see on my t-shirt on page 4. Full eclipses are caused when the Moon's apparent size is bigger than the Sun's and the Moon the covers the Sun completely. Annular eclipses are caused when the Moon's apparenet size is smaller than the Sun so that the outer ring of the Sun is seen all around the Moon during eclipse.

Sunspots are another solar phenomenon that are fun to observe. When you look at the Sun through a dark filter (or white light solar filter) sunspots show up as dark against the bright surface of the Sun. These filters are very inexpensive and can be put on telescopes and binoculars too. Sunspots are cooler areas on the surface of the Sun. While the surface of the Sun is about 5800K, sunspots are only 3800K. They can be very large, as much as 50,000 km in diameter! (Earth's diameter is 12,600 km)

If you look at the Sun these days, you won't see many sunspots. We are at the low point in the 11 year solar cycle. In fact we are experiencing an unusually low amount of sunspots even for solar minimum. There have been, as of this writing, 190 spotless days in 2009. That is 78% of the days this year with no sunspots. Not much fun for us solar observers!

The other way to observe the sun is to use a special solar telescope. These telescopes use fancy (and expensive) filters to show you the surface of the sun.
Sometimes called “Solar Prominence” filters, Hydrogen-Alpha filters come in filter sets. The first part of the filter set is the Energy Rejection Filter which blocks almost all light which the exception of a narrow band of red light. The second part is a Tuning Filter which allows the filter to be tuned along the narrow red spectrum passed by the Energy Rejection Filter. You can see the granulation on

(Continued on page 4)

Moon Phases

June 22 2009

June 29 2009

July 7 2009

July 15 2009

The darkness of space
Starlight cutting through velvet
Capture photons here

Brilliant flash of light
Pain ripping across my wrist
Meteorite jabs

Parabolic curves
Silver and spiders and flats
Panoptic beauty

Shaking in the cold
Breath ice hanging in the air
What kind of hobby

Racing to China
Fleeting shadow being chased
Away clouds, away

Apochromatic
Red and blue in synchrony
Joyous to the eye

London Centre Executive

President and ATM Chair
Dave McCarter
email: dmccarter (at) sympatico.ca

Vice-President and Newsletter Editor
Patrick Whelan
email: patusratus (at) sympatico.ca

Tri-County Public Star Party Coordinator, Librarian and Hume Cronyn Coordinator
Robert Duff
519-439-7504
email: rduff (at) sympatico.ca

Treasurer and Sky and Telescope Coordinator
Bill Gardner
email: gardner.w (at) rogers.com

Secretary and Webmaster
Rick Saunders
email: ozzzy1 (at) gmail.com

National Representative
Craig Levine
email: craigslevine (at) gmail.com

Observer's Chair
Peter Raine
pete_raine (at) rogers.com

Honorary President and past National President
Peter Jedicke
email: PJedicke (at) fanshawec.ca

Past President
John Rousom
email: jdr (at) netscape.ca

Observatory Trustee and Supplier of Fine Telescopes
Joe O'Neil
email: joneil (at) oneilphoto.on.ca

Find the Polaris newsletters on the internet at: www.patusratus.ca/Polaris

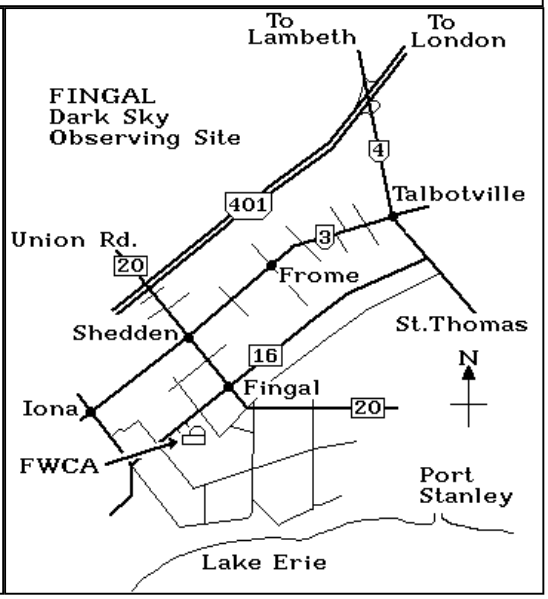
LONDON RASC MONTHLY MEETINGS

The London RASC group meets at Fanshawe college in London Ontario, September through July on the third Friday of the month at 19:00. They meet in room B1073.

