

RASC Toronto Centre – www.rascto.ca

The Sky This Month – Sept 12 to Oct 10, 2018 (times in EDT)

by Chris Vaughan

NEWS

Space Exploration – Public and Private

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

Launches

Sept 13 at 5:21 pm EDT – Japanese H-2B rocket from Tanegashima Space Center, Japan, payload unmanned cargo vehicle to deliver equipment and supplies to ISS.

Sept 15 at 8:46-11:20 am EDT - ULA Delta 2 rocket from Vandenberg Air Force Base, payload NASA's ICESat 2 investigating ice-sheet elevation change, sea-ice freeboard, and vegetation canopy height.

Sept 16 at TBD - India's Polar Satellite Launch Vehicle from Satish Dhawan Space Center, Sriharikota, India, payload NovaSAR-S radar imaging instrument and SSTL-S1 Earth observation satellites.

Sept 25 at TBD - Ariane 5 ECA rocket from Kourou, French Guiana, payload Horizons 3e and Azerspace 2/Intelsat 38 communications satellites.

Oct TBD - India's Geosynchronous Satellite Launch Vehicle Mk. 3 from Satish Dhawan Space Center, Sriharikota, India, payload GSAT 29 communications satellite.

Oct 6 at 4:00-5:30 am EDT - Air-launched Northrop Grumman Pegasus XL rocket from Cape Canaveral Air Force Station, payload NASA's Ionospheric Connection Explorer (ICON) satellite to study the ionosphere.

Oct 7 at TBD - SpaceX Falcon 9 rocket from Vandenberg Air Force Base, payload SAOCOM 1A Earth observation satellite for Argentina's space agency.

JUNO at Jupiter

Juno is presently executing a series of 53 day orbits. The 15th perijove close pass occurred on September 7.

News at <https://www.missionjuno.swri.edu/news/>

DAWN at Ceres

The DAWN spacecraft will exhaust its manoeuvring hydrazine supply any time now, and then remain in orbit around Ceres for decades (at least) to protect Ceres against Earth-contamination. <https://dawn.jpl.nasa.gov/>

Hayabusa-2 at Ryugu

The first touchdown by Hayabusa2 to collect samples from the asteroid surface is planned for the end of October. The first rehearsal for this operation will be held from September 10 – 12. The spacecraft will approach to within 40 metres! Excellent animations from JAXA data are available via @_RomanTkachenko <http://www.hayabusa2.jaxa.jp/en/>

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

September 17, 1764 – John Goodricke – English astronomer is born, pioneer of periodic variable stars, discovering Algol's eclipsing binary mechanism and researching Cepheid variables
September 21, 1874 - Gustav Holst – composer of *The Planets* (in 1916, before Pluto was discovered in 1930)
September 24, 1898 – American astronomer Charlotte Moore Sitterly, solar spectroscopy expert is born
September 27, 1918 – Sir Martin Ryle – pioneer of astronomical radio interferometry is born
September 28, 1953 – American astronomer Edwin Hubble dies at age 63
October 5, 1958 – American astrophysicist Neil deGrasse Tyson is born
October 8, 1873 – Danish astronomer Ejnar Hertzsprung Danish astronomer, period-luminosity, stellar classification, co-developed H-R diagram, is born
October 10, 1958 – American physicist and astronaut John Grunsfeld is born

Astronomy and Space Exploration

September 15, 1965 – *Lost in Space* premieres only weeks after *Star Trek*
September 18, 1977 – Voyager I images the Earth and Moon together
September 21, 2003 – Galileo spacecraft's end of mission impact into Jupiter
September 23, 1846 – Johann Galle discovers Neptune within 1 degree of Urbain Le Verrier's predicted position, observing it the same night he received the position and confirmed it over subsequent nights, never accepting credit for the discovery.
September 27, 1905 – Einstein's $E=mc^2$ paper is published
September 27, 1858 – William Usherwood takes 1st photo of a comet, Donati (7-sec exposure with f/2.4 portrait lens, since lost). Sept 28, G.B. Bond of Harvard took the 1st comet images through a telescope.
October 1, 1958 – NASA is created by the US Congress
October 4, 1957 – Sputnik 1 becomes the first manmade object to orbit the Earth.
October 5, 1923 – Edwin Hubble identifies the first extra-galactic Cepheid variable star, named V1, in M31
October 6, 1995 – The first exo-planet is detected around the star 51 Pegasi
October 7, 1959 – Luna 3 photographs the far side of the Moon for the first time

Star Parties, etc.

