RASC Toronto Centre – www.rascto.ca
The Sky This Month – June 20 to July 18, 2018 (times in EDT)

by Chris Vaughan

NEWS

Space Exploration – Public and Private

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

Launches

22nd/23rd from 8:30 pm-12:30 am EDT - Rocket Lab Electron rocket from Mahia Peninsula, New Zealand, payload "It's Business Time" weather and ship tracking cubesats and remote sensing sat
June TBD - Long March 2C rocket from Taiyuan, China, payload remote sensing satellite for Pakistan
June 29 at 5:41 am EDT - Falcon 9 rocket from Cape Canaveral Air Force Station, Florida, payload 17th Dragon spacecraft mission to the International Space Station.
July 9 at 5:51 pm EDT - Soyuz rocket from Baikonur Cosmodrome, Kazakhstan, payload 70th Progress cargo delivery ship to the International Space Station.

JUNO at Jupiter

An image summary of the JunoCam images taken during Juno's first 12 close approaches to Jupiter has been compiled by Seán Doran. There are only 11 sets of images because no imaging was performed on Perijove 2. Dates of the 12 perijoves are as follows: (PJ1) 27 Aug 2016; (PJ3) 11 Dec 2016; (PJ4) 2 Feb 2017; (PJ5) 27 Mar 2017; (PJ6) 19 May 2017; (PJ7) 11 Jul 2017; (PJ8) 1 Sep 2017; (PJ9) 24 Oct 2017; (PJ10) 16 Dec 2017; (PJ11) 8 Feb 2018; (PJ12) 1 Apr 2018. See this composite in high resolution at Gigapan.

Hayabusa2 Approaches asteroid Ryugu

http://www.planetary.org/blogs/jason-davis/2018/20180618-rotating-ryugu.html
The ion powered Japanese Hayabusa2 spacecraft is approaching asteroid 162173 Ryugu at about 0.83 meters per second. It will arrive between June 21 and July 5, first entering surveying orbital distance of 20 km to plan for the sample retrieval touch and go late in 2019, and a return to Earth a year later. Several small probes will land or impact the asteroid as well.

Queqiao orbital insertion at Earth-Moon L2

http://www.planetary.org/blogs/guest-blogs/2018/20180615-queqiao-orbit-explainer.html
Queqiao is a communications relay satellite for December's Chang'e 4 lunar lander and rover mission. It recently deployed two small satellites bound for lunar orbit called Longjiang-1 (failed) and Longjiang-2.

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

Jun 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.
Jul 7, 1746 - Italian astronomer and discoverer of Ceres, **Giuseppe Piazzi**, is born.
Jul 7, 1907 – American "dean" of Science Fiction, author **Robert Heinlein**, is born.

Jul 10, 1832 – American scion of telescope makers, 1st observer of Sirius B white dwarf, **Alvan G. Clark**, is born.
Jul 13, 1897 – American astronomer specializing in interstellar medium spectra, **Mary Lea Shane (nee Heger)**, is born.

Astronomy and Space Exploration
Jun 22, 1633 - **Galileo Galilei** is forced by the Holy Office of Rome to recant the Solar-centric view of the Universe.
Jun 25, 1638 - The first astronomical event, a **lunar eclipse**, recorded in North America.
Jun 30, 1908 - The great **Tunguska** impact in Siberia.
Jul 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.
Jul 1, 1962 – **Kennedy Space Center** is opened.
Jul 4, 1054 - Chinese astronomers record a bright supernova later to become the **Crab Nebula** (M1).
Jul 6, 1687 - Isaac Newton publishes **Principia** outlining his three Laws of Motion.
Jul 7, 1947 - Alleged UFO crashes in **Roswell**, New Mexico
Jul 16-22, 1994 – The **Comet Shoemaker-Levy 9 fragments** plunge into Jupiter at 216,000 kph
Jul 16, 1969 – **Apollo 11** launched

Star Parties, etc.