Everyone interested in astronomy is invited to attend and enjoy our guest speaker, member activity and observing reports, announcements of new discoveries and upcoming events, telescopes and telescope accessories show and tell, and other fun activities. Have a look at our future and past activities on our website to see what we are doing.

Parking is free on Friday evenings, and there is plenty of room in the east parking lot off Oxford St. and parking spaces on the south side of B building. Enter the college by B building doors near Oxford Street, just west of the bus stop. College signs at key hallway locations will help you find us. The London RASC webpage can be found at:
www.rasc.ca/London

They have a preferred observing site at Fingal Wildlife Management area.



Sky Events for June and July 2009

June 19 Venus 2.0° S of Mars
June 20 Moon 0.5° N of Pleiades(M45)
June 21 Solstice
July 4 Antares 0.5° S of Moon
July 7 Penumbral lunar eclipse
July 13 Jupiter 0.6° S of Neptune

Jupiter rises in late evening and transits around 4:00 am
Saturn sets around midnigh. The rings are only inclined 3.7°
Venus is brilliant at dawn
Mars is in Aries being chased by Venus

R.A.S.C. London Centre Library
Books of the Month June 2009
By Robert Duff

In order to make our library collection available to members, I bring three books to our general monthly meetings. These "Books of the Month" are available for loan, to be returned at the following monthly meeting.

The books for June 2009 are as follows:

Burnham's Celestial Handbook: an Observer's Guide to the Universe Beyond the Solar System, by Robert Burnham. Revised and Enlarged Edition. c1978.

Volume One, Andromeda—Cetus.

The Backyard Astronomer's Guide, by Terence Dickinson & Alan Dyer. Revised Edition, 2002.

NightWatch: a Practical Guide to Viewing the Universe, by Terence Dickinson. 3rd Edition, Revised and Expanded for Use Through 2010. 1998 (2003 printing).

For a complete listing of our library collection please see our RASC London Centre Web site at: http://www.astro.uwo.ca/~rasc/

If there is a particular book or video you wish to borrow, please feel free to contact me by telephone at (519) 439-7504 or by e-mail at rduff@sympatico.ca

Sky and Telescope Subscriptions

Sky & Telescope subscriptions are available at a discounted rate through the London Centre. The cost is $39.95USD instead of the normal $49.95USD subscription rate. Please see Bill Gardner for details.

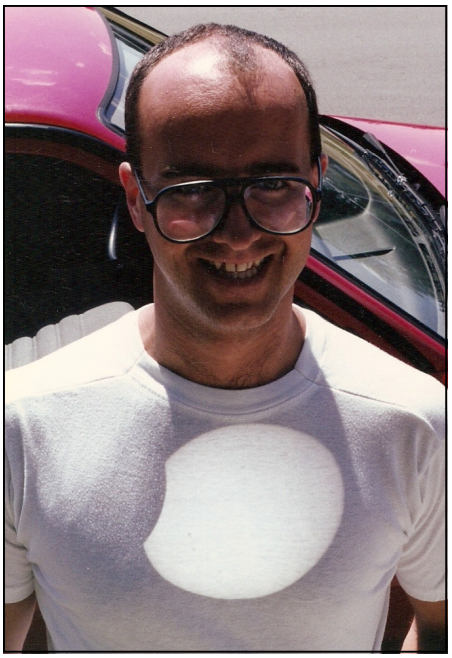
(Continued from page 1)

the surface and you can also see huge flares coming off the sun and prominences. You don't need sunspots to enjoy viewing the Sun with one of these telescopes. One of the smallest and least expensive Hydrogen-Alpha telescopes will cost about $500.