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

"RASC Dark Skies Observing", Long Sault Conservation Area – window runs Sept 10-13

"RASC Millennium Square Observing", Pickering – Sept 14-15

"RASC City Skies Observing", Bayview Village Park, Toronto – window runs Sept 17-20

"RASC Solar Observing", Ontario Science Centre Teluscape – 10 to noon on Sept 22 (or Oct 29)

"Lennox & Addington Stargazing", Lennox & Addington County, ON – Sept 14-15 (<https://lennox-addington.on.ca/explore/dark-sky-viewing-area/events>)

"Northern Lights Festival", Kluane National Park, Yukon – Sept 21-22 (<https://www.pc.gc.ca/en/pn-np/yt/kluane/activ/ciel-sky>)

"Frontenac Stargazing", North Frontenac Township, ON – Oct 6 (<http://www.northfrontenac.com/dark-sky-preserve.html>)

And many more throughout Canada and 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 fall campaign's focus is on **Pegasus** from Oct 1-10.

Sunrise/Sunset

September 12, sunrise at 6:53 am, sunset at 7:33 pm (12h40m of daylight)

October 10, sunrise at 7:25 am, sunset at 6:42 pm (11h17m of daylight)

Saturday, September 22 at 9:54 pm – Northern Autumnal Equinox

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>

Sept 12, astronomical twilight ends at 9:11 pm EDT and starts at 5:14 am EDT (8h03m of imaging time)

Oct 10, astronomical twilight ends at 8:17 pm EDT and starts at 5:50 am EDT (9h33m of imaging time)

Moon - Orbit

Apogee – Wed, Sept 19 at 9 pm EDT

Perigee – Fri, Oct 5 at 6 pm EDT

Moon - Phases

Sunday, Sept 16 at 7:16 pm - First Quarter Moon (sets around midnight)

Monday, September 24 at 10:53 pm - Full Harvest Moon (closest to the equinox)

Tuesday, October 2 at 5:45 am - Last Quarter Moon (rises around midnight)

Tuesday, October 8 at 11:47 pm - New Moon

Due to the shallow evening ecliptic, the Harvest Moon rises at nearly the same time over several nights (~27 minutes later).

Sept 22 – moonrise at 6:30 pm

Sept 23 – moonrise at 6:58 pm

Sept 24 – moonrise at 7:25 pm (Full Harvest Moon)

Sept 25 – moonrise at 7:52 pm

Sept 26 – moonrise at 8:19 pm

The Winter Solstice full moon rises ~62 minutes later each night!

Oct 20 - International Observe the Moon night https://www.lpi.usra.edu/observe_the_moon_night/

Libration

E limb most exposed on Sept 14 (+7.0°) and Oct 12 (+6.1°)

W limb most exposed Sept 27 (–5.0°)

N limb most exposed on Sept 28 (+6.6°)

S limb most exposed on Sept 13 (–6.7°)

Moon – Conjunctions, Eclipses, etc.

Lunar Appulses and Conjunctions

In the western early evening twilight on **Wednesday, September 12**, the young crescent moon will appear an outstretched fist's diameter above Venus. After dark on the evening of **Wednesday, September 19**, look for

the waxing gibbous moon sitting 4.5° above Mars. On the evening of **Thursday, September 13**, the young crescent moon will be situated 4° to the upper right of Jupiter. **That pairing, when combined with Venus below them, will make a lovely wide field photo opportunity.** The young crescent moon will return to a similar position on October 11. On the evening of **Monday, September 17**, look for the first quarter moon sitting 4 finger widths to the upper left of Saturn.

Planets and Dwarf Planets

After September 12, **Mercury** will gradually become hidden by the sun's glare – re-appearing well after its superior conjunction with the sun on September 21. After conjunction, the speedy planet will commence an appearance in the western evening sky that will be poor for mid-northern latitude observers, but very good for Southern Hemisphere observers. Viewed through a telescope during early October, Mercury's disk will exhibit a nearly fully illuminated phase.

Venus' long evening apparition of 2018 is in its closing stage during September. During the month, the planet will traverse the more southerly portion of its orbit, which lies below an already descending evening ecliptic. So Venus will be pulled steadily closer to the western evening horizon while it swings back toward the sun. On Friday, September 21, Venus will reach visual magnitude -4.78 , its maximum brightness for this year. On September 12 the planet will be setting about 68 minutes after the sun, shortly after 8:30 pm local time. Around the last week of September, Venus will become too close to the sun to see. As Venus moves closer to Earth during September, it will wane to a crescent phase while growing in apparent disk diameter. It will continue to brighten until it reaches a peak in visual magnitude of -4.7 on September 21. In the western early evening twilight on Wednesday, September 12, the young crescent moon will appear an outstretched fist's diameter above Venus.