Ref: http://www.amsky.com/calendar/events/#may

"**RASC City Skies Observing**", Bayview Village Park, Toronto – windows runs Jun 18-21
"**RASC Millennium Square Observing**", Millennium Square, Pickering – Friday, Jun 22
"**OSC Shoot the Moon Star Party**", Ontario Science Centre, Toronto – Saturday, Jun 23
"**RASC Solar Observing**", Ontario Science Centre Teluscape – Sat. 10 to noon, on Jun 23
"**RASC General Assembly**", Calgary – Jun 28 to Jul 3
"**RASC Dark Skies Observing**", Long Sault Conservation Area – window runs Jul 9-12
"**Astronomy Nights at Gordon's Park**", Gordon's Park Dark Sky Preserve Manitoulin Island, ON – Thursdays and Saturdays from Jun 30 (http://gordonspark.com/events/)
Coming soon – Star Fest – Aug 9-11
And many more throughout the USA…

OBSERVING

Globe at Night 2018

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 summer campaign's focus is on **Hercules** from July 4-13.

Sunrise/Sunset

June 20, sunrise at 5:35 am, sunset at 9:02 pm (15h27m of daylight)
July 19, sunrise at 5:52 am, sunset at 8:54 pm (15h02m of daylight)

Summer Solstice - Sun, June 21 at 6:07 am EDT
Earth at Aphelion (1.521 million km) – Fri, July 6 at 1 pm EDT

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
https://www.timeanddate.com/sun/canada/toronto?month=6
http://www.timeanddate.com/astronomy/canada/toronto

June 20, astronomical twilight ends at 11:25 pm and starts at 3:13 am (3h48m of imaging time)
July 18, astronomical twilight ends at 11:04 pm and starts at 3:43 am (4h39m of imaging time)

Moon - Orbit

Apogee – Fri, June 29 at 11 pm EDT
Perigee – Fri, July 13 at 4 am (~5 hrs after new moon, large tides)

Moon - Phases

Wed, Jun 20 at 6:51 am – First Quarter Moon (sets around midnight)
Thu, Jun 28 at 12:53 am – Full "Strawberry/Mead/Rose/Hot" Moon (smallest full moon of 2018)
Fri, Jul 6 at 3:51 am – Last Quarter Moon (rises around midnight)
Thu, Jul 12 at 10:48 pm – New Moon (Partial Solar Eclipse)

Sat, Jun 23 at 4 pm - Golden Handle Effect / Jeweled Scimitar is a Large bright semi-circle of the shallowly illuminated Montes Jura along the edge of Mare Iridum. (Lunar Northwest – our upper left)

Moon – Conjunctions, Eclipses, etc.

Lunar Appulses and Conjunctions

Starting in the southern sky after sunset on the evening of Saturday, **June 23**, the waxing gibbous moon will sit less than 4 degrees north (to the upper left of) very bright Jupiter. In the southern sky on the evening of Tuesday, **June 26**, the nearly full moon will sit less than three degrees west (to the upper right) of the large asteroid Vesta. In the southeastern sky after dusk on the evening of Wednesday, **June 27**, the full moon will sit one degree north of (above) bright, yellowish Saturn. About 11 pm local time on Saturday, **June 30**, Mars will rise in the east with the waning gibbous moon shining 4 degrees northeast (to the upper left) of it. In the eastern pre-dawn sky on **July 10**, the eastward orbital motion of the waning crescent moon will carry it just north of (above) reddish Aldebaran, the brightest star in Taurus. In the western sky after sunset on Saturday, **July 14**, look for the young crescent moon sitting about 1.5 degrees northeast of (above) Mercury. In the western sky on the evening of Sunday, **July 15**, the young waxing crescent moon will take up a position west of Venus and east of Regulus, the brightest star in Leo.

Planets and Dwarf Planets

Mercury has entered the western evening sky and will steadily climb away from the sun as it heads toward its greatest angle east of the sun on July 12. Mercury's position north of a shallowly tilted ecliptic will make this evening apparition a medium-quality one for observers in the Northern Hemisphere. The best viewing times in mid-June will be around 9:30 p.m. local time. By month-end, the prime observing window will span 9:30 to 10 p.m. local time. On the evenings of July 3 and 4, Mercury's orbital motion will carry it through the southern edge of the Beehive Cluster (also known as Messier 44) in Cancer. After June 12, Mercury will be travelling through the stars of Gemini. Over the next four weeks, the planet will increase in apparent diameter, but decrease in phase (from 80% to 31%) and brightness (-0.7 to 0.8).

