RASC Toronto Centre – www.rascto.ca
The Sky This Month –June 3 to July 8, 2015
by Chris Vaughan

NEWS

Space Exploration – Public and Private

Ref. http://spaceflightnow.com/launch-schedule/

Launches

June 5 TBD - Soyuz rocket from Plesetsk Cosmodrome, Russia, payload military Persona recon satellite.
June 23 at 9:52 pm - Vega rocket from Kourou, French Guiana, payload Sentinel 2A Earth observation satellite for ESA.
June 25 TBD - PSLV rocket from Satish Dhawan Space Center, Sriharikota, India, payload 3 satellites for the DMC3 disaster monitoring constellation.
June 26 at 11:09 am - Falcon 9 rocket from Cape Canaveral Air Force Station, Florida, payload 9th Dragon spacecraft on 7th cargo delivery to ISS.
TBD - Soyuz rocket from Plesetsk Cosmodrome, Russia, payload Kobalt M military recon satellite.
TBD - Proton rocket from Baikonur Cosmodrome, Kazakhstan, payload Inmarsat 5 F3 communications satellite.
TBD - Proton rocket from Baikonur Cosmodrome, Kazakhstan, payload Garpun military communications satellite.
June 30 TBD - Proton rocket from Baikonur Cosmodrome, Kazakhstan, payload Turksat 4B communications satellite.
July TBD - Soyuz rocket from Baikonur Cosmodrome, Kazakhstan, payload 60th Progress cargo delivery to ISS.
July 2 TBD - Ariane 5 rocket from Kourou, French Guiana, payload Star One C4 television and MSG 4 meteorological satellite.
TBD - Soyuz 2-1v rocket from Plesetsk Cosmodrome, Russia, payload Kanopus ST Earth observation satellite.
July TBD - Soyuz rocket from Baikonur Cosmodrome, Kazakhstan, payload manned Soyuz spacecraft to ISS with next Expedition crew. The capsule will remain, as a crew escape pod.

New Horizons Mission to Pluto-Charon

The New Horizons spacecraft is scheduled to fly through the Pluto-Charon system on July 14, 2015, travelling approx. 14 km per second (49,600 kph), then head out into the Kuiper Belt. The Pluto-and-moons system will be approximately face-on, so close attention has been paid up to the last days of approach in order to "thread the needle". Radio signal travel times are more than 4 hours one-way. The spacecraft is awake and healthy, and engineers have practiced refining the science collection work plan while they wait for the July pass. Data will take many months to flow to Earth. On June 2, the spacecraft is 31.71 AU, or 4.74 billion km (4.4 light-hours) from Earth.

DAWN to Ceres

The DAWN spacecraft is in orbit around the dwarf planet Ceres and has commenced Phase One of its science orbiting at a distance of 13,500 km. A false colour map of the surface has recently been released.

Lightsail Update

The Planetary Society (www.planetary.org) recently launched the first of two cubesat (30x10x10 cm) light sail spacecraft. They have to piggyback on existing launches, so this one was not launched to a high enough orbit

for sustained flight. Instead, they are testing the device so refinements can be made in time for the second launch. The entire program has been funded through donors and member support from the society.

Originally, the 35-square metres of sail were due to be unfurled four weeks after launch, giving the cubesat swarm time to disperse. Due to a software bug, the memory of the spacecraft was filling and locking up. Engineers have now regained control and are commanding Lightsail to reboot daily to prevent the problem recurring. To avoid any more problems, the unfurling may be triggered in the next few days. The orbit will decay quickly due to friction with the upper atmosphere, but ground observers should be able to spot the shiny sails for a limited time. Stay tuned…

Rosetta Update
The Rosetta Orbiter is still mapping the comet's surface, classifying surface morphologies, measuring gravity, mass, shape, and analyzing the coma and plasma.