Mars, well positioned for viewing all month, will spend the next four weeks moving eastward through the stars of western Capricornus. It will be relatively low in the southern evening sky and then set in the early hours after midnight. During the month, as Earth pulls away from the Red Planet, Mars will remain a bright reddish naked-eye object, but its visual brightness will diminish from magnitude -1.8 to -1.1 . Meanwhile, the planet's apparent disk diameter will decrease from 18.8 arc-seconds to 14.4 arc-seconds. After dark on the evening of Wednesday, September 19, look for the waxing gibbous moon sitting 4.5° above Mars. The pair of objects will fit into the same binocular field of view.

The available time for observing **Jupiter** will shorten considerably during the next month. The very bright planet (visual magnitude -1.8) will be positioned low in the southwestern evening sky all month, moving eastward through the stars of central Libra, and pulling away from the nearby bright double star Zubenelgenubi. Jupiter will set at around 10 pm local time on September 12 and at 8:17 pm, shortly after local twilight, on October 10. As Jupiter and the summer stars are carried west by Earth's orbital motion, Jupiter will move towards Venus; but that planet's westward passage towards the sun will prevent a close meeting of the pair of bright planets. On the evening of Thursday, September 13, the young crescent moon will be situated 4° to the upper right of Jupiter. That pairing, when combined with Venus below them, will make a lovely wide field photo opportunity. The young crescent moon will return to a similar position on October 11.

Saturn will be visible for the next four weeks as a medium-bright (visual magnitude 0.4 to 0.5), yellowish object in the lower part of the southern evening sky. Look for it just to the left of the Milky Way, moving slowly eastward among the stars that form Sagittarius' teapot-shaped asterism. The planet's rings, which subtend an angular size of about 40 arc-seconds, continue to be well open because the planet's northern pole is tilted roughly sunward. On the evening of Monday, September 17, look for the first quarter moon sitting 4 finger widths to the upper left of Saturn.

Blue-green **Uranus** (magnitude 5.7) will spend the next four weeks moving slowly retrograde westward among the stars of western Aries, sitting less than 4 degrees east of the naked-eye star Omicron (o) Piscium. Uranus will be observable all night after rising in the eastern sky after 9 pm local time. The planet will reach opposition on October 23.

On September 7, blue-tinted **Neptune** reached opposition, the date when it was closest and brightest (magnitude 7.8) for 2018. It will spend the next four weeks moving retrograde westward through the stars of eastern Aquarius - shifting slowly toward that constellation's naked-eye star, Hydor (Lambda (λ) Aquarii). Look for the planet approximately midway between Hydor and the slightly fainter star Phi (φ) Aquarii.

Zodiacal Light

During moonless periods in September and October annually, the steep morning ecliptic favors the appearance of the zodiacal light in the eastern sky for about half an hour before dawn. This is reflected sunlight from interplanetary particles concentrated in the plane of the solar system. During the two weeks starting just before the new moon on September 9, look east below the stars of Cancer for a broad wedge of faint light rising from the horizon and centered on the ecliptic. Don't confuse it with the Milky Way, which is sitting further to the southeast.

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 a periodically returning comet (6.6 years) first discovered on Dec 20, 1900 by Michael Giacobini and again on Oct 23, 1913 by Ernst Zinner. It rises near midnight local time now, and is highest in the sky before dawn. Currently a binoculars object with stubby tail at about magnitude 7, it passed perihelion and perigee on September 10, and will now slowly dim. Its orbit is inclined 32° to the solar system's plane. Over the next month it will travel southwards along the Milky Way - through Gemini/Orion and Monoceros, passing many deep sky objects.



Comet 46P/Wirtanen is a periodically returning comet (5.4 years) discovered on January 17, 1948 by Carl Wirtanen. It is currently in Cetus, and too dim to observe, but it is predicted to reach a peak brightness of magnitude 4 during December.



Meteor Shower(s)

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

Camelopardalids (October 5 to 6)

