# PROFESSOR COMET REPORT

*(APRIL/MAY 2017 – EARLY/MID SPRING)*

**Welcome to the Professor Comet Report!**
*This is a monthly, bimonthly, or seasonal report on the latest information for the tracking, studying, and observation of comets. All comet reports will include tables of definitions & terminologies, basic understanding about comets, how to observer comets to the latest ephemeris data and tracking charts, photometry graphs, etc.! All information within this report can freely be referenced from a table of contents. Enjoy the world of comet astronomy!*

45P/Honda – Mrkos - Pajdusakova

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# Professor Comet Report

## Early Spring 2017

