

RASC Toronto Centre – www.rascto.ca

The Sky This Month –August 17 to Sept 14, 2016

by Chris Vaughan

NEWS

Space Exploration – Public and Private

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

Launches

Aug. 19 at 12-4 am - United Launch Alliance Delta 4 rocket from Cape Canaveral, payload AFSPC 6 mission for the USAF.

Aug. 24 at 5:55-6:40 pm - Ariane 5 Rocket from Kourou, French Guiana, payload Intelsat 33e and 36 comsats.

September TBD - Falcon 9 rocket from Cape Canaveral, payload Amos 6 comsat for Israel.

September TBD - GSLV rocket from Sriharikota, India, payload Insat 3DR geostationary weather sat.

Sept. 8 at 7:05-9:05 pm - Atlas 5 rocket from Cape Canaveral, payload NASA's OSIRIS-REx asteroid sample return mission. The Origins, Spectral Interpretation, Resource Identification, Security, Regolith Explorer (OSIRIS-REx) will reach asteroid Bennu in 2018 to collect surface samples for return to Earth in 2023.

September TBD - PSLV rocket from Sriharikota, India, payload ScatSat 1 spacecraft designed to aid tropical cyclone forecasting and cubesats.

Sep TBD – Long March 2F rocket from Jiuquan Satellite Launch Center, payload Tiangong 2 two-person space laboratory (14.4 m by 4.2 m, 20 tonnes). Crewed Shenzhou 11 spacecraft docks in October 2016.

<http://www.spaceflightinsider.com/organizations/china-national-space-administration/tiangong-2-arrives-chinese-launch-center-september-liftoff/>

JUNO at Jupiter

Phase One of the JUNO mission's orbits are designed to keep the spacecraft well away from the crippling radiation of Jupiter's magnetic field for long periods, followed by quick, close pole-to-pole passes only 4,300 km above the cloud tops.

Since arriving, the spacecraft has been on the first of three 53.5-day orbits for orbital capture and systems testing. The current one ends in a close pass on August 27, next two orbits, to collect science data on a trial run, commence.

In October, the orbits will be converted to 14-day science orbits that will drop the spacecraft to within 2,000 km of the cloud tops. They are timed to scan different strips of the planet each pass, in order to prepare global maps of Jupiter's magnetic and gravity field, both of which aid in developing detailed models of the interior. This phase lasts about 15 months, then the spacecraft will be de-orbited into Jupiter on February 21, 2018.

JunoCam will take RGB images at 15 km/pixel resolution for seven months, or until it fails. The camera's 58 degree FOV will allow global images an hour flanking perijove, and small areas during close passes. The images will be available for processing and animating. Eventually, the public will be invited to vote/request where to image on the planet. Earth-bound planetary imagers are being asked to submit images for inclusion in a global map. Christopher Go is helping with this.

Rosetta EOM

The Rosetta spacecraft is scheduled to end its mission in a controlled descent onto Comet 67P Churyumov-Gerasimenko on September 30th, 2016 because insufficient sunlight is available for a successful hibernation in

orbit through aphelion. The final hours of descent will offer very high resolution images and scientific measurements.

The spacecraft has already commenced altering its orbit, and the landing site has been selected on an area of the comet's "head" named Ma'at, consisting of dust-covered terrain. Impact is planned to be at a rate of 50 cm/s, half that of the Philae Lander. It may land more or less intact, but the high-gain antenna is unlikely to be optimally positioned for transmitting to Earth of any more scientific data.