This Month in History (a sampling)

Ref. http://www2.jpl.nasa.gov/calendar/, http://space.about.com/library/weekly/bldatechoice.htm, http://www.planetary.org/multimedia/space-images/charts/whats-up-in-the-solar-system-frohn.html, http://www.lunar-occultations.com/rlo/calendar.pdf

Astro-Birthdays and Milestones
May 31, 1865 – **Clarence A. Chant**, father of Canadian astronomy, founder of DDO
June 5, 1819 - English astronomer **John Couch Adams** is born. Predicted the existence and position of Neptune, using only mathematics.
June 7, 1928 - American astronomer, **Bernard Burke**, is born. In 1955, discovers radio waves emitted by the giant Jupiter.
June 8, 1625 - **Giovanni Cassini** is born. Co-discoverer of the GRS and discoverer of Saturnian moons and the eponymous ring gap. He also determined the Earth-Mars distance using parallax and explained zodiacal light.
June 17, 1839 - American astronomer and clergyman, **Rev. George Mary Searle**, is born (and dies on same day in 1918). Discovered the asteroid 55 Pandora and six galaxies.
June 26, 1730 - French Astronomer **Charles Messier** is born. Later he will create his famous Messier Catalogue black list of dim fuzzy objects that are not comets.
July 7, 1746 - Italian astronomer and discoverer of Ceres, **Giuseppe Piazzi**, is born.

Astronomy and Space Exploration
June 3, 1969 - NBC cancels the original Star Trek series after a 3 season run
June 4, 781 BCE - First Solar Eclipse recorded by the Chinese.
June 16, 1963 - Valentina Tereshkova becomes the first woman in space.
June 18, 1983 - Sally Ride becomes the first American female astronaut.
June 19, 240 BCE - Eratosthenes calculates the circumference of Earth using two sticks.
June 22, 1633 - Galileo Galilei is forced by the Holy Office of Rome to recant the Solar-centric view of the Universe.
June 25, 1638 - The first astronomical event, a lunar eclipse, recorded in North America.
June 30, 1908 - The great Tunguska impact in Siberia.
July 1, 1917 - The 100-inch Hooker Telescope mirror arrives at Mt. Wilson. The only telescope larger than DDO's 74-inch telescope when it opened in 1935.
July 4, 1054 - Chinese astronomers record a bright supernova later to become the Crab Nebula (M1).
July 6, 1687 - Isaac Newton publishes Principia outlining his three Laws of Motion.
July 7, 1947 - Alleged UFO crashes in Roswell, New Mexico

Star Parties, etc.

Ref: http://www.amsky.com/calendar/events/#may , http://stardate.org/nightsky/star_parties

"**RASC Solar Observing**", Ontario Science Centre Teluscape – Sat. 10 to noon, on June 13 (or 20) and July 4
"**RASC Dark Skies Observing**", Long Sault Conservation Area, ON – window runs June 15-18
"**RASC City Skies Observing**", Bayview Village Park, Toronto – windows runs June 22-25
"**AstroCATS 2015**", Ontario Science Centre – June 27-28 (http://www.astrocats.ca/)
"**New Moon in June Star Party"**, Mew Lake, Algonquin Park, ON – June 11-14 (http://rascto.ca/content/new-moon-june-algonquin-star-party-mew-lake-campground)
"**Thursday Night Astronomy Nights at Gordon's Park**", Gordon's Park Dark Sky Preserve Manitoulin Island, ON – from July 1 (http://gordonspark.com/astronomy-and-stargazing/)
And many more throughout the USA…

OBSERVING

Globe at Night 2015

A citizen science program to map light pollution around the world. During the observing window, you are encouraged to make a visual measurement to determine the limiting magnitude of stars you can observe at your location. The website provides charts for assisting observations, instructions for submitting results, and an interactive map showing current and historical results. Details are at http://www.globeatnight.org/
The next campaign focus is on **Bootes** from June 8-17 and July 7-16.

