RASC Toronto Centre – www.rascto.ca
The Sky This Month – Lazy, Hazy Dog Days of Summer Edition
July 17 to Aug 14, 2019 (times in EDT)

by Chris Vaughan

NEWS

Space Exploration – Public and Private

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

Launches

July 20 at 12:25 pm EDT – Soyuz rocket from Baikonur Cosmodrome, Kazakhstan, Expedition crew to the ISS, Soyuz to remain at ISS for 6 months

July 21 at 7:35 pm EDT - Falcon 9 rocket from Cape Canaveral Air Force Station, 20th Dragon spacecraft cargo delivery to the ISS

July 22 at 0913 GMT (5:13 a.m. EDT) - GSLV Mk.3 rocket from Satish Dhawan Space Center, Sriharikota, India, Chandrayaan 2 mission, India's second mission to the moon. Chandrayaan 2 will consist of an orbiter, the Vikram lander and rover launched together into a high Earth orbit

July 31 at 8:13 am EDT - Soyuz rocket from Baikonur Cosmodrome, Kazakhstan, 73rd Progress cargo delivery ship to the ISS

TBD – Virgin Orbit LauncherOne rocket from modified Boeing 747 over Pacific, 2nd flight, Cubesats to orbit

This Month in History (a sampling)

Ref. http://www2.jpl.nasa.gov/calendar/, 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

Aug 8, 1931 – **Sir Roger Penrose**, mathematical physicist and cosmologist is born

Astronomy and Space Exploration

July 16-22, 1994 – Hubble images the Comet Shoemaker-Levy 9 impacts into Jupiter
Jul 20, 1976 – Viking I lands on Mars
Jul 28, 1851 – First Daguerreotype of the eclipsed Sun reveals the Corona
Jul, 1610/1612/1616 – Galileo observes Saturn and rings
Aug 6, 2011 - Launch of JUNO mission to Jupiter, scheduled to arrive July 4, 2016, and enter a polar orbit
Aug 11, 3114 BCE – The Beginning of Creation, according to the Maya civilization
Aug 11 and 17, 1877 – Asaph Hall discovers Phobos and Deimos (aka Gods of Fear and Dread respectively)
Aug 13, 1642 – Christiaan Huygens discovers the Martian south polar cap

50th Anniversary of Apollo 11

Chose Mare Tranquillitatis for smooth surface safety and for its unique high-Titanium basalts
Landing site is north-northwest of Moltke Crater

July 18, 1969 (50 yrs before RASC RAN Meeting started)
7:27:00 pm EDT – Crew return to CM after LM check
July 20

10:56:15 pm EDT – Neil Armstrong steps on the moon
11:09:53 pm EDT - Contingency sample collected
11:15:16 pm EDT – Buzz Aldrin steps onto the moon
July 21
1:09:32 am EDT – Both astronauts returned to LM (Only 2:12:45 on the lunar surface!)
1:54:00 pm EDT – LM Ascent stage ignition
5:35:00 pm EDT – LM docks with Command Module
July 22
12:58:13 am EDT – Transfer to Earth burn complete
July 24
12:50:35 pm EDT – Splashdown!

Dog Days of Summer

Traditionally, the Dog Days of Summer are the period from July 3 to August 15. It commences with the heliacal rising of Sirius (i.e., with the sun) annually in early July. In ancient times, Sirius, the Dog Star, was associated with heat, fever, and thunderstorms. The ancient Greeks thought combining Sirius' light with the sun brought more heat. Hesiod wrote: "Then goats are plumpest and wine the sweetest; Women are most wanton, but men are feeblest." When Sirius appeared at dawn in ancient Egypt, the Nile would begin to rise ahead of the welcome annual floods

Star Parties, etc.

Ref: http://www.amsky.com/calendar/events/#may, https://www.skynews.ca/star-party-calendar/

OBSERVING

Globe at Night 2019

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 fall campaign's focus is on **Hercules** from July 25 to Aug 2.

Smoke Maps

weather.gc.ca/firework/firework_anim_e.html?type=tc&utc=00

Sunrise/Sunset

July 17, sunrise at 5:51 am, sunset at 8:55 pm (15h04m of daylight)
August 14, sunrise at 6:20 am, sunset at 8:22 pm (14h02m 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
https://www.timeanddate.com/sun/canada/toronto?month=10
http://www.timeanddate.com/astronomy/canada/toronto

Jul 17, astronomical twilight ends at 11:06 pm EDT and starts at 3:39 am EDT (4h36m of imaging time)
Aug 14, astronomical twilight ends at 10:13 pm EDT and starts at 4:29 am EDT (6h16m of imaging time)

Moon - Orbit

Apogee – Sat, Jul 20 at 8 pm EDT
Perigee – Fri, Aug 2 at 3 am EDT

Moon - Phases

Wednesday, July 24 at 9:18 pm - Last Quarter Moon (rises around midnight)
Wednesday, July 31 at 11:12 pm - New Moon
Wednesday, Aug 7 at 1:31 pm - First Quarter Moon (sets around midnight)
Thursday, Aug 15 at 8:29 am - Full Green Corn Moon

Libration

N limb most exposed on July 24 (+6.8°)
W limb most exposed July 27 (–6.9°)
S limb most exposed on Aug 6 (–6.7°)
E limb most exposed on Aug 9 (+7.2°)

Moon – Conjunctions, Eclipses, etc.