Over the next four weeks, **Venus** will continue a long and very good apparition in the evening western sky that lasts into early autumn. Each evening, the extremely bright planet will swing wider of the sun while traversing the stars of Cancer and then Leo. In early July, Venus will set at about 11:20 p.m. local time; an hour later by

month end. On June 20, Venus' orbital motion will place the planet on the northern edge of the huge open star cluster Messier 44. On the evening of July 9, Venus' orbital motion will carry it only 1 degree north (to the upper right) of Leo's brightest star Regulus, and on July 15, the three-day-old crescent moon will land 1.5 degrees west (to the right) of the planet. All month, Venus will maintain a brightness of about magnitude -4.1. At the same time, its apparent disk size will increase by 28% and its illuminated phase will decrease from 74% to 62%.

Bright, reddish **Mars** will spend the next four weeks by first ceasing its eastward motion on June 28 and then moving retrograde (west) through the stars of southern Capricornus as Earth begins to overtake it on the "inside track". On June 20, Mars will rise just after 11:30 pm local time. On July 18, it will rise at 10 pm local time, and remain visible all night all the while. As Earth draws nearer, Mars will dramatically increase in brightness from visual magnitude -1.8 to -2.6 and its apparent disk diameter will swell from 19 to 23.6 arc-seconds. (These trends will continue past opposition on July 27 until closest approach on July 31.) Mars will be well worth observing telescopically all month but, in the GTA, it will only climb to a maximum of about 21° above the southern horizon. Observers farther south will see Mars higher in the sky and through less of Earth's distorting atmosphere. A developing global dust storm enveloping the planet could serious impede our anticipated views of Mars' surface features, but its moons Phobos and Deimos remain viable challenge targets.

For the next month, very bright **Jupiter** (visual magnitude -2.4) will be observable in the western half of the sky between dusk and the wee hours. The planet will be in central Libra, slowly move westward until July 10, when it will resume eastward prograde motion. This maneuver can be seen by watching Jupiter initially draw away from, and then return towards, the nearby bright double star Zubenelgenubi. On the evening of June 23, look for the waxing gibbous moon sitting about 4° northeast of Jupiter.

Europa shadow transit Wednesday, Jun 20 from 10:58 pm to 1:13 am EDT (with GRS).
Io shadow transit Friday, Jun 22 from 11:19 pm to 1:29 am EDT (with GRS).
Ganymede shadow transit Monday, Jun 25 from 8:59 pm (twilight) to 10:42 pm EDT (with GRS).
Europa shadow transit Tuesday, Jun 28 from 1:35 am EDT (sets in progress).
Io shadow transit Saturday, Jun 30 from 1:14 am EDT (sets in progress).
Ganymede shadow transit Tuesday, Jul 3 from 12:58 am EDT (sets in progress).
Io shadow transit Sunday, July 8 from 9:37 pm (twilight) to 11:46 pm EDT.

Over the next four weeks, **Saturn** will be visible as a medium-bright (visual magnitude 0.0), yellowish object low in the southeastern evening sky and moving retrograde (westward) through the stars of northwestern Sagittarius. The ringed planet will reach opposition and peak visibility on June 27, just days after the solstice, so it will remain very low in the southern sky for observers in the Northern Hemisphere and reach its highest elevation over the southern horizon around midnight. On opposition night, the full moon will take a position less than 1° north of Saturn. The planet's disk will subtend 18.4". The rings will subtend about 42" and continue to be well open due to the planet's northern pole tilting sunward.

For the next month, blue-green **Uranus** (magnitude 5.9) will be moving slowly eastward through the stars of western Aries. On June 20, the planet will be observable in the eastern pre-dawn sky for several hours after 2 am local time. On July 18 it will start rising shortly after midnight, extending the observing time.

Blue-tinted **Neptune** (magnitude 7.8) will spend the next four weeks slowly moving retrograde (westward) among the stars of eastern Aquarius - shifting slowly toward that constellation's naked-eye star Hydor. As an aid in locating the planet, look for it about 4.5° to the east of Hydor and 3° north of fainter Psi (ψ) Aquarii.

Pluto is a faint mag. 14.2 object moving retrograde in northeastern Sagittarius. On July 3-4, it will pass very close to the magnitude 5.6star 50 Sgr. Reaching opposition on July 12, Pluto is an all-night target, but a challenge to see due to its dim nature and the low summer ecliptic.

On Tuesday, June 19, the minor planet **(4) Vesta** reached opposition, when will be visible all night long, and appear at its brightest (magnitude 5.33) for the year; within easy reach of binoculars and small telescopes. On June 20, Vesta will be moving retrograde in northwestern Sagittarius, approximately 8° west of Saturn. On June 29, it will pass into Ophiuchus, and by July 18, it will be setting around 3:30 am local time.