Sunrise/Sunset

June 3, sunrise at 5:39 am, sunset at 8:53 pm (15h14m of daylight)
July 8, sunrise at 5:45 am, sunset at 9 pm (15h15m of daylight)

Summer Solstice - Sun, June 21 at 12:38 pm
Earth at Aphelion (1.52 million km) – Mon, July 6 at 3 pm

Astronomical Twilight

The skies are not truly dark until the Sun drops well below the horizon. Below are the times of true darkness, also known as Astronomical Twilight. Astrophotography is best done in full darkness. Details are at http://www.timeanddate.com/sun/canada/toronto?month=4, http://www.timeanddate.com/astronomy/canada/toronto

June 3, astronomical twilight ends at 11:11 pm and starts at 3:22 am (4h11m of imaging time)
July 8, astronomical twilight ends at 11:18 pm and starts at 3:27 am (4h09m of imaging time)

Moon - Orbit

Apogee – Tue, Jun 23 at 1:00 pm
Perigee – Wed, June 10 at 1 am

Moon - Phases

Tue, June 9 at 11:42 am – Last Quarter Moon (rises around midnight)
Tue, Jun 16 at 10:05 am – New Moon
Wed, Jun 24 at 7:03 am – First Quarter Moon (sets around midnight)
Wed, July 1 at 10:20 pm – Full "Buck/Thunder/Hay" Moon

Moon – Conjunctions, Eclipses, etc.

Lunar X – June 23/24 Sort of…

On rare occasions, for a few hours near the First Quarter Moon, a feature called the Lunar X becomes visible. When the rims of the craters Parbach, la Caille, and Blanchinus are illuminated from a particular angle of sunlight, they form a small, but very clear and bright X shape. It's located on the terminator about one third of the way up from the bottom of the Moon (at 2° East, 24° South). The prominent round crater Werner sits to the lower right. The next Lunar X will peak at 1:16 am on June 24th, about 10 minutes after the Moon sets. The X should start to develop sometime after 11 pm on Tuesday, June 23rd, continuing until moonset at about 1 am Wednesday morning, but you'll need a low western horizon. Observers in the west will be able to see the entire event.

Lunar Appulses and Conjunctions

In the early evening of **June 19**, the very young crescent Moon (12.7% illlum.) sits 7.3° southwest (below) Venus, with Jupiter nearby. On the evening of **June 20**, the crescent Moon (19.9% illum.) sits 5.5° southeast (to the lower left) of Jupiter, with Venus nearby. Photo ops! On the evening of **June 21**, the crescent Moon (28.1% illum.) sits 5.6° to the lower left (southeast) of Regulus. On the night of **June 25**, the waxing gibbous Moon (65.4% illum.) sits 3.3° above (northwest of) Spica. On the evening of **June 28**, the nearly Full Moon (89.9% illum.) sits 1.5° above Saturn. Photo op!

Planets and Dwarf Planets

June 3/4th – Jupiter double shadow transit. On Wednesday, June 3rd, Ganymede begins a transit in twilight at 8:20 pm. A second moon, Io, begins to transit at 10:47 pm. Ganymede moves off Jupiter at 11:55 pm as Io's shadow begins a transit. Jupiter sets at 12:52 am EDT with both features still in view. At about the same time, observers farther west will be able to see Ganymede's shadow join the party, and then Io moves off Jupiter a few minutes later. Io's shadow moves off at 2:13 am. At 3:26 am, Ganymede mostly covers Io for a few minutes, and at 4:30 am, Ganymede's shadow moves off.

Mercury will start to become observable in the eastern pre-dawn sky about mid-June (rising just before 5 am), and into early July, but it remains very low throughout the period due to the shallow ecliptic. The very old crescent Moon hops over Mercury on the mornings of June 14th and 15th. Mercury reaches greatest western elongation on June 24th at magnitude 1.4, then continues to brighten to magnitude 0.6 on July 8th, when it rises at 4:33 am.