Lunar Appulses and Conjunctions

On **July 25**, the waning crescent moon will be positioned 5 degrees below (south of) Uranus. On the evenings surrounding **Friday, July 26**, Jupiter's orbital motion will carry it close past the globular star cluster NGC 6235 in the southern sky in the constellation of Ophiuchus, sitting only 4 arc-minutes above the cluster at closest approach. For a brief period after sunset on **August 1**, look low in the northwestern sky for the very slim crescent of the young moon positioned less than two degrees above (celestial northeast of) Mars. On **August 11**, the bright, waxing gibbous moon will be positioned 4 degrees to the right (west) of Saturn. Mercury will slide past the southern edge of the Beehive Cluster (Messier 44) on **August 17**, but the sky will be too bright for observers at higher latitudes to see the cluster's stars.

Planets and Dwarf Planets

During the early part of July, **Mercury** will be visible low in the western evening sky for a short period after sunset, the best viewing time falling between 9:30 and 10 p.m. local time. In a telescope, Mercury will exhibit a waning crescent as it slides towards inferior conjunction with the sun on July 21. During the final week of July, the swift planet will re-appear in the eastern pre-dawn sky, now showing a waxing slim crescent. For both appearances, the planet's apparent disk size will be a healthy 10 arc-seconds. On July 3, the young crescent moon will be positioned less than 3 degrees to the lower right (west) of Mars and 5.5 degrees to the right of Mercury. **Mercury** will spend all of August in the eastern pre-dawn sky, but it will only be observable with relative ease until the final week of the month. Due to the steeply dipping morning ecliptic, this will be a good apparition for Northern Hemisphere skywatchers, but a poor one for those viewing the planet from the Southern Hemisphere. As August begins, Mercury will be climbing away from the soon-to-rise sun, and will show a slim crescent in backyard telescopes. The best time to look for the swift planet will fall between 5:15 and 5:30 a.m. local time. For the rest of the month, Mercury will brighten dramatically from magnitude 1.9 to -1.7. Its disk will increase in illuminated phase and diminish in apparent diameter as the Mercury-Earth separation distance increases. On August 9, Mercury, now half-illuminated, will reach its widest separation angle of 19 degrees west of the Sun, allowing it to be seen for a longer period of time – approximately 5 to 5:45 a.m. local time. Mercury will slide past the southern edge of the Beehive Cluster (Messier 44) on August 17, but the sky will be too bright for observers at higher latitudes to see the cluster's stars.

During July and August, **Venus** will be out of sight near the sun. It will pass solar conjunction on August 14, and then re-appear in the western evening sky in September.

Mars will spend July very low in the western evening sky among the stars of Cancer, shining at magnitude 1.8. The red planet will become increasingly difficult to spot in the twilit sky as it descends steadily towards the sun and solar conjunction in early September. **Mars** will spend August in the western evening sky among the stars of Leo. But the red planet will only be visible with difficulty on the opening days of the month, as it swings steadily towards the sun and solar conjunction in early September. For a brief period after sunset on August 1, look low in the northwestern sky for the very slim crescent of the young moon positioned less than two degrees above (celestial northeast of) Mars.

Extremely bright **Jupiter** will spend July moving retrograde westward among the stars of southern Ophiuchus; just west of the Milky Way. The planet will be very well placed for evening observing all month, occupying the lower part of the southern sky (above Scorpius) after dusk, and setting in the west a few hours after midnight. During the month, the planet's apparent disk size will decrease slightly from 45.4 to 42.5 arc-seconds, and its brightness will drop from magnitude -2.57 to -2.42 as we increase our distance from the planet. From time to time during July, the little round shadows cast by Jupiter's four Galilean moons will be visible as they cross the planet's disk. See blue events below. Extremely bright **Jupiter** will continue to be a fine evening observing target during August. As Earth moves farther from it, the planet will decrease slightly in brightness (from magnitude -2.41 to -2.22) and apparent disk size (from 42.5 to 39 arc-seconds). On August 11, Jupiter will end a westerly retrograde loop that began in April, and resume its regular eastward motion with respect to the distant stars of southern Ophiuchus. On the evenings surrounding August 26, Jupiter will make a close pass of a globular star cluster designated NGC 6235. At closest approach on August 26, the bright planet will sit only 2 arc-minutes above the cluster. In the southern sky on the evening of August 9, the waxing gibbous moon will be positioned to the upper left (celestial northeast) of Jupiter.