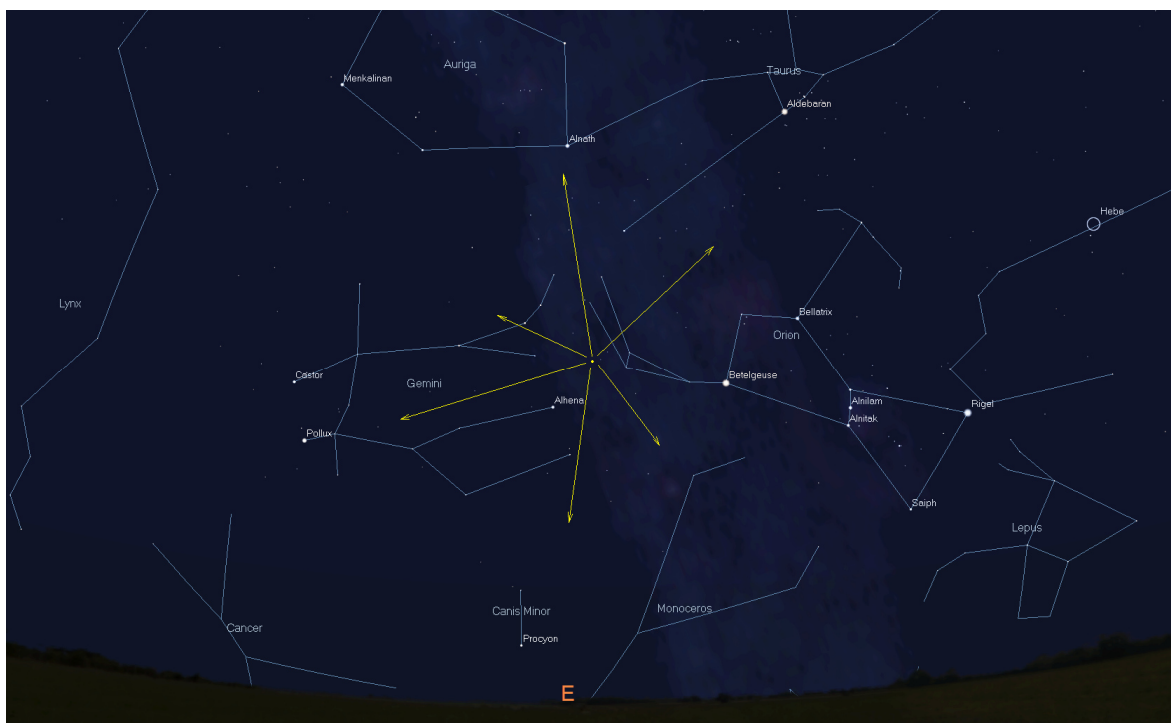
The brief Camelopardalids meteor shower runs only from October 5 to 6. It peaks around midnight on **Friday, October 5** under a dark moonless sky. At that time the sky overhead is moving directly into the densest region of the particle field, producing 5 meteors per hour. The meteors can appear anywhere in the sky, but will be travelling away from the radiant point between Draco's tail and Polaris (R.A. 12:12, Dec. +77° 36').

Draconids (October 6 to 10)

The annual Draconids Meteor Shower will peak overnight on the moonless night of Monday, October 8. This shower, generated by debris dropped by Comet 21P/Giacobini-Zinner, usually delivers relatively few meteors. But it has occasionally been much more prolific. The best time to watch for Draconids will be after dusk, when the radiant in Draco is high in the northern sky.

Orionids (October 2 to November 7)

The annual Orionids meteor shower, composed of debris from repeated passages of Comet Halley, runs from October 2 to November 7. It peaks between midnight and dawn on **Sunday, October 21** under a moonlit sky. At that time the sky overhead is moving directly into the densest region of the particle field, producing 10-20 fast meteors per hour. The meteors can appear anywhere in the sky, but will be travelling away from the radiant point between the constellations of Orion and Gemini (R.A. 6:19:30, Dec. +15° 58'45").



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:	1170 (~138/month)
Minor Planets Discovered This Year:	5,094 (~599/month)
Comets Discovered This Year:	33 (~3.9/month)
Observations This Year:	11.0 million

Satellites

A GTA International Space Station (ISS) morning pass series lasts until September 18 (Most are visible between 3:55 and 6 am). An evening pass series commences on September 20 (Most are visible between 7:30 and 9:30 pm). Some higher/brighter ones include*:

Date	Time	Direction	Alt.	Mag.
Sat, 22-Sep	8:34:58 pm to 8:38:45 pm	moves SW to ESE	46°	-3.5
Mon, 24-Sep	8:27:02 pm to 8:32:12 pm	moves WSW to NE	79°	-3.8
Tue, 25-Sep	7:34:58 pm to 7:41:28 pm	moves SW to ENE	58°	-3.7
Thu, 27-Sep	7:27:05 pm to 7:33:38 pm	moves WSW to NE	65°	-3.4
Sun, 7-Oct	8:25:12 pm to 8:28:37 pm	moves NW to NE	73°	-3.9
Mon, 8-Oct	7:32:56 pm to 7:38:31 pm	moves NW to E	45°	-3.3
Tue, 9-Oct	8:17:05 pm to 8:21:10 pm	moves WNW to SSE	51°	-3.2
Wed, 10-Oct	7:24:42 pm to 7:31:16 pm	moves WNW to ESE	87°	-3.9