Venus remains an easy target in the western evening sky all month, moving from Cancer into Leo. It reaches greatest eastern elongation on June 6th at magnitude -4.3, showing a 50% illuminated disk, then continues to grow in brightness and disk size as it draws closer to Earth. It sets at 12:14 am on June 3rd and at 10:56 pm on July 8th. Its phase will reduce from 51% to 28% illuminated during that period. On June 12th and 13th, Venus will pass within about 1° north (upper right) of the Beehive cluster (M44). On June 19th, the very young crescent Moon (13% illum.) will sit 7.3° below (southwest) of Venus, with Jupiter nearby (Io and its shadow will be in transit, too.). Photo op! On June 30th, Venus will pass with 21' of Jupiter, with both planets showing the same disk diameters (32.4"), sitting low in the west, and setting at 9:21 pm. The pairing will fit within most low power eyepiece fields of view, and the GRS will be in transit. Excellent photo op! It is still fairly close the following evening. On July 8th, Venus will set at 10:56 pm (mag. -4.47)

Mars is unobservable until mornings of early August.

Jupiter moves from Cancer into Leo and fades, from magnitude -1.91 to -1.77, this month. It remains easily observed low in the western evening sky, but will appear less clearly, through more atmosphere, as it shifts

lower. It sets at sets at 12:58 am on June 3rd and, almost in twilight, at 10:56 pm on July 8th. On June 20th, the waxing crescent Moon (20% illum.) will sit 5.6° to the lower left (south) of Jupiter, with Venus nearby. The Great Red Spot will be transiting, too. Photo op! I have been noting mutual moon events and transits in my weekly Skylights. See Venus (above) for the close grouping on June 30th and July 1st.

This month, **Saturn** is moving retrograde in eastern Libra, just above the claw stars of Scorpius. In early June, recently past opposition, it's observable all night as a bright yellowish object of magnitude 0.08, and setting at 5:15 am. By early July, it has dimmed to magnitude 0.29 and will set at 2:50 am. Due to the shallow night-time ecliptic, Saturn remains fairly low in the southern sky throughout this apparition, and the observing window is brief. On the evening of June 28th, look for the Full Moon sitting within 1.5° to the upper left (northeast) of Saturn.

Uranus (mag 5.8) is in Pisces, and observable low in the eastern sky during morning hours all month. On June 3rd, it rises at 3:15 am and on July 8th it rises at 1 am. On June 11th, the waning crescent Moon (31% illum.) sits 7° to the upper right (west) of Uranus. The following morning, June 12th, the Moon (21% illum.) shift to sit 7.5° to the lower left (east).

Neptune, in Aquarius all month (mag 7.9) is observable low in the morning southeastern sky. On June 3rd it rises at 1:50 am, and on July 8th it rises at 11:32 pm. It commences a retrograde loop on June 12th.

Pluto, northeast of Sagittarius' teapot, is a faint mag 14.1 object. In early June, it's in the southern post-midnight sky, rising at 10:54 pm. By opposition on July 6th, it becomes an all-night object.