This was a short article about the sun. This subject could certainly take many pages if I wanted to go into more depth.

Why don't you think about doing some solar observing? The white light filters are inexpensive and are available for most every telescope out there. They are also available for binoculars! If you are handy, you can buy the solar filter film on its own and make your own custom solar filters! Have fun, and clear skies!

The photo opposite is of a partial solar eclipse. The moon is eclipsing just a small sliver of the Sun. I used a 4.5 inch Tasco reflector to project the image of the Sun onto my t-shirt. In the original photo, you can actually see lots of sunspots!



Cronyn Observatory Saturday Evening Summer Open House, May 2nd—August 29th, 2009
By Robert Duff

Cronyn Observatory Open House, Saturday, May 16th

Clouds, followed by clear sky, and cool temperatures greeted visitors to the Cronyn Observatory Open House . Dr. Pauline Barmby delivered a digital slide talk, "News from Telescopes in Space," while Dr. Jeff Hutter operated the big 25.4cm refractor in the dome. I set up the 25.4cm Dobsonian on the roof patio and was soon joined by Dave McCarter, Peter Jedicke and Stuart Happy. Dr. Hutter, with help from Dave, showed people Saturn . He also directed the big telescope at Mizar and Alcor. We showed people Saturn in the 25.4cm Dobsonian. There were about 12 visitors and the Observatory closed around 11:00 p.m.

Cronyn Observatory Open House, Saturday, May 23rd

Stuart Happy, Mike Roffey, Bill Gardner, Greg Andres, Steve Imrie and Adam Priestap-Suttis helped out at the Cronyn Observatory Open . On the Observatory's roof patio Mike set up his 127mm Maksutov and Adam his 20.3cm Dobsonian, while Stuart operated the RASC London Centre's 25.4cm Dobsonian. On the front lawn Bill Gardner set up his 101mm refractor and Steve Imrie his 20.3cm. Stuart Happy reported in his e-mail that the Cronyn wasn't too busy and estimated there were about 20 visitors. Saturn was the principal object of viewing. Doctoral student Alyssa Gilbert delivered the digital slide talk, "Earth & Moon," while another grad student, Talayeh Hezareh, operated the big 25.4cm refractor in the dome.

Cronyn Observatory Open House, Saturday, May 30th

Despite earlier poor weather, we did manage a good star night for 12 visitors (10 adults and 2 children) at the Cronyn Observatory.

Dr. Shantanu Basu made a digital slide presentation on galaxies and post doctoral student Phil McCausland and I made ready the 25.4cm refractor in the dome and set up the London Centre's 25.4cm Dobsonian on the Observatory's roof patio. We showed visitors the first quarter Moon and Saturn through the Dobsonian. Through the big refractor in the dome they viewed the Moon and Saturn, as well as the star Vega and the Double-Double star system Epsilon Lyrae.

Cronyn Observatory Open House, June 6th

I arrived at the Cronyn Observatory under a cloudy sky. Graduate student Wolfgang Dapp made a digital slide presentation on "Nebulae" before a group of 14 people, which increased to a total of 27 visitors by the end of the evening. Wolf made his presentation a second time later. Bill Gardner set up the RASC London Centre's 25.4cm Dobsonian on the roof patio. Graduate student Draco Szathmary showed visitors views of the communications tower in south London through the big 25.4cm refractor in the dome.

Besides Bill Gardner, Mike Roffey and myself, other RASC London Centre members who came to the Cronyn were Greg Andres, with his son Abram, and Peter Jedicke. Peter, Bill and I had a lengthy discussion with 3 visitors from Ottawa, Calgary and Montreal who were attending a Let's Talk Science conference at Western.

Cronyn Observatory Open House, June 13th

Stuart Happy and Greg Andres reported in their e-mails (June 14th) that some 50 people attended the Cronyn Observatory Open. Stuart and Greg (with his son, Abram) set up their Sky-Watcher 20.3cm Dobsonian telescopes on the front lawn and were joined by Bill Gardner with his 101mm apochromatic refractor. Mike Roffey operated the RASC London Centre's 25.4cm Dobsonian on the roof patio along with Adam Priestap-Suttis, who brought his 20.3cm Dobsonian.