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

August 19, 1891 – American Astronomer at Mt Wilson and assistant to E. Hubble, **Milton Humason**, is born
August 19, 1646 – English Astronomer Royal **John Flamsteed**, is born. Sighted "Uranus", cataloged stars...
August 19, 1871 – American aviation pioneer **Orville Wright**, is born
August 29, 1959 – Canadian Astronaut, singer, social media icon **Chris Hadfield**, is born
August 30, 1931 – Apollo 13 Astronaut **John "Jack" Swigert**, is born
September 7, 1914 – **James van Allen** – American physicist and magnetospheric researcher is born

Astronomy and Space Exploration

August 23, 1966 – Earth is photographed for the first time from lunar orbit by Lunar Orbiter 1
August 24, 2006 – International Astronomical Union (IAU) demotes the planet Pluto to a dwarf planet or "Trans-Neptunian Object".
August 26, 1981 – Voyager 2 flyby of Saturn
August 28, 1789 – William Herschel discovers Enceladus with a 1.26m telescope, the world's largest
August 29, 1541 – Nicolaus Copernicus' book "De Revolutionibus Orbium Coelestium" ("On the Revolutions of the Celestial Spheres") goes to the printer
September 1, 1804 - German astronomer Karl Ludwig Harding discovers the asteroid, Juno
September 1, 1886 – 1st photograph of the Ring Nebula, by Eugene von Gothard
September 3, 1976 – Viking 2 Mars landing
September 4, 1682 - English astronomer Edmund Halley observes "his" comet
September 6, 1997 - Gladman, Nicholson, Burns, and Kavelaars using the 200-inch Hale telescope discover Caliban and Sycorax, moons of Uranus
September 8, 1966 – First episode of Star Trek airs
September 9, 1892 - Edward Barnard of the Lick Observatory discovers Jupiter's innermost satellite, Amalthea.
The first since Galileo's four Galilean moons

Star Parties, etc.

Ref: <http://ontariostargazing.ca/astronomy-star-party-and-astronomy-events-listing-for-canada/>,
<http://www.amsky.com/calendar/events/#may>

"RASC Dark Skies Observing", Long Sault Conservation Area, ON – window runs Aug 29-Sep 1
"Millennium Square Observing", Millennium Square, Pickering – Fri, Sep 9
"RASC Solar Observing", Ontario Science Centre Teluscape – Sat. 10 to noon, on Sep 10 (or 17)
"RASC City Skies Observing", Bayview Village Park, Toronto – windows runs Sep 12-15
"Thursday Night Astronomy Nights", Gordon's Park Dark Sky Preserve, Manitoulin Island – July/Aug
(<https://gordonspark.com/thursday-night-astronomy/>)

OBSERVING

Globe at Night 2016

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 current campaign's focus is on **Cygnus** from August 25 to September 2, 2016.

Sunrise/Sunset

August 17, sunrise at 6:25 am, sunset at 8:17 pm (13h52m of daylight)
September 14, sunrise at 6:56 am, sunset at 7:29 pm (12h32m of daylight)

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>

August 17, astronomical twilight ends at 10:06 pm and starts at 4:37 am (6h31m of imaging time)
September 14, astronomical twilight ends at 9:07 pm and starts at 5:19 am (8h12m of imaging time)

Moon - Orbit

Perigee – Sun, Aug 21 at 5 pm
Apogee – Tue, Sep 6 at 3 pm

Moon - Phases

Thu, Aug 18 at 5:27 am – Full “Sturgeon/Green Corn/Grain” Moon
Wed, Aug 24 at 11:41 pm – Last Quarter Moon (rises around midnight)
Thu, Sep 1 at 5:03 am – New Moon (Annular Solar Eclipse across central Africa)
Fri, Sep 9 at 7:49 am – First Quarter Moon (sets around midnight)

Moon – Conjunctions, Eclipses, etc.

Lunar X – Thursday, September 8 at 7:40 pm

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 southern pole (bottom) of the Moon (at 2° East, 24° South). The prominent round crater Werner sits to the lower right.

The next Lunar X should be formed after 5:40 pm on Thursday, September 8th, and peak around 7:40 pm, and last until at least 8:40 pm. Despite a well-positioned First Quarter Moon, it won't be visible until after the peak due to twilight.