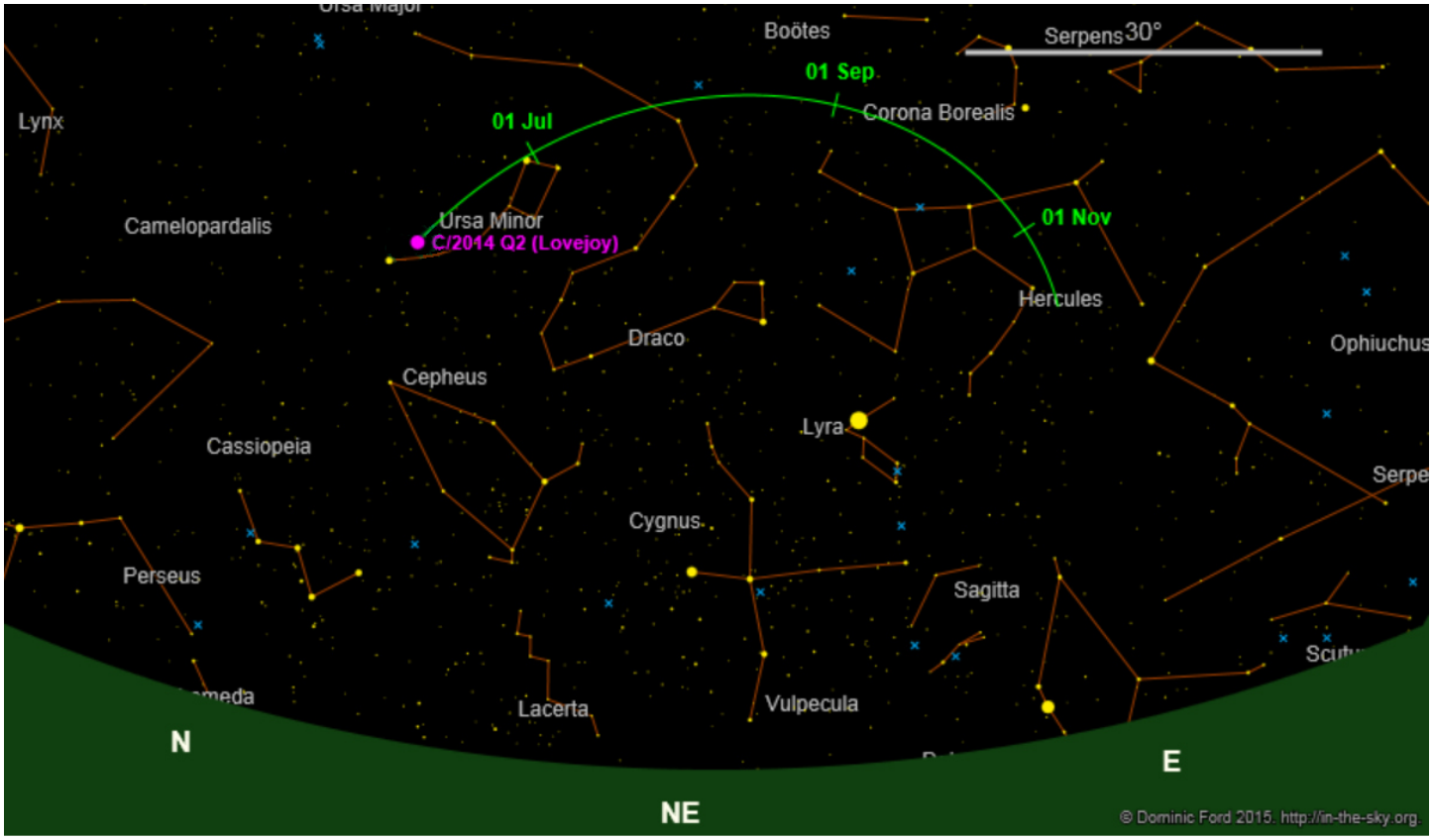
Vesta is in the pre-dawn eastern sky moving from southern Pisces (mag 7.8 on June 3rd) into Cetus (mag 7.5 on July 8th).

Ceres is in the pre-dawn southeastern sky moving retrograde from southern Capricornus (mag 8.4 on June 3rd) into Microscopium (mag 7.7 on July 8th).