(Continued on page 6)

Almost Everything You Wanted to Know About Polarization But Were Afraid To Ask

Mark Ingram

Okay, so we have discussed how photons are absorbed and emitted, and how the frequency of a photon is determined by the energy it carries away, and how that energy is determined by how quickly the photon is created. Cool stuff, but really only half of what a photon is all about. The energy, frequency, wavelength, and momentum of photons (each completely determined by any one of the others) are the extrinsic property of photons, that is, it characterizes how photons are embedded in spacetime. We needs must now discuss intrinsic properties of photons, those properties that are inherent to the photon itself and independent of any embedding.

A photon is an elementary particle, and as such can have only three intrinsic properties, mass, charge, and spin. Photons, however, have mass 0 and charge 0, so really photons only have one intrinsic property, namely spin -- an interesting counterpoint to the photon only having one extrinsic property. Quantum physics tells us that the spin of an elementary particle is quantized, that is, it can only have a finite set of values, and since the photon is a spin-1 particle it can only have two values, +1 or -1. These values correspond to the helicity of the photon's polarization, if +1 the photon is circularly polarized in one direction (say left), and if -1 the photon is circularly polarized in the opposite direction (which we must now call right).

Now we get to the fun stuff. A photon is a boson (since it has integral spin), and as such it loves to share its intrinsic properties with other photons (a phenomenon known as quantum interference).

In fact, it loves to do that so much that it even interferes with itself! Now since a photon has only one intrinsic property, its spin, and this spin can have only two values, -1 or +1, we have the interesting fact that this self-interference of a photon can be described as every photon having a certain amount of +1 spin, and a certain amount (the remainder) of -1 spin.

We have now physically characterized photon polarization! Well, almost. I myself still have no idea what (physically) determines the initial polarization state when a photon is emitted.
If any of you do, or know someone who does, please tell me, mingram@rogers.com. Really.

So, OK, a photon has polarization, and some of it is left, and some right. Boring, right?

Not for much longer! Let's say we have a photon with an equal amount of left and right polarization. What this means is that the photon is linearly polarized, and one can say (sacrificing a little rigour) that it is vibrating back-and-forth rather than round-and-round.

But this back-and-forthing can occur in any direction perpendicular to the direction of propagation of the photon, so arbitrarily picking an x and y axis (where z is the propagation direction) we can have a photon that vibrates back and forth entirely on the x-axis, or we can have a photon that vibrates back and forth on the y-axis (if the photon is linearly polarized, of course). It turns out that this is another way to decompose the polarization state of an arbitrary photon; it is a superpostion of some x back-and-forthing and some y back-and-forthing (note that in this case, there is another determining factor, the phase angle -- the two back-and-forthing states may not occupy the center (0) spot at the same time; in fact, if they do, the photon is linearly polarized).

Now to the heart of the matter (for this article, at least). You are of course familiar with transparency, the fact that some materials transmit photons rather than absorbing or reflecting them. The photon coming out of the material has exactly the same energy as it did going into the material. But the speed of light is lower inside the material (assume it is surrounded by vacuum), and even more interestingly, some materials have a lower speed of light for x-linearly-polarized photons then they do for y-linearly-polarized photons. This is a property of the (asymmetric) crystalline structure of the material.

What this means is that a photon passing through such a material has its x-component slowed down relative to its y-component; thus the phase angle changes, and the transmitted photon emerges with a different polarization state!

I am just astonished. First, photons in vacuum travel at the speed of light, which means that time stops for them. Second, a photon has a certain energy that never changes from emission to absorption. Yet, when we pass it through a material, it can change quantum state, and emerge as a differently-polarized photon with the same energy! It's like it slows down just enough to give it enough "time" to change state!