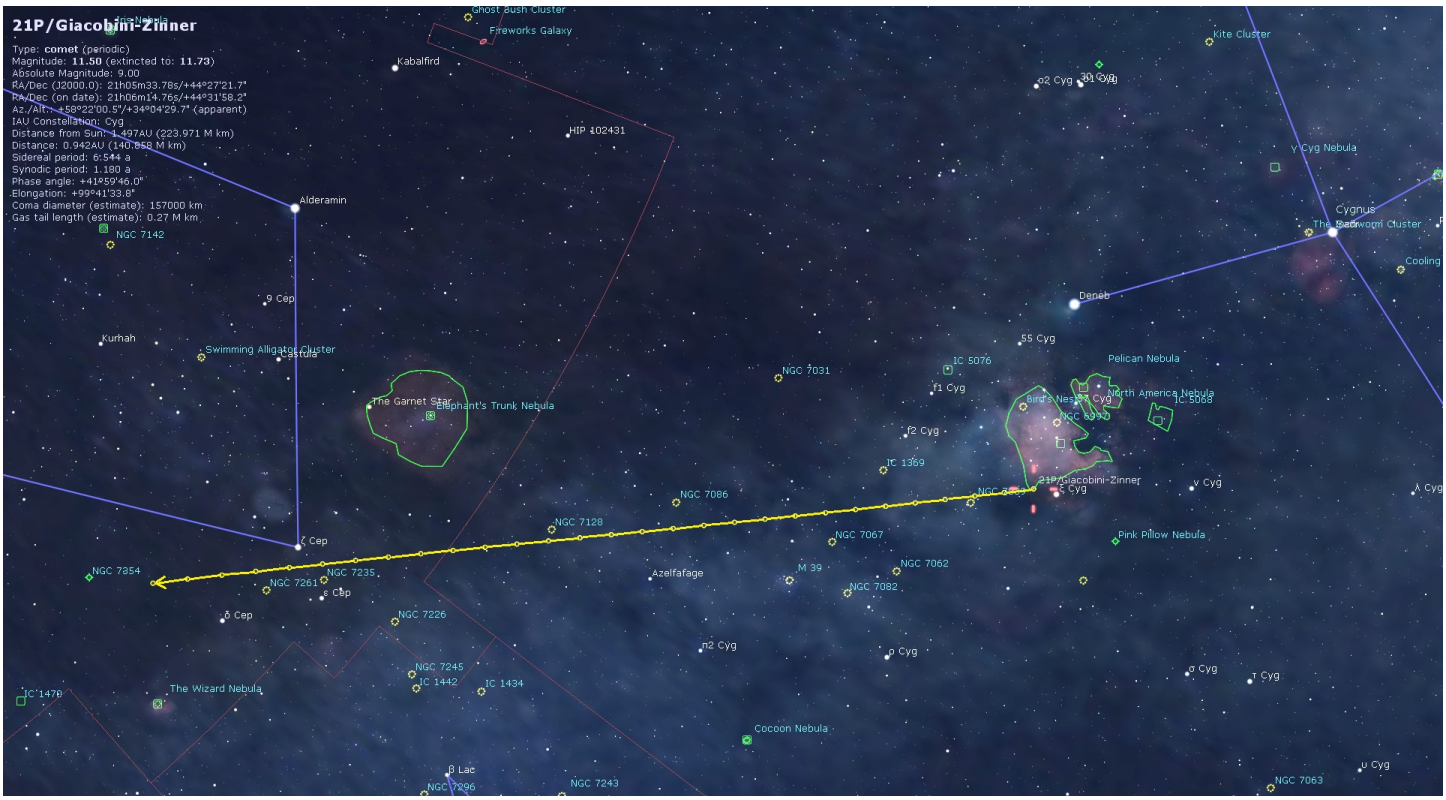
(1) Ceres, magnitude 8.8, is an early evening target in the western sky - moving prograde through central Leo. An early heads-up that Ceres will traverse the Leo Triplet on the evening of August 4, 2018, although it will be low in the west by then. Ceres will more or less cruise past the northern ends of Messier 65 and Messier 66.

(3) Juno, magnitude 9.8, is a pre-dawn target - moving prograde through Pisces until July 8, when it moves into Cetus. On July 11, it will pass about 0.5° north of the naked eye star Al Kaff al Jidmah (Xi Cet).