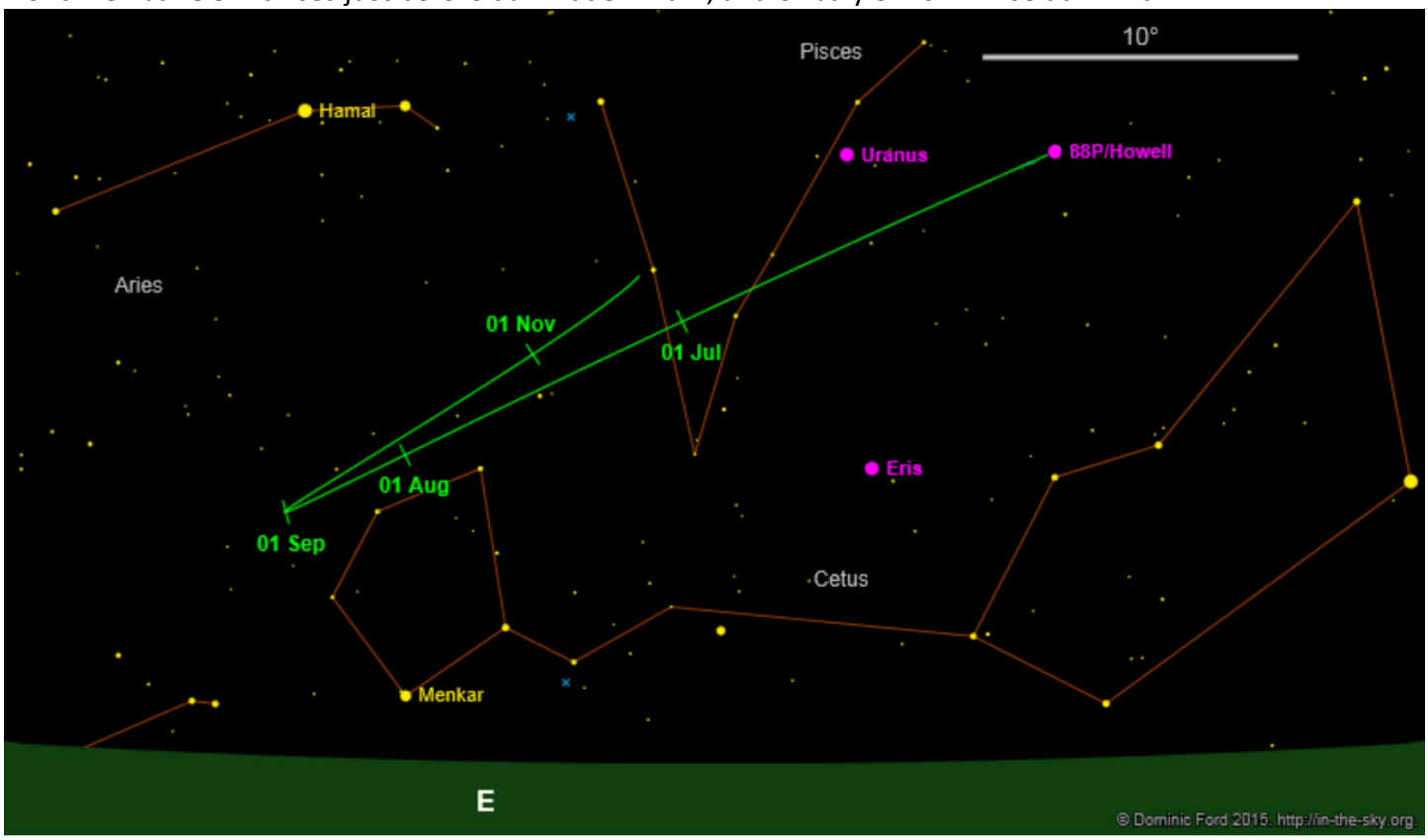
Comets

Ref http://www.aerith.net/comet/weekly/current.html, http://cometchasing.skyhound.com/, https://in-the-sky.org/data/comets.php , https://www.ast.cam.ac.uk/~jds/ , http://www.cobs.si/

C/2014 Q2 (Lovejoy) just keeps on giving! In early June it is around magnitude 7.6 and fading slowly, but remains conveniently positioned for observing all night (circumpolar) this month. On June 3rd it is 3.3° from Polaris and heading south through Ursa Minor, passing within 13' of Kochab on June 29th, and then entering Draco between Edasich and Thuban around mid-July.



88P/Howell is a pre-dawn comet in the eastern sky. In late May it was magnitude 10.5 and fading. It is currently in northern Cetus and climbing northward, heading through southeastern Pisces over the next month. On June 3rd it rises just before dawn at 3:14 am, and on July 8th it will rise at 1:41 am.



Meteor Shower(s)

Ref. http://www.amsmeteors.org/meteor-showers/meteor-shower-calendar/

No showers of note.