In fact, this is exactly why the speed of light in matter is lower than in vacuum. As the photon is transmitted through matter, it is the interference of its polarization with the matter's electromagnetic field that slows it down.

Yet even this astonishing fact seems almost mundane when you consider this: your eye can see polarization! Apparently it takes just a little training, but there is in fact a physical difference in the way the human retina reacts to polarized light.

I haven't found a way to train myself yet; wish me luck. You may be even more interested to know that there are certain insects that can detect the difference between left-circularly-polarized light and right-circularly-polarized light. One might be inclined to ask how this can occur (and there is research being done on that right now) but I myself am more inclined to ask why this occurs. Exactly what evolutionary pressure can result in insects caring about polarization, particularly the arbitrary-seeming difference between left and right circular polarization?

And just as one final point, I would like to mention that polarization is going to tell us how the universe began. The cosmic microwave background radiation, the universe-sized picture of the Big Bang, is after all just photons, It turns out that the distribution of the polarization states of those photons will tell us about the one remaining mystery of cosmic creation, how the early universe expanded faster than the speed of light. Stay tuned!

(Continued from page 4)

Dr. Sarah Gallagher made the digital slide presentation on "Galaxies" and galactic collisions. Sean Kohut, who just completed his undergraduate studies in astronomy at Western, was operating the big 25.4cm refractor in the dome. The main object of viewing was, of course, Saturn.

Thank you to everybody who helped out at the Cronyn on this clear Saturday night June 13th!

Star Night, Camp Timken, Friday, May 22nd
By Robert Duff

Some 400 Scouts and Cubs were at Camp Timken for an annual camping event and this year's theme was "Reach for the Stars." Six RASC London Centre members arrived showed up Friday evening, May 22nd, including Steve Imrie, Rick Saunders, Dave McCarter, Craig Levine, Peter Jedicke and me. Three of five telescopes were set up, including Rick's 102mm TeleVue refractor, Dave's 25.4cm Dobsonian and Craig's 33cm truss-tube Dobsonian. Cloudy skies prevented any observing and the members left the campsite a little after 10:00 p.m.

Astronomy Presentation, 4-H Club Glencoe, May 23rd
By Robert Duff

Peter Jedicke, Steve Gauthier and I made an astronomy presentation before a group of 115 people, including 95 children (ages 10—12) and 20 adults, at the 4-H Club Ontario "High Energy Event" in the Glencoe Arena. The theme was, "Out of This World." Peter made an enthusiastic digital slide presentation, introducing astronomy, and was immediately followed by Steve who gave them a sky tour using Stellarium and Celestia sky charting software.

Star Night, Guides, Camp Peco Dah Quah, May 23rd
By Robert Duff

Cheri McCracken, Peter Raine and I arrived for a Guides star night at Camp Peco Dah Quah, east of Wyoming. Cheri made am excellent digital slide presentation, "Constellations," before 80 Guides and 10 adults and this was followed by questions from the group. I demonstrated how to assemble the "Star Finder" planispheres and then left 100 for them to assemble on their own. A Guide leader distributed the Galileo Moment cards as the group exited the door of the presentation room. We succeeded in showing the Guides views of Saturn, M13 and the stars Mizar and Alcor, in Cheri's 25.4cm and my 20.3cm Dobsonian telescopes. Peter announced an ISS pass, which was bright and glided overhead.

Star Night, Clara Brenton Public School, June 3rd
By Robert Duff

A clear sky with some clouds greeted some 61 elementary school students, Scouts, parents and teachers at Clara Brenton Public School in west London. I brought my 20.3cm Dobsonian to join Dave McCarter with his 25.4cm Dobsonian and 80mm Stellarview refractor set up on the school's front lawn.

We showed people the gibbous Moon while it was still daylight. I was able to show people excellent views of the Moon.

Peter Jedicke arrived bringing his Celestron SkyScout and helped Dave locate Saturn in the twilight sky. I eventually also located Saturn and it made a pleasing image for people with its rings visible edge on and preceded by its moon Titan, far to the celestial west (left) as it drifted from east to west across the field of view. Saturn's second brightest moon, Rhea, also became visible to the celestial west, between Saturn and Titan, as the sky darkened. People observing through Dave's telescopes were able to see a third moon, between Rhea and Saturn.