Lunar Appulses and Conjunctions

In the pre-dawn hours of **August 22**, the waning gibbous Moon (81% illum.) sits 5.5° south of (below) Uranus. After sunset on **September 2**, the young crescent Moon (3% illum.) sits 48' northeast (to the left of) Jupiter and 5.5° south (to the lower right) of Venus (shifting to sit 5.5° to Venus' upper left the following evening). On

the evening of **September 8**, the First Quarter Moon (46% illum.) sits 3° north of (above) of Saturn and 10° to the northwest (upper right) of Mars (then east of the planets on the following evening).

Planets and Dwarf Planets

Mercury reached greatest eastern elongation on August 16th and, ending a very poor evening apparition (due to shallow Ecliptic), is observable with difficulty for a few more days. It sets at 9:07 pm (mag. 1.21) on August 17. It enters the dawn sky after September 14.

Venus is in the early stages of an apparition that lasts until next spring, improving when the ecliptic tilts vertically late this year. For the next month it remains a magnitude -3.9 object in Leo, low in the western evening sky, and setting about an hour after the Sun. On August 17th it sets at 9:08 pm and on Sept 14th it sets at 8:28 pm. **On Aug 27th, Venus passes with 6' of Jupiter! (A telescope photo op!)**

Mars is an evening object moving from near Scorpius into Ophiuchus over the next month, while dimming as we pull away. On Aug 17th it sets at midnight (mag. -0.5) and on Sept 14th it sets at 11:18 pm (mag. -0.1). As it traverses the plane of the Milky way, it will pass near several objects: 72' below M80 (GC) on Aug 17th, passes 1.75° from Antares, and below Saturn, on Aug 23rd and 24th, 47' above M19 (GC) on Sep 6th, and 34' above NGC 6355 (GC) on Sept 14th.

Jupiter (mag -1.7) is prograde in Virgo and on August 17 sits very low in the west at dusk, setting at 8:54 pm. Over the next few weeks it will sink into the sunset, setting at 7:51 pm on Sep 14th, only 25 minutes after the Sun. **On Aug 27th, Venus passes with 6' of Jupiter! (A telescope photo op!)** After sunset on September 2, the young crescent Moon (3% illum.) sits 48' northeast (to the left of) Jupiter.

Saturn is in southern Ophiuchus (to the upper left of the claw stars of Scorpius), making it a convenient target in the southwestern evening sky, though not very high due to the shallow night-time Ecliptic. It sets at 12:45 am on August 17th and at 10:55 pm on Sept 14th, dimming through the month from magnitude 0.42 to 0.52. On the evening of September 8, the First Quarter Moon (46% illum.) sits 3° north of (above) of Saturn

Uranus (mag. 5.8) is slowly moving retrograde in Pisces, and observable low in the eastern sky in late evening all month. On August 17th, it rises at 10:23 pm and on Sept 14th it rises at 8:32 pm. In the pre-dawn hours of August 22, the waning gibbous Moon (81% illum.) sits 5.5° south of (below) Uranus.

Neptune (mag. 7.8) is moving retrograde in Aquarius all month, and is observable nearly all night due to reaching opposition on Sept 2nd, when it will exhibit a 2.4" disk. It is southwest of Lambda Aqr. Over the month it increases from 52' to 101' away. On August 17th it rises at 8:50 pm, and crosses the meridian, low in the southern sky, around 2:20 am. On Sept 14th it rises at 6:58 pm and crosses the meridian at 12:30 am.

Pluto, northeast of Sagittarius' teapot, only 26' from the star Manubrij, is a faint mag. 14.1 object. In mid-August, it's in the southern sky around 10:30 pm, setting at 3:10 am. On Sept 14th it sets at 1:18 am.

(4) Vesta (mag. 8.5) is a pre-dawn target moving prograde in Gemini all month. It rises at 2:41 am on Aug 17th and at 1:38 am on Sept 14th.

(1) Ceres, (mag. 8.6) is prograde in Cetus observable in the post-midnight sky. It's stationary on Sept 2nd. It rises at 11:48 pm on Aug 17th and at 10:03 pm on Sept 14th.