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/

Comet 21P/Giacobini-Zinner is visible all night in the northeastern sky, but it's highest in the sky after 4 am local time. It is predicted to peak in brightness at magnitude 7 in early September. Now about magnitude 12, over the next four weeks it should almost reach magnitude 8, within easy reach of binoculars, while it travels northwards from central Cygnus and into southwestern Cepheus, roughly on a straight line from Xi Cygni to Zeta Cepheii. On June 20, it will sit on the southern outskirts of the North American Nebula, pass 1.5° above M39 on June 28-29, pass 2° below the Elephant's Trunk Nebula / Garnet Star complex on July 10, and 20' below the magnitude 9.4 planetary nebula NGC7354 on July 20. Photo ops!



Comet C/2017 S3 (PanSTARRS) is an all-night circumpolar comet in the northeastern sky that reaches its highest elevation before dawn. It is predicted to reach a peak in brightness near magnitude 4 in late August. Now about magnitude 12, over the next four weeks, it should brighten to about magnitude 10 while heading west from western Cassiopeia to southwestern Camelopardalis. Between now and June 26, it will traverse the sky between the Double Cluster and the Heart and Soul Nebulas, setting up the potential for a nice widefield image. On July 5 it will pass close to the naked-eye stars CS and CE Cam. Photo ops!

Meteor Shower(s)

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

The **Alpha-Capricornids shower** runs from July 11 through August 10, peaking overnight on July 26-27, low ZHR, but fireballs. No moon during the first week.

Perseid meteor shower runs from July 13 through August 26, peaking August 11-12. No moon during the first week.

Asteroids

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

No notable close asteroids

According to the Minor Planet Centre…
Near-Earth Objects Discovered This Year: 838 (~149/month)
Minor Planets Discovered This Year: 3,544 (~630/month)
Comets Discovered This Year:20 (~3.6/month)

Observations This Year: 8.2 million

Satellites

A GTA International Space Station morning pass series commences on July 3 (Most are visible between 1 and 5 am). Evening passes resume July 20. Some higher/brighter ones include*:

Date	Mag.	Time	Direction	Alt.
04-Jul	-3.7	5:00 am to 5:07 am	from SW to ENE	71°
07-Jul	-3.9	4:01 am to 4:06 am	from SW to ENE	86°
10-Jul	-3.8	3:02 am to 3:05 am	from N to ENE	79°

* predicted times may shift slightly in the far future

Iridium Flares most frequent evening flares occur after 11 pm, with morning flares common from 2:30 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)