Star Night, Longwoods Conservation Area June 13th
By Robert Duff

Clear skies made for promising star night as Dave McCarter, Craig Levine and I arrived, with our telescopes, at Longwoods Road Conservation Area. Dave McCarter made a digital slide presentation before 11 members (8 children and 3 adults) of the 22nd Cub. The Cubs were working towards their Astronomy Badges. Dave followed this with another presentation from 8:00—9:00 p.m. before a group of 30 members of the public.

Craig Levine set up his 13.1-inch (33.3cm) home-built truss-tube Dobsonian reflector near the campsite. I set up my 20.3cm Dobsonian near Craig's telescope and Dave with his 25.4cm Dobsonian joined us after the slide presentation.

Saturn was a splendid sight in all three telescopes with its moon Titan visible, following to the celestial east (right) of the planet, as it drifted across the telescope's field of view. The shadow of the nearly edge-on rings was visible as a thin dark line across Saturn's disc.

Three of Saturn's moons were visible in Craig's 13.1-inch (33.3cm) Dobsonian telescope and he was later able to show visitors a nice view of the Whirlpool Galaxy (M51).

I located Saturn in my 20.3cm Dobsonian in the twilight sky. I showed visitors views of Saturn. Saturn was a splendid sight with 3 moons visible as well as cloud belts noticeable on the planet's surface. I also showed visitors the globular cluster M13 in Hercules, the Double-Double star system Epsilon Lyrae and the Whirlpool Galaxy (M51).

We observed several satellites overhead, including Iridium flares and Dave and I identified stars and constellations for the visitors with our green laser pointers. I handed out Galileo Moment cards. The Cubs and their leaders and other visitors, as well as the Longwoods Conservation Area staff, were very appreciative of the slide presentation and what was an excellent night under the stars. We left the campground a little before midnight.

Star Night, Upper Thames Public School, June 12th
By Robert Duff

Peter Jedicke reported in his e-mail that Dave McCarter, John Rousom and himself joined Adam Priestap-Suttis and his mother, Cheryl Priestap, at Upper Thames Public School for a star night. Possibly because of the Pittsburgh / Detroit Stanley Cup hockey game only 5 people showed up. John, Dave and Adam set up their telescopes in the parking lot under clear skies but there was too much light pollution. They moved to the soccer field and pointed out some constellations to the visitors. The star night was wrapped up by 10:30 p.m.

June Pocket Sky Atlas Challenges

John Kulczycki

This is the first installment of interesting things to watch for in the seasonal sky using the Pocket Sky Atlas. I've indexed the object to the star chart page it's on so this should be easy hunting.
There's a lot more to see on those pages, but this will give you a start.

Naked Eye:
Brocchi's Cluster, (AKA the Coathanger or Collinder 399) page 65

Small Scopes and binoculars:
M57 (You know you want to see it!) Page 63

Larger Scopes:
NGC 6826, Blinking Planetary Page 62

Bonus objects:
NGC 6818, Page 66 and NGC 6822 Barnard's Galaxy, Page 66

Happy hunting!

Amazing Nova 2

Miroslav

Dear friends of astronomy

In my last report (newsletter Polaris - February 2009))on V5558 Sgr (amazing nova) a little judgmental error ocurred regarding famous variable star R CrB. Declining from around magnitude 6
(dimming started JD2454208 = 5 July 2007 according to my observations)
this prototype variable is still down to below 14 magnitude. Famous R CrB did NOT start to recover from deep minimum as I assumed (newsletter Polaris - February 2009) and is still below 14 magnitude in my last observation 29. May 2009. "Shining" at magnitude 14.5 - 15 this prototype class variable star is at her minimum for over 300 days.