(2) Pallas, (mag 6.3) traverses Equuleus over the next month. It's an all-night target because it reaches opposition on Aug 20th.

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/>

No bright comets to report.

Meteor Shower(s)

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

Perseids - Active period July 13 – Aug 26, peaking before dawn on August 12th. The early setting waxing gibbous Moon will not impact observers too much. The shower radiant point is between Camelopardalis and Perseus in the NE sky – and nearly overhead by dawn (RA 3h 12m, Dec. +57.6°). Source of material is comet 109P/Swift-Tuttle (130 year period). Usually 60-80 per hour at the peak, many are of a fireball nature.

Asteroids

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

According to the Minor Planet Centre...

Near-Earth Objects Discovered This Year:	1,146 (~153/month)	All Time:	14,762
Minor Planets Discovered This Year:	33,485 (~4,465/month)	All Time:	714,825
Comets Discovered This Year:	29 (~4/month)	All Time:	3,945
Observations This Year:	11.9 million	All Time:	153.3 million

Satellites

Over the GTA, an International Space Station (ISS) morning pass series commences September 4th (Most are visible between 4 am and 6 am). Some higher/brighter ones include*:

Date	Mag.	Time	Direction	Alt.
5-Sep	-2.4	6:06:52 am to 6:13:06 am	from SW to ENE	44°
7-Sep	-3.4	5:56:57 am to 6:02:54 am	from WSW to ENE	85°
8-Sep	-2.9	5:05:54 am to 5:09:30 am	from S to ENE	51°
10-Sep	-3.2	4:56:12 am to 4:59:11 am	from NNE to NE	68°

*far future predicted times may shift slightly

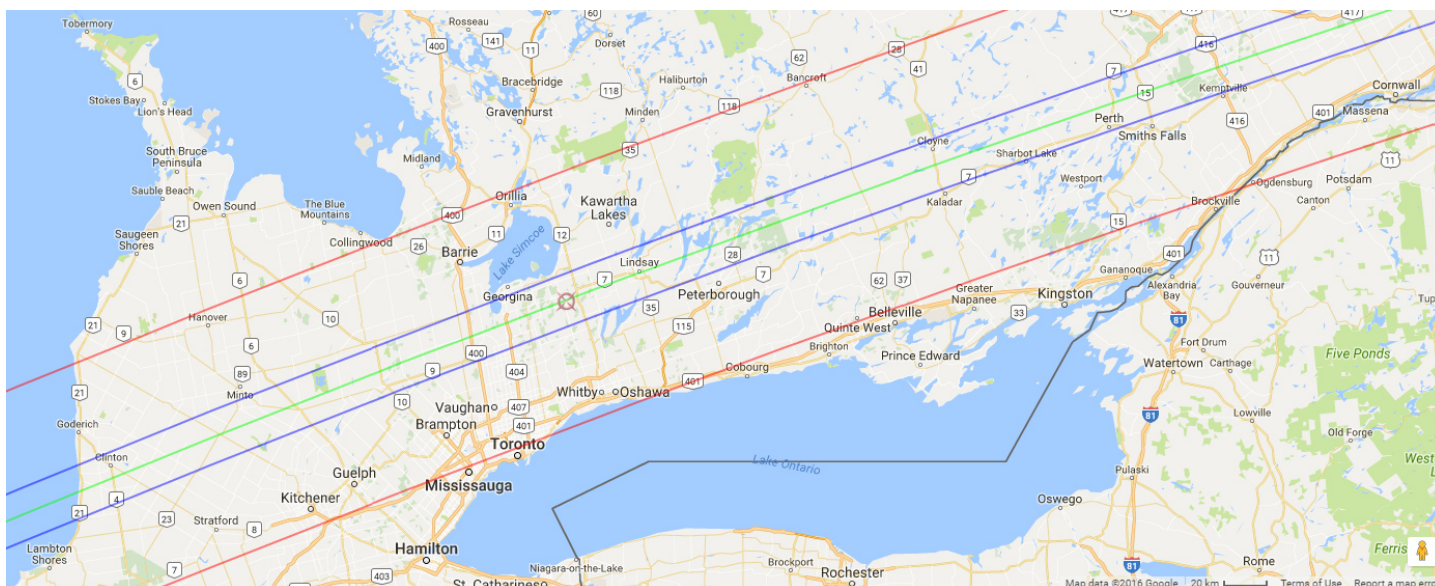
Iridium Flares most frequent evening flares occur between 10 pm and 11 pm, with morning flares common around 4 am. Local occurrences info at www.heavens-above.com and enter your location, from phone/tablet apps, Chris Vaughan's Skylights (subscribe to email [here](#) or visit www.astrogeoguy.tumblr.com)