During July, **Saturn** will be well-positioned for observing all night while it moves retrograde (westward) through the stars of northeastern Sagittarius. Look for it as a medium-bright, yellowish object in the lower part of the southeastern sky, sitting east of the Milky Way. The ringed planet will reach opposition on July 9. On

that night, Saturn will rise at sunset. Its minimum separation from Earth of 9.0 AU (839,472 miles or 1,351 million km) will cause Saturn to shine at a maximum brightness of magnitude +0.05 and exhibit an apparent disk diameter of 18.4 arc-seconds. The rings, which will narrow every year until the spring of 2025, will subtend 42.86 arc-seconds across. On July 15, the bright, nearly full moon will be positioned 2.5 degrees to the right (west) of Saturn. Fresh from opposition in July, **Saturn** will be well-positioned for observing all night during August as it moves retrograde (westward) through the stars of northern Sagittarius. Look for it as a medium-bright, yellowish object in the lower part of the southeastern sky - a half-dozen degrees east of the Milky Way. Over the course of the month, Earth's increasing distance from the ringed planet will cause Saturn to diminish slightly in brightness and apparent size. On August 11, the bright, waxing gibbous moon will be positioned 4 degrees to the right (west) of Saturn. Observers in eastern Indonesia, most of Australia, northern New Zealand, Melanesia, and Polynesia (except Hawaii) will see the moon occult Saturn on August 12.

During July, blue-green **Uranus** (magnitude 5.8) will be moving slowly eastward through the stars of southwestern Aries. In early July, the planet will be observable in the southeastern pre-dawn sky for about 3 hours. By the end of the month it will start rising at around midnight, extending our observing time. On July 25, the waning crescent moon will be positioned 5 degrees below (south of) Uranus. As August begins, blue-green **Uranus** (magnitude 5.8) is transitioning from a post-midnight object to an evening object – eventually rising at 10 p.m. local time by month-end. On August 12, Earth's faster orbit will cause Uranus to cease its eastward motion with respect to the distant stars of southwestern Aries, and begin a westward retrograde loop that will last until mid-January, 2020. The slow-moving planet can be found by looking less than 5 degrees above (celestial north of) the faint, naked-eye star Xi Ceti. In the southern pre-dawn sky on August 21, the waning gibbous moon will be positioned 6.5 degrees to the lower right (southwest) of Uranus.

Blue-tinted **Neptune** (magnitude 7.8) will spend July moving retrograde (westward) among the stars of eastern Aquarius - shifting slowly toward that constellation's naked-eye star Phi (ϕ) Aquarii. As of July 1, Neptune will be positioned 1.25 degrees to the left (east) of that star. By month-end it will be less than a degree away from it. During August, Blue-tinted **Neptune** (magnitude 7.8) will be visible from late evening onward in the southeastern and southern sky - moving retrograde (westward) among the stars of eastern Aquarius. The planet will be shifting steadily toward that constellation's naked-eye star Phi (ϕ) Aquarii. On August 1, Neptune will be positioned 1 degree to the left (east) of that star. By month-end it will have moved to within 9 arc-minutes east of it.

On Friday, July 19, the dwarf planet **Ceres** will complete a retrograde loop that began in April and resume its regular eastward orbital motion through the background stars (red path). Today, you'll find the magnitude 8.0 object in the southern evening sky - in eastern Libra, sitting 0.6 degrees to the upper right (northwest) of the medium-bright star Lambda (λ) Librae, and about 2 degrees to the right of the claw stars of Scorpius.

On Sunday, July 14, the dim and distant dwarf planet **Pluto** will reach opposition, the day of the year when Earth moves between it and the sun. On this date, Pluto will be the closest to Earth (3.05 billion miles, 4.91 billion km, or 273 light-minutes) and reach its greatest visual magnitude (+14.2) for 2019. Pluto will rise in the east at sunset and reach its highest elevation, over the southern horizon, at 1:20 a.m. local time. While Pluto is far too dim to see in amateur-grade telescopes, your astronomy app can show you where it is compared to the brighter nearby stars. Even if you can't see it directly, you will know that Pluto is there.

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

Meteor Shower(s)

Ref. http://www.amsmeteors.org/meteor-showers/meteor-shower-calendar/, https://www.imo.net/files/meteor-shower/cal2018.pdf

Southern Delta Aquariids (July 21 to Aug 23)

The Southern Delta Aquariid meteor shower runs annually from July 21 to August 23. It peaks before dawn on Sunday, July 28, but is quite active for a week surrounding that date. This shower commonly generates 15-20 meteors per hour at the peak, but is best seen from the southern tropics, where the shower's radiant, in Aquarius, is positioned higher in the sky. The 4% illuminated waning crescent moon on the peak date should not adversely affect the shower very much.