And amazing nova V5558 Sgr continues to be amazing. Observations of 26 February 2009, 2 March 2009, 4 March 2009 did all confirmed this nova to be shining at magnitude 11.6.....
27 March 2009 magnitude 11.7—amazing nova is apparently ever so slowly declining....
and 17 May 2008 magnitude again 11.7m vis. The same results May18,20,21....

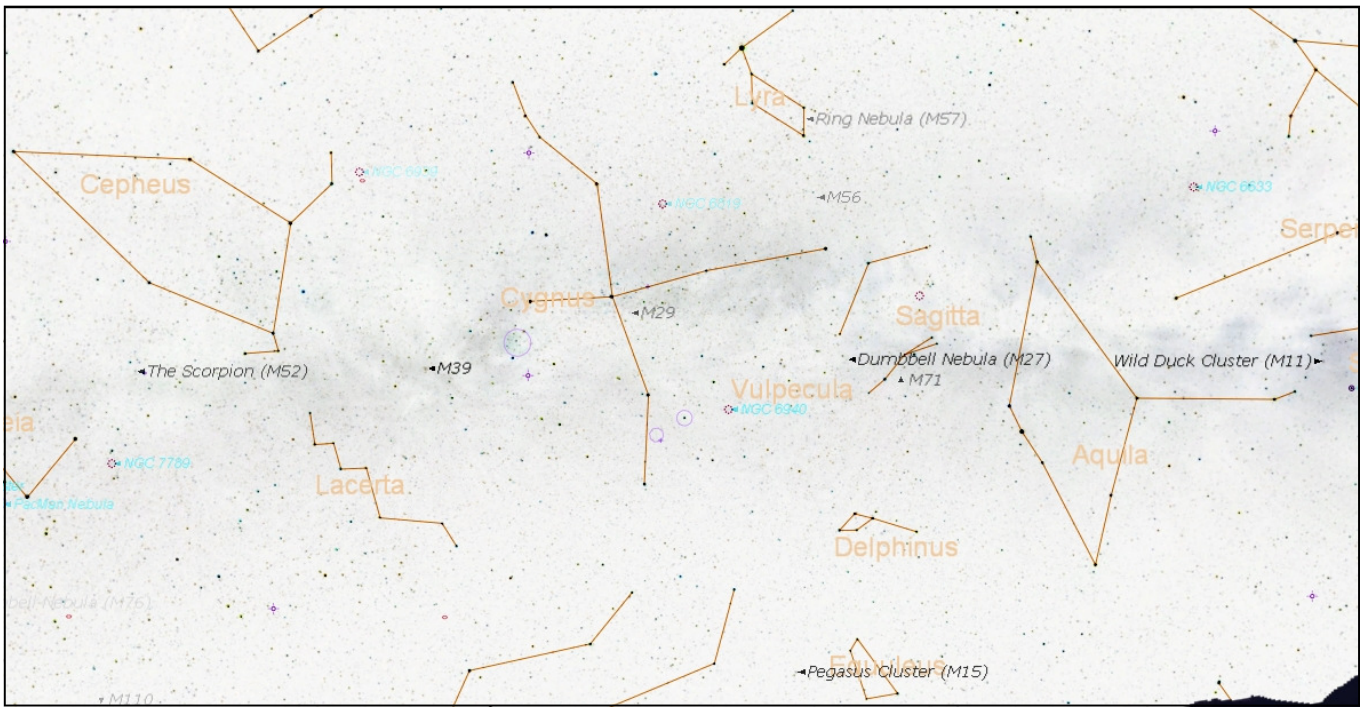
Not sure I did mention this..... a few years ago after rising roof of my backyard observatory, (to accommodate 16"f12 Cassegrain box) limiting southern declination became even more restricted, in other words I can only reach about -10 degrees (south).
So, anything more south I have to observe with portable 8"f10 Meade SCT. Been really lucky about this telescope (optics is very good) I have to say with Pentax eyepieces it became optically phenomenal.....(to me).
In this light polluted town I can reach magnitude 12.5 (star) down -18 degrees south where amazing nova is.