*far future predicted times may shift slightly

Iridium Flares most frequent evening flares occur between 7:30 pm and 9 pm, with morning flares common from 5:45 to 6:30 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)

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

After dusk in the southeastern evening sky on Friday, September 21, the waxing gibbous moon will complete an occultation of the bright (magnitude 2.85) **triple star Deneb Algedi** (Delta Capricornus). The star will reappear from behind the moon's illuminated east limb at 8:10 pm EDT. (For a challenge, try to see the star disappear behind the moon's leading dark limb in twilight at 7:00 pm EDT.)

After midnight on the evening of Thursday, September 27, the waning gibbous moon will occult the naked-eye (magnitude 4.25) **multiple star Al Kaff al Jidhmah** (Mu Ceti). The illuminated west limb will cover the star at 12:33 am Friday and the star will emerge at 1:41 am EDT.

After midnight on the evening of Monday, October 1, the waning last quarter moon will occult two stars. The northern portion of the illuminated western limb will cover the modest (magnitude 6.2) **star 16 Geminorum** at 12:14 am Tuesday, while the moon is quite low in the eastern sky. The star will emerge near the top of the moon's eastern (right-hand) limb at 12:50 am EDT. At 12:27 am, the southerly western limb will occult the bright (magnitude 4.1) **multiple star Nucatai** (Nu Geminorum). That star will emerge from the moon's dark eastern limb at 1:17 am EDT.

In the southeastern pre-dawn sky of Thursday, October 4, the waning crescent moon will occult the bright naked eye **triple star Asellus Australis** (Delta Cancr). At 7:00 am EDT, in growing twilight, the moon's lit leading limb will cover the star. The star will emerge from the opposite dark limb, in daylight, at 8:17 am.

Asteroidal Occultations

Rank 100 - 16 Sep 2018 at 08:54 UT asteroid (80) Sappho (mag 11.8) occults star HIP 24403 (mag 7.2), dips 4.61 mags for 5.0 seconds, alt 69° in Taurus, visible across Owen Sound – Kawartha - Brockville corridor
http://www.asteroidoccultation.com/2018_09/0916_80_56486.htm

Variable Stars

The "Demon Star" Algol (Beta Persei) in Perseus is among the most accessible variable stars for beginners. Its naked-eye brightness dims noticeably for about 10 hours once every 2 days, 20 hours, and 49 minutes because a dim companion star orbiting nearly edge-on to Earth crosses in front of the much brighter main star. On Sunday, September 30 at 9:47 pm EDT, Algol will reach its minimum brightness of magnitude 3.4. At that time, it will sit partway up the northeastern horizon. By 2:47 am EDT, it will be approaching the zenith and will have brightened to its usual magnitude of 2.1.

Constellations near the Meridian (Annually in early-Autumn)

9 pm: Corona Australis, Sagittarius, Scutum, Aquila, Serpens Cauda, Sagitta, Vulpecula, Cygnus, Lyra, E. Draco, Cepheus

11 pm: Microscopium, Piscis Austrinus, Capricornus, W. Aquarius, Equuleus, W. Pegasus, Delphinus, Lacerta, E. Cygnus, Cepheus, E. Draco

1 am: Sculptor, Piscis Austrinus, E. Aquarius, W. Pisces, Pegasus, W. Andromeda, Lacerta, Cassiopeia, and Cepheus

Observing Targets (Annually in early-Autumn)

All Stars - The Teapot, Summer Triangle, The Coathanger, Square of Pegasus, etc.

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Early Fall Globbs – M13, M92 (Her), M22 (Sag), M2 (Aqr), M15 (Peg), etc.

(🔭 / 🔭)

Early Fall Blobs – Double Cluster (Per), M31 Andromeda Galaxy (And), M11 (Scu), M33 Galaxy (Tri), Heart, Soul (Cas), Veil, N American, Crescent (Cyg), etc.

(🔭 / 🔭)

Early Fall Knobs – Ring (Lyr), Dumbbell (Vul), Blinking Planetary (Cyg),

Blue Snowball (And), Cat's Eye (Dra), Owl (UMa), etc.

(🔭 / 🔭)

Double Plays – Albireo (Cyg), Eps Lyrae Double-double (Lyr), Marfik (Her/Oph), Almach (And), etc.

(🔭 / 🔭)

Hit Singles - Antares (Sco), Vega (Lyr), Altair (Aqu), Deneb (Cyg), Arcturus (Boo), Capella (Aur)

(🔭 / 🔭)

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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