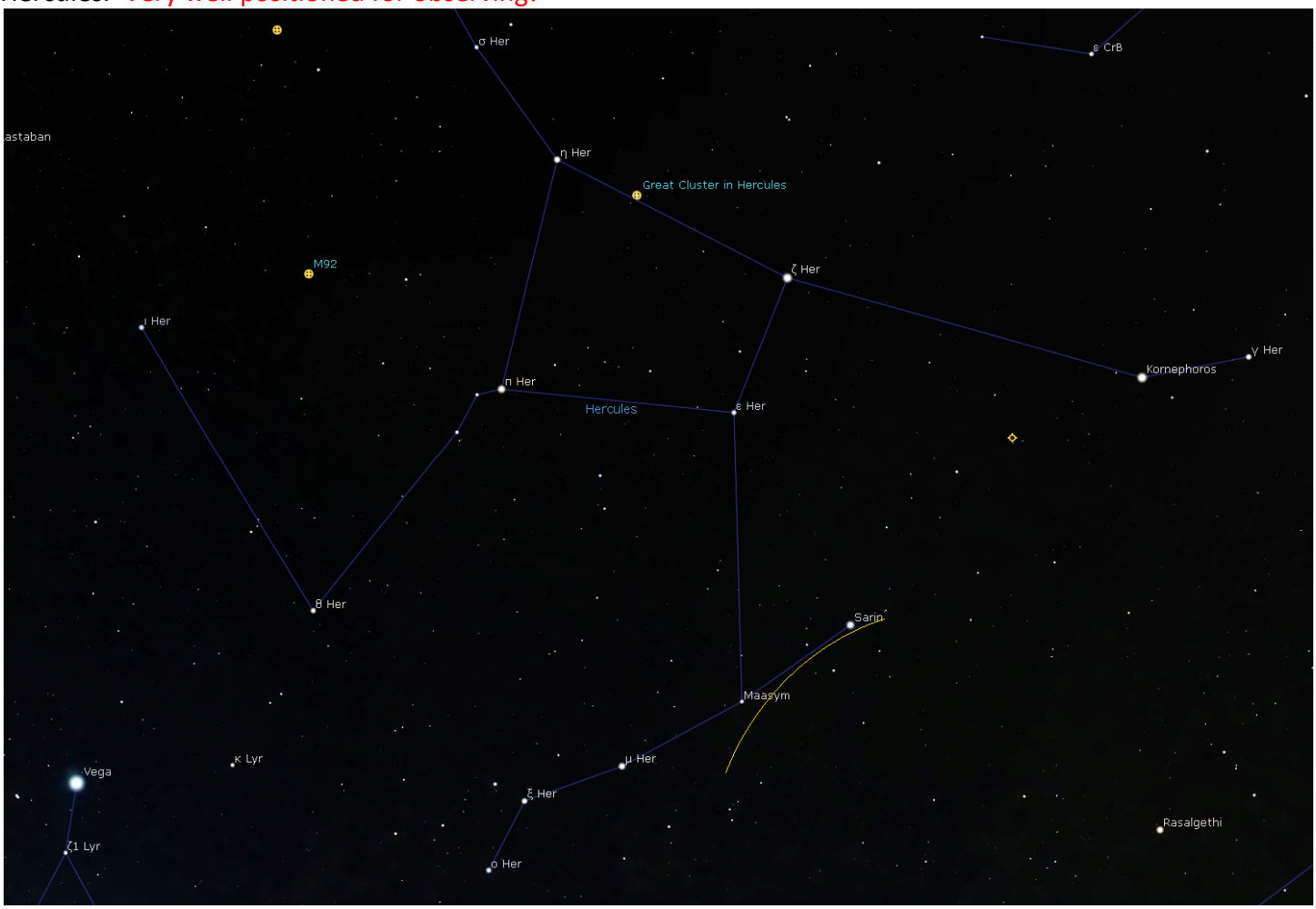
Nova

Nova Sagittarii 2015 No. 2 (pnv j18365700-2855420) is a pre-dawn object below the Teapot's Lid in Sagittarius. It peaked in brightness about magnitude 4.3 in late March and has been fluctuating wildly as it gradually fades. As of June 3rd, it is readily observable at magnitude 5.8, rising at 11:19 pm. By July 8th it will rise at 9:01 pm.