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)



Rank 99 - 19 Aug 2016 at 9:25 pm EDT, asteroid (107) Camilla (mag 12.9) occults star 2UCAC 27737945 (mag 12.3) (sits above Sgr), centre track near Gananoque (Hamilton, Toronto, Bancroft mark northern track edge), dips 1.13 mags for 29.1 seconds, alt 40° (May be hampered by a Full Moon rising at 9:04 pm.)
http://www.asteroidoccultation.com/2016_08/0820_107_36962.htm



Rank 43 - 5 Sep 2016 at 4:30 am EDT, asteroid (999) Zachia (mag 13.0) occults star TYC 1152-00519-1 (mag 10.0) (sits between Aqr and Peg), centre track: Orangeville to Lindsay and beyond, dips 3.07 mags for 3.0 seconds, alt 85° http://www.asteroidoccultation.com/2016_09/0905_999_37668.htm

Lunar Occultation

On August 25, from 4:53 am to 6:07 am, the **Last Quarter Moon occults the double star Hyadum I (Gam Tau)** (mag. 3.6). The Moon will be 47° above the horizon at first contact. Emersion occurs in twilight. This event can be observed with unaided eyes, binoculars, and telescopes.

Constellations near the Meridian (Annually in Late August/September)

9 pm: Corona Australis, Sagittarius, Scutum, Serpens Cauda (E), Ophiuchus, Hercules, Lyra, and Draco

11 pm: Microscopium, Capricornus, Aquila, Aquarius, Equuleus, Delphinus, Sagitta, Vulpecula, and Cygnus

1 am: Piscis Austrinus, Aquarius, Pegasus, Lacerta, and Cepheus

Late Summer Star party Skylights (Annually in August/September)

Milky Way, the Big Dipper, Northern Cross/Cygnus, Scorpius, the Teapot (Sag), Milky Way, the Coathanger, Summer Triangle, etc. (eye / binoculars)

Summer Globbs – M13, M92 (Her), M10 (Oph), M15 (Peg), M5 (Ser), M22 (Sgr), M4 (Sco), M2 (Aqr), M71 (Sge), etc. (binoculars / telescope)

Summer Blobs – M8 Lagoon, M20 Trifid, M17 Omega/Swan (Sgr), C34 Veil, C20 North American, C27 Crescent (Cyg), M16 Eagle (Ser), etc. (binoculars / telescope)

Summer Knobs – M57 Ring (Lyr), M27 Dumbbell (Vul), C15 Blinking Planetary (Cyg), C6 Cat's Eye (Dra), C55 Saturn Nebula (Aqr), etc. (binoculars / telescope)

Fireworks – M11 Wild Duck Cluster (Sca), IC4756 Graff's Cluster (Ser), M6 Butterfly Cluster, M24 Sagittarius Star Cloud, M7 (Sgr) (binoculars / telescope)

Double Plays – Izar, Xi (Boo), Albireo (Cyg), Eps Lyrae Double-double (Lyr), Marfik (Oph), Rasalgethi (Her), etc. (binoculars / telescope)

Hit Singles - Antares (Sco), Vega (Lyr), Altair (Aqr), Deneb (Cyg), Arcturus (Boo), Herschel's Garnet Star (Ceph) (eye / binoculars / 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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