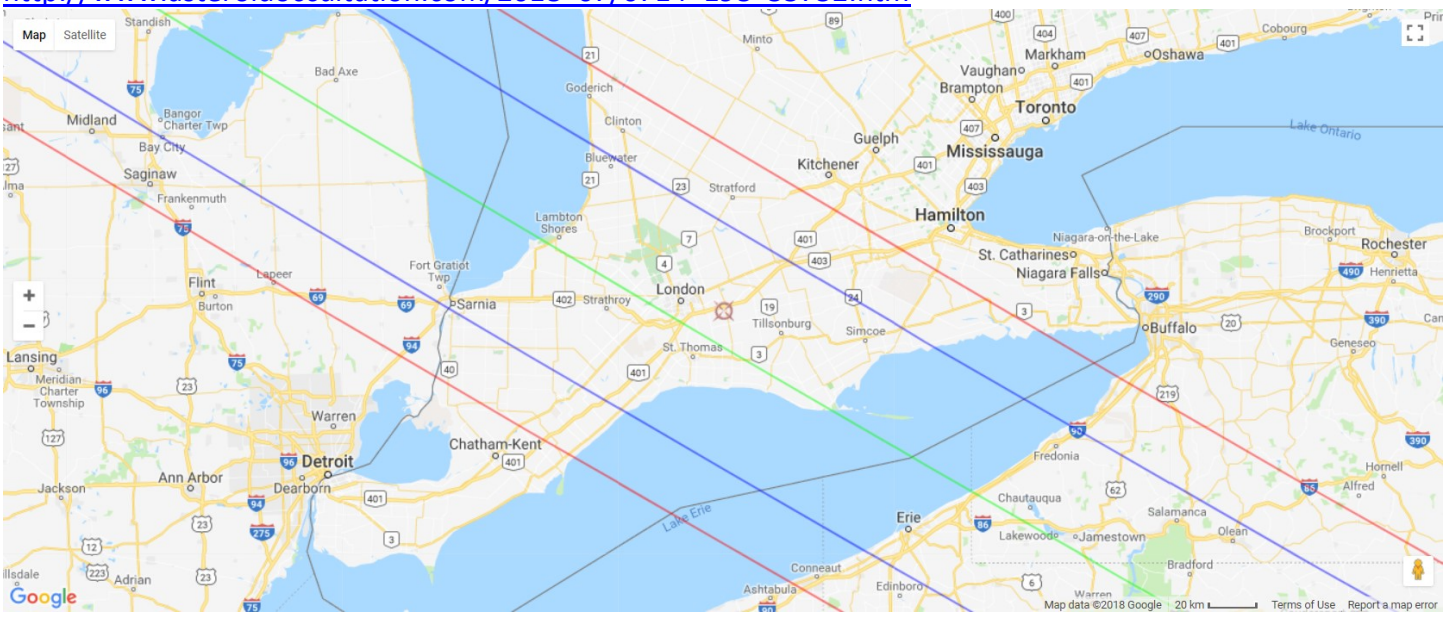
Occultations – Lunar and Asteroidal

Ref: http://asa.usno.navy.mil/SecA/olist18.html, http://www.asteroidoccultation.com/ and http://www.poyntsource.com/New/Global.htm (additional links on the following URLs open track maps)

Lunar Occultations

In the eastern pre-dawn sky on July 10, the eastward orbital motion of the waning crescent moon will carry it just above reddish Aldebaran, the brightest star in Taurus. Observers in Central America, northern North America, most of Greenland, and north-central Russia will see the moon pass in front of (or occult) the star. Observers just south of those regions will see the star graze the moon's dark southern limb, and the rest of the world will see the two objects somewhat farther apart, but the pair will still fit within the field of view of a telescope at low magnification. Grazing occultation for about 48° N (Wawa, Ontario).

Rank 98 - 14 Jul at 03:25 UT asteroid (198) Ampella (mag 10.7) occults star TYC 6285-03427-1 (mag11.4), dips 0.47 mags for 6.2 seconds, alt 41°. Star is in northern Sagittarius, 4° above Xi (ξ) Sgr.
http://www.asteroidoccultation.com/2018_07/0714_198_55752.htm



Constellations near the Meridian (Annually in early July)

11 pm: Lupus, W Scorpius, E Libra, Ophiuchus, Serpens Cap, Hercules, Lyra, Corona Borealis, Draco, Ursa Minor
1 am: E Scorpius, Sagittarius, Scutum, E Ophiuchus, Serpens Cauda, Hercules, Lyra, Draco
3 am: Microscopium, E Sagittarius, Capricornus, W Aquarius, Aquila, Delphinus, Sagitta, Vulpecula, Cygnus

Chris' Picks in early July

The Veil Supernova Remnant (in OIII filter at low power)
Eagle Nebula (in OIII filter at low power)
Lyra Doubles: Eps Lyrae, all four corners of the parallelogram, and HR7140 below centre is Albireo-ish!
Tour the Milky Way
15 Ophiuchus globulars! How many can you see?

Early Summer Star party Skylights (Annually in early July)

Asterisms - Big Dipper, Hercules, Scorpius, the Teapot (Sagittarius), Summer Triangle (/)
Summer Globs – M13, M92 (Her), M3 (CVn), M10 (Oph), M5 (Ser), M22 (Sag), M4 (Sco), etc. ( )
Summer Knobs – M57 Ring (Lyr), M27 Dumbbell (Vul), NGC6210 Turtle (Her), NGC 6543 Cat's Eye (Dra), etc. (/)
Summer Blobs – Lagoon, Trifid (Sag), Eagle (Ser), Veil, North America (Cyg), Heart / Soul (Cas), etc. ( )
Fireworks – Melotte 111 (Com), M11 Wild Duck Cluster (Scu), The Coathangar (Vul), IC 4756 Graff's Cluster (Ser), etc. (/)
Double Plays – Double Double (Lyr), Albireo (Cyg), Zubenelgenubi (Lib), Dabih (Beta Cap), Izar (Boo), etc. ( )
Hit Singles – Antares (Sco), Vega (Lyr), Arcturus (Boo), Altair (Aqu), Deneb (Cyg) (eye / /)

See you at DDO, Long Sault C A, Bayview Village Park, or the CAO!

Questions or comments to chris.vaughan@astrogeo.ca
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("Skylights" content is archived at www.astrogeoguy.tumblr.com)