Perseids (July 13 to Aug 26)

The Perseid meteor shower, which runs annually between July 13 and August 26, will peak before dawn on Tuesday, August 13. The best time for seeing Perseid meteors starts after midnight, when the shower's radiant is higher in the northeastern sky. Derived from debris dropped by Comet Swift-Tuttle, it is always the most reliable shower of the year, delivering up to 100 meteors per hour at the peak. This year, the waxing gibbous moon phase around the peak nights will greatly reduce the number of meteors we'll see.

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:	1149 (~177/month)
Minor Planets Discovered This Year:	4390 (~675/month)
Comets Discovered This Year:	40 (~6.2/month)
Observations This Year:	10.7 million

Satellites

Current GTA **International Space Station** (ISS) evening pass series ends on Aug 7 (mostly between 9:30 pm and 1 am). Only one **Iridium Flare** is predicted - on Aug 1 at 9:31:20 pm

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), http://www.lunar-occultations.com/bobgraze/index.html

Lunar Occultations

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Asteroidal Occultations

Rank 42 – Jul 28 at 07:24 UT asteroid (2519) Annagerman (mag 15.2) occults star TYC 6364-793-1 (mag10.1), dips 5.08 mags for 2.3 seconds, alt 25°, visible along zone from Hamilton to Peterborough and beyond. http://www.asteroidoccultation.com/2019_07/0728_2519_62816.htm

Variable Stars

See Observers Handbook monthly events

Constellations near the Meridian (Annually in early-August)

Green text indicates less than 1.5 air masses and best viewing

10 pm: Scorpius, Sagittarius, Scutum, Ophiuchus, Serpens, Hercules, Lyra, Draco, Ursa Minor

12 am: Corona Australis, Sagittarius, Scutum, Serpens Cauda, Aquila, Sagitta, Vulpecula, Cygnus, Lyra, Cepheus, Eastern Draco

2 am: Microscopium, Capricornus, Western Aquarius, Equuleus, Delphinus, Western Pegasus, Cygnus, Lacerta, Cepheus

Observing Targets (Annually in early-August)

Lyra Doubles: Epsilon (Double-Double) and all four corner stars of the parallelogram. HP92833 aka HR7140 in central Lyra is Albireo-ish!

Don't forget the RASC Finest NGC list! They're listed in the 2019 OH on pages 318-320 (many are as good, as easy to see as Messier objects). There are 22 RASC Finest NGC objects in the Summer season (FNGC # 90 through 110). Those highlighted with green are especially worth a look.

NGC#	Description	Mag	Con
NGC 6210	Very starlike blue planetary	9.3	Her
NGC 6369	Little Ghost PN; look for NGC 6309 nearby	10.4	Oph
NGC 6572	Tiny bright blue oval PN	9	Oph
NGC 6633	Sparse wide field open cluster; IC 4756 nearby	4.6	Oph
NGC 6712	Small globular cluster; look for IC 1295 in field	8.2	Sct
NGC 6781	Pale PN, but much larger than the Ring Nebula	11.8	Aql
NGC 6819	Foxhead Cluster; faint, rich open cluster in Milky Way	7.3	Cyg
NGC 6826	Blinking Planetary; 10.4-mag central star	9.8	Cyg
NGC 6888	Crescent Nebula; faint; use nebula filter	7.4	Cyg
NGC 6960	Veil Nebula: west half; use neb filter	7	Cyg
NGC 6992/5	Veil Nebula: east half; use neb filter	7	Cyg
NGC 7000	North America Nebula; use OIII or UHC filter & low mag.	4	Cyg
NGC 7027	Pink Pillow / Magic Carpet Nebula protoplanetary nebula	10.4	Cyg
NGC 6445	Small; bright and annular PN; near M23	11.8	Sgr
NGC 6520	Rich open cluster; small; dark neb. B86 in same field	8.1	Sgr
NGC 6818	Little Gem PN; annular; NGC 6822 0.75 deg S	9.9	Sgr
NGC 6802	Open cluster at east end of Brocchi's cluster Cr 399	8.8	Vul
NGC 6940	Mothra Cluster; 60*; fairly rich open cluster in Milky Way	6.3	Vul
NGC 6939	Ghost Bush / Flying Geese / Silk Fan Cluster; very rich;	7.8	Cep
NGC 6946	Fireworks Galaxy; diffuse face-on spiral near 6939	8.9	Cep
NGC 7129	Faint reflection nebula around several stars	-	Cep
NGC 0040	Bow-tie Nebula; unusual red planetary; central star	10.2	Cep

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

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