Also.... for about 10 - 15 years now quite discouraging rumours about visual data gathering was spread around, not only by CCD folks but also on the ground of automatic stations scanning night sky "all the time" and so on.

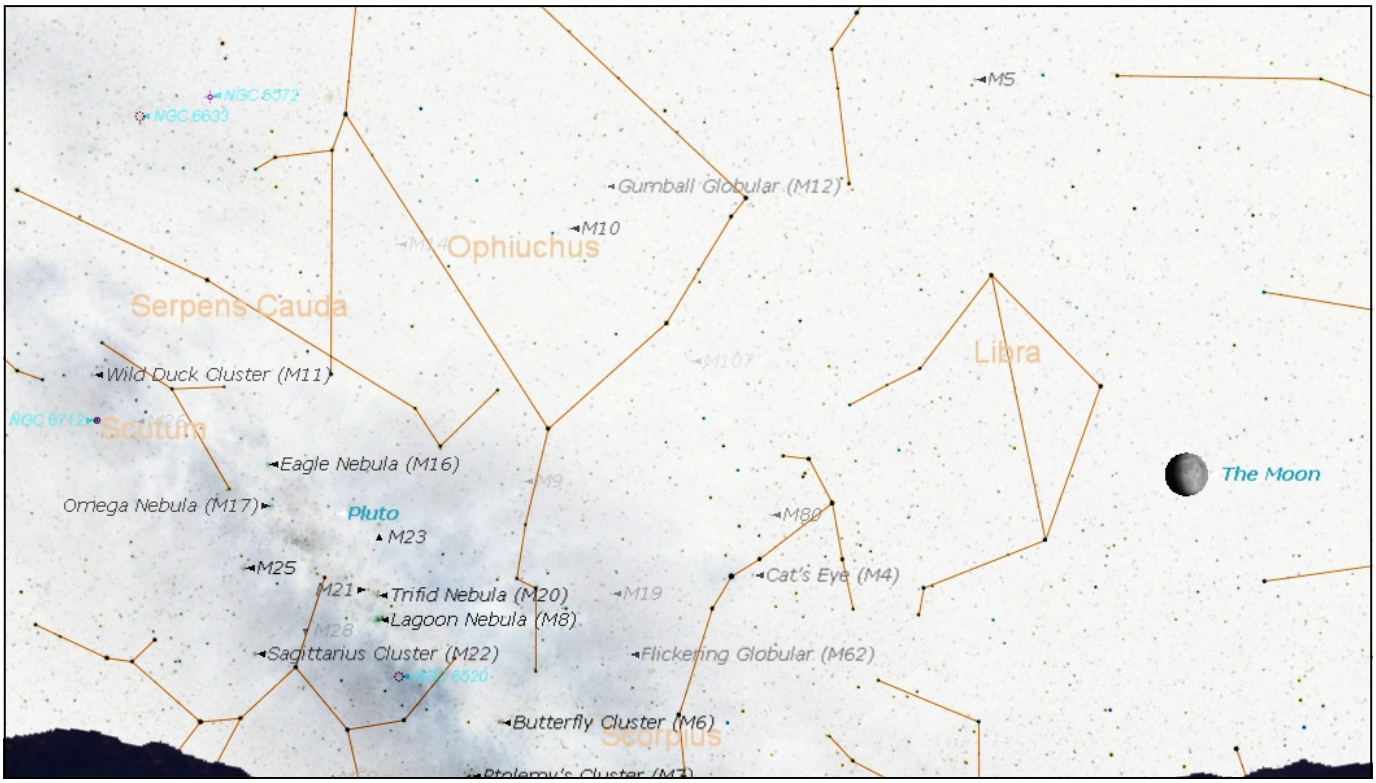
This proved to be utterly false concern and I have to say visual observing of variable stars is well and alive.

One can just to check international presence of visual variable stars observers on AAVSO website to get the picture.

Best wishes to all



This is the view from London on July 1st, looking East at 10:30pm



This is the view from London on July 1st, looking South at 10:30pm