Asteroids

Ref. http://neo.jpl.nasa.gov/ca/, http://www.minorplanetcenter.net/
https://www.youtube.com/watch?v=ONUSP23cmAE#action=share

On the evening of June 11th, asteroid (2) Pallas (mag. 9.38) reaches opposition. At R.A. 17h32m18.96s, Dec. +25°32'16.3" (J2000), it is located approximately 40' southeast (below) the star Maasym (lambda Her) in Hercules. Very well positioned for observing!



According to the Minor Planet Centre…

Near-Earth Objects Discovered This Year:	687 (~115/month)
Minor Planets Discovered This Year:	47,390 (~7,900/month)
Comets Discovered This Year:	30 (~5/month)
Observations This Year:	9.3 million

Satellites

Current GTA International Space Station evening pass series ends June 20th (Most are visible between 9:30 pm and midnight). Morning passes commence on July 13th (most between 4 and 5 am). Some higher/brighter ones include*:

Date	Mag.	Time	Direction	Alt.
04-Jun	-2.7	9:37:54 pm to 9:44:19 pm	from WSW to NE	60°
11-Jun	-2.9	11:28:07 pm to 11:32:01 pm	from NW to ENE	56°
12-Jun	-2.0	10:34:49 pm to 10:40:23 pm	from NW to E	36°
13-Jun	-3.5	11:17:45 pm to 11:21:21 pm	from WNW to SSE	73°
14-Jun	-3.1	10:24:22 pm to 10:29:47 pm	from NW to ESE	63°
15-Jun	-2.4	11:07:31 pm to 11:10:49 pm	from WNW to SSW	33°
16-Jun	-3.2	10:13:57 pm to 10:19:19 pm	from WNW to SE	63°

*far future predicted times may shift slightly

Iridium Flares most frequent evening flares occur between 10 pm and midnight, with morning flares common from 3 to 5 am. Local occurrences info at www.heavens-above.com and enter your location, from phone/tablet apps, Chris Vaughan's Skylights (subscribe to email here or visit www.astrogeoguy.tumblr.com)

Occultations – Lunar and Asteroidal

Ref: http://www.asteroidoccultation.com/ and http://www.poyntsource.com/New/Global.htm (additional links on the following URLs open track maps)

Lunar Occultation

On June 28, from 10:58:36 pm to 11:51:00 pm, the nearly Full Moon occults the star Theta Libra (mag. 4.1). This can be observed with unaided eyes, binoculars, and telescopes.

Constellations near the Meridian (Annually in June)

11 pm: Lupus, Libra, Serpens, Corona Borealis, Draco, and Ursa Minor
1 am: Scorpius, Ophiuchus, Serpens, Hercules, Draco, and Ursa Minor
3 am: Sagittarius, Scutum, Aquila, Sagitta, Vulpecula, Cygnus, Lyra, and Draco

Early Summer Star party Skylights (Annually in June)

The Big Dipper, Hercules, Scorpius, the Teapot (Sagittarius), and the Summer Triangle (eye / binoculars)
Summer Globs – M13, M92 (Her), M3 (CVn), M5 (Ser), M22 (Sag), M4 (Sco), etc. (telescope)
Summer Knobs – M57 Ring Neb (Lyr), M27 Dumbbell (Vul), NGC6210 Turtle Neb (Her), NGC 6543 Cat's Eye (Dra), etc. (binoculars / telescope)
Summer Blobs – Lagoon, Trifid (Sag), Eagle (Ser), Crescent (Cyg), Heart / Soul (Cas), etc. (telescope)
Fireworks – Melotte 111 (Com), M11 Wild Duck Cluster (Scu), The Coathangar (Vul), IC 4756 Graff's Cluster (Ser), etc. (binoculars / telescope)
Double Plays – Regulus and Algieba (Leo), iota Cancri (Cnc), Cor Caroli (CVn), Porrima (Vir), Izar (Boo), etc. (telescope)
Hit Singles – Antares (Sco), Vega (Lyr), Arcturus (Boo), Altair (Aqu), Deneb (Cyg) (eye / binos / telescope)

See you at Long Sault C A, Glen Major Forest, Bayview Village Park, CAO, or DDO!

Questions or comments to chris.vaughan@astrogeo.ca
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