

RASC Toronto Centre – www.rascto.ca

The Sky This Month – June 21 to July 19, 2017 (times in EDT)

by Chris Vaughan

NEWS

Space Exploration – Public and Private

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

Launches

June 22/23 at midnight - PSLV rocket from Satish Dhawan Space Center, India, payload Cartosat 2E high-res Earth obs sat.

June 23 at 2:10-4:10 pm - Falcon 9 rocket from Kennedy Space Center, payload BulgariaSat 1 comsat.

June 25 at 4:25 pm - Falcon 9 rocket from Vandenberg Air Force Base, payload 10 sat for Iridium next fleet.

June 28 at 4:55 pm - Ariane 5 rocket from Kourou, French Guiana, payload Inmarsat S-band/Hellas-Sat 3 and GSAT 17 comsats.

July 1 at 7:35-8:35 pm - Falcon 9 rocket from Kennedy Space Center, payload Intelsat 35e comsat.

July 2 TBD - Long March 5 rocket from Wenchang, China, payload Shijian 18 comsat.

July 14 at 2:36 am - Soyuz rocket from Baikonur Cosmodrome, Kazakhstan, payload Kanopus-V-IK infrared Earth obs sat for Roscosmos.

July 15 at 1 am - Minotaur 4 rocket from Cape Canaveral Air Force Station, payload U.S. military Operationally Responsive Space program.

Late July TBD - Falcon 9 rocket from Cape Canaveral, payload SES-11/EchoStar 105 hybrid comsat.

JUNO at Jupiter

According to the JUNO Mission Principal Investigator Scott Bolton, 44 papers have already been published based on the first two flybys, and more are in press! The belts don't continue at depth as far as expected, except for a narrow equatorial band that extends down "as far as we can see". It has a high ammonia concentration that increases with depth. Under the surface clouds is a region of variability that is independent of the zone/belt structure despite no sunlight to energize it. The atmosphere varies with latitude AND longitude! The planet's core looks like it is "fuzzy", and larger than expected - up to 50% of the planet. The magnetic field may be generated much closer to the surface than was thought. The polar aurorae are partly produced by charged particles emitted from Jupiter itself!

The revised 53 day orbit mission is working well, with no radiation damage issues, so far. Next seventh pass, on July 11, will pass is RIGHT OVER the Great Red Spot! Stay tuned!

Incredible JUNOcam video by Sean Doran here <https://www.youtube.com/watch?v=3kQbTBt418o>

Shorter one here <https://youtu.be/9UHP28JiPeE>

Cassini at Saturn

What's Cassini been up to?

Cassini's Synthetic Aperture Radar instrument (formerly used on Titan) has been probing the rings, both actively and by listening to radio emissions from ring particles.

Cassini's Ultraviolet Imaging Spectrograph (UVIS) and the Visual and Infrared Mapping Spectrometer instrument (VIMS) have been observing occultations of the sun and bright stars, including red Betelgeuse, blue Alnilam, and Alnitak, by Saturn's atmosphere and the rings. It also observed one behind Tethys to probe for an atmosphere around that moon.

The spacecraft's radio beacon has been monitored for Doppler shifts caused by accelerations due to the gravity of the planet and rings – in order to weigh the rings.

The Imaging Science Subsystem (ISS) has been taking 13 hour long looks at Enceladus' icy plumes.

Cassini is executing 22 Grand Finale Proximal orbits, each with a period of 6.4 days, in a plane inclined 62 degrees from the planet's equatorial plane. Each orbit minimum distance shrinks to about 2,500 km above Saturn's visible atmosphere. End of mission entry into Saturn's atmosphere occurs on Sept 15.

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 Dark Skies Observing**”, Long Sault Conservation Area – window runs Jun 19-22

“**RASC City Skies Observing**”, Bayview Village Park, Toronto – windows runs Jun 26-29

“**RASC Solar Observing**”, Ontario Science Centre Teluscape – Sat. 10 to noon, on Jul 8 (or 15)

“**RASC General Assembly**”, Ottawa – Jun 26 to Jul 3

“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 – Jul 20-23
And many more throughout the USA...

OBSERVING

Globe at Night 2017

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 Jun 16-25 and July 15-24.

Sunrise/Sunset

June 21, sunrise at 5:36 am, sunset at 9:02 pm (15h26m of daylight)
July 19, sunrise at 5:53 am, sunset at 8:53 pm (15h00m of daylight)

Summer Solstice - Sun, June 21 at 12:24 am
Earth at Aphelion (1.521 million km) – Mon, July 3 at 4 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 <https://www.timeanddate.com/sun/canada/toronto?month=6>
<http://www.timeanddate.com/astronomy/canada/toronto>

June 21, astronomical twilight ends at 11:25 pm and starts at 3:13 am (3h48m of imaging time)
July 19, astronomical twilight ends at 11:02 pm and starts at 3:43 am (4h41m of imaging time)

Moon - Orbit

Perigee – Fri, Jun 23 at 7 am (~15 hrs before new moon, large tides)
Apogee – Wed, July 5 at midnight

Moon - Phases

Fri, Jun 23 at 10:30 pm – New Moon
Fri, Jun 30 at 8:51 pm – First Quarter Moon (sets around midnight)
Sun, Jul 9 at 12:07 am – Full “Buck/Thunder/Hay” Moon
Sun, Jul 16 at 3:26 pm – Last Quarter Moon (rises around midnight)

Tuesday, Jul 4 - 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

On the evening of Tuesday, **June 27**, the waxing crescent moon will sit approximately 34 arc-minutes to the south (lower left) of Regulus in Leo. On Friday evening, **June 30 from 10:40 to 11:48 pm** the first quarter moon will occult the naked eye double star Porrima in Virgo. Because the double star’s separation is one arc-second,

telescope observers should see one star in the pair wink out seconds before the other one. Also on **June 30**, the first quarter moon will sit 4 degrees to the right (northwest) of Jupiter in the southwestern evening sky. Overnight on Thursday, **July 6** the nearly full moon will sit only two degrees above Saturn. In the eastern pre-dawn sky on **July 17**, the last quarter moon will sit 6° southeast of (below) Uranus.

Planets and Dwarf Planets

For the next four weeks, **Mercury** presents a very good evening apparition, becoming visible low in the west after sunset from the last third of June onwards. During this period, it approaches Earth – causing its disk to increase in diameter, while waning from a nearly full disk to half illuminated phase and dropping in brightness. On **June 28**, Mercury passes a degree to the northwest (right) of dimmer Mars, but both planets are immersed in the evening twilight.

Over the next four weeks, **Venus** will shine brightly in the eastern pre-dawn sky amid the stars of Aries, moving into Taurus on June 28. Throughout the period, it will slowly swing sunward, but continue to rise about 3 am local time as the summer ecliptic tilts higher. It will also decrease in disk diameter while slightly dropping in brightness and growing in phase. On the mornings around **July 12**, Venus will pass just above the Hyades in Taurus for a nice photo opportunity.

Reddish **Mars** is more or less unobservable in the western early evening sky as it sinks sunwards towards solar conjunction. On **June 28**, Mercury passes a degree to the northwest (right) of dimmer Mars, but both planets are immersed in the evening twilight.

Very bright **Jupiter** is an evening object somewhat low in the southwestern sky all month, and setting after midnight. It will be moving prograde through the body of Virgo all month, closing to within 9 degrees of that constellation's brightest star Spica in late July. On **June 30**, the first quarter moon will sit 4 degrees to the right (northwest) of the planet.

Io shadow transit Monday, Jun 26 from 10:23 pm to 12: 33 am EDT.

Europa shadow transit Tuesday, Jun 27 from 12:42 am EDT (sets in progress).

Io shadow transit Tuesday, Jul 4 from 12:18 am EDT (sets in progress).

Io shadow transit Wednesday, Jul 12 from 8:40 pm (twilight) to 10: 52 pm EDT.

Io shadow transit Wednesday, Jul 19 from 10:35 pm EDT (sets in progress).

Saturn spends the next four weeks near the Milky Way, moving retrograde through southern Ophiuchus. It reached opposition on June 15th, so is at its best appearance in late June, but is easily observable all month. Unfortunately this year, Saturn remains very low in the southern sky, making telescope views less than ideal from mid-northern latitudes. As a consolation prize, the planet is experiencing its winter solstice, when the northern side of the ring plane is tilted to its maximum extent (26.7°) toward the Sun and Earth. Overnight on Thursday, **July 6** the nearly full moon will sit only two degrees above Saturn.

At magnitude 5.9, **Uranus** is visible with binoculars or a small telescope as a tiny blue-green dot. During the next four weeks, it is in the eastern pre-dawn sky among the stars of Pisces, rising at 2:20 am now and at 12:23 am on July 19. On **July 17**, the last quarter moon will sit 6° southeast of (below) Uranus.

Neptune, at magnitude 7.9, is moving retrograde in the constellation of Aquarius all month, observable in the eastern sky between midnight and morning twilight. On June 21 it rises at 12:45 am. Over the next four weeks it becomes an evening target rising before 11 pm.

Pluto is a faint mag. 14.2 object moving retrograde in northeastern Sagittarius towards the star Albidah, from which it is about 2° separated. Close to opposition, Pluto is an all-night target, but a challenge to see due to its dim nature and the low summer ecliptic.

(3) Juno, magnitude 9.9, is an all-night target (opposition on July 10) crossing the Milky Way - moving retrograde through Scutum all month. On June 21, it sits about 1.5° above the Wild Duck Cluster, and passes about 9 arc-minutes below Beta Scuti on June 23-24.

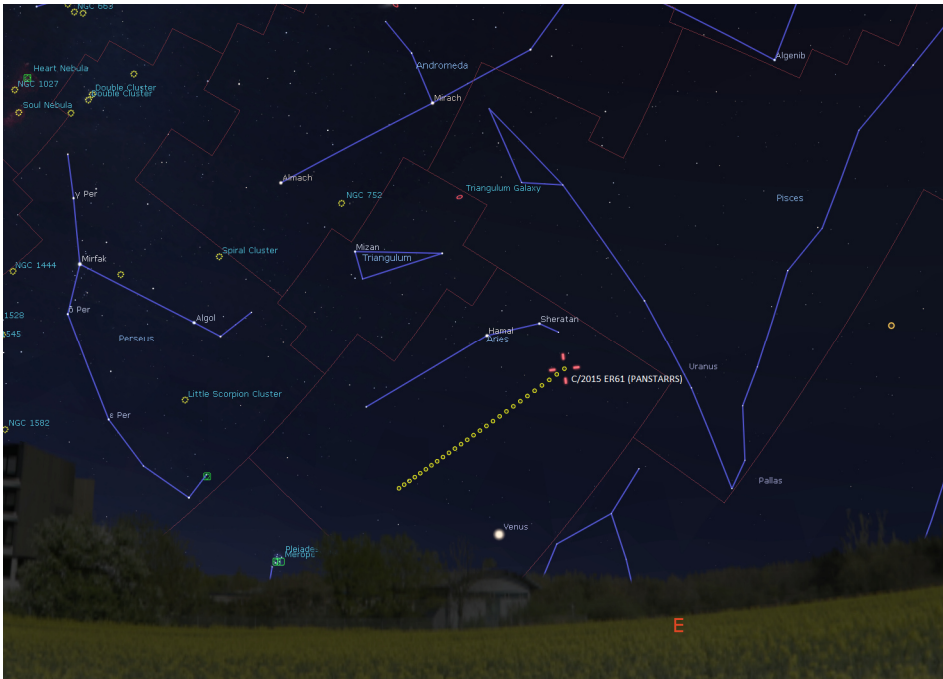
Comets

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 41P/Tuttle-Giacobini-Kresak is visible all night, but it's highest in the sky about 1 am local time. It has peaked in brightness, but is still in reach of binoculars in the southeastern evening sky. Over the next month it will travel southwards through Serpens Cauda.



Comet C/2015 ER61 (PANSTARRS) is a pre-dawn binocular comet that has recently passed peak brightness. Over the next month it travels parallel to Aries (the Ram), about a palm's width below the line of stars. It's slowly moving in the direction of the Sun, staying above Venus.



Comet C/2015 V2 (Johnson) is a binocular comet that is still brightening. Currently it's visible in the evening southeastern sky as soon as it's fully dark, and sets about 3:30 am local time. During the next month, it moves downward through the legs of Virgo while veering eastwards (to the left) of Spica (which is near Jupiter).



Meteor Shower(s)

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

Alpha-Capricornids run July 11 through August 10, peaking July 26-27

Perseids run July 13 through August 26, peaking August 11-12

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:	808 (~140/month)
Minor Planets Discovered This Year:	15,245 (~2,675/month)
Comets Discovered This Year:	29 (~5/month)
Observations This Year:	8.5 million

Satellites

A GTA International Space Station morning pass series commences on July 5 (Most are visible between 2 and 5 am). No evening passes Some higher/brighter ones include*:

Date	Mag.	Time	Direction	Alt.
09-Jul	-3.9	4:34 am to 4:40 am	from WSW to ENE	87°
10-Jul	-3.5	3:44 am to 3:47 am	from S to ENE	51°
12-Jul	-3.8	3:35 am to 3:39 am	from W to NE	73°

*far future predicted times may shift slightly

Iridium Flares most frequent evening flares occur between 11 pm and 12:30 am, with morning flares common from 3:30 to 5:30 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)

~~Feb 23 at 7:36:48 pm mag -8.0 — 47° alt due SE (near Procyon)~~

~~Feb 25 at 6:37:35 pm mag -6.1 — 58° alt due NNE (upper right of Polaris)~~

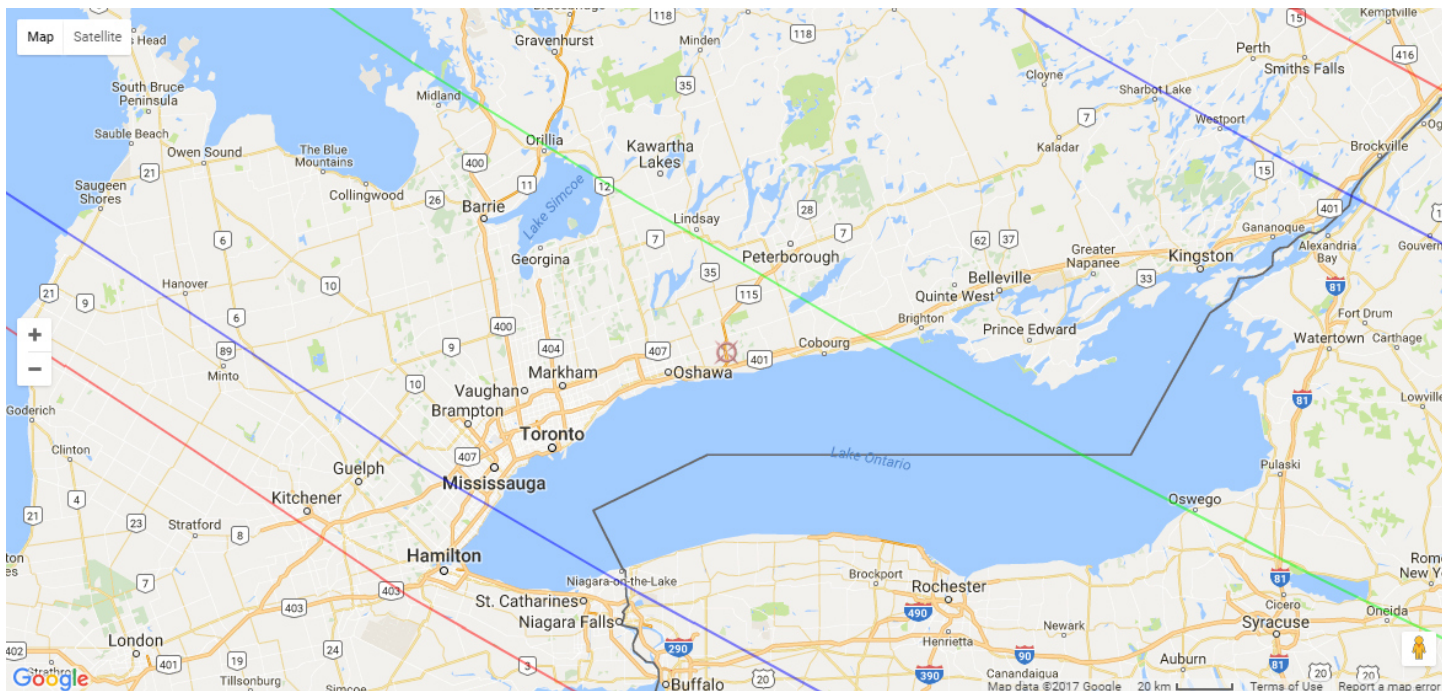
Occultations – Lunar and Asteroidal

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

Lunar Occultations

On Thursday morning, June 22 the old crescent moon will occult the bright star Aldebaran in the daytime. Observers with telescopes can watch the bright leading edge of the moon cover the star first about 9:42 am EDT. About 70 minutes later at 10:54 am Aldebaran will emerge from the opposite darkened limb of the moon. (Note: Care must be taken to avoid pointing a telescope anywhere near the sun.)

Rank 99 - 28 Jun at 03:12 UT asteroid (83) Beatrix (mag 11.9) occults star TYC 6806-00794-1 (mag10.8), dips 1.44 mags for 13.2 seconds, alt 21°. **Star location is near Antares.**
http://www.asteroidoccultation.com/2017_06/0628_83_53520.htm



Constellations near the Meridian (Annually in early July)

11 pm: Lupus, W Scorpius, E Libra, W Ophiuchus, Serpens Cap, Hercules, Corona Borealis, Draco, Ursa Minor

1 am: E Scorpius, Sagittarius, Scutum, E Ophiuchus, Serpens Cauda, Hercules, Lyra, Draco

3 am: E Sagittarius, Capricornus, Aquila, Delphinus, Sagitta, Vulpecula, Cygnus, E Draco

Early Summer Star party Skylights (Annually in early July)

Asterisms - Big Dipper, Hercules, Scorpius, the Teapot (Sagittarius), Summer Triangle (👁️/🔭)

Summer Globes – 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), Crescent (Cyg), Heart / Soul (Cas), etc. (🔭)

Fireworks – Melotte 111 (Com), M11 Wild Duck Cluster (Scu), The Coathanger (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 Long Sault C A, Bayview Village Park, or the CAO!

Questions or comments to chris.vaughan@astrogeo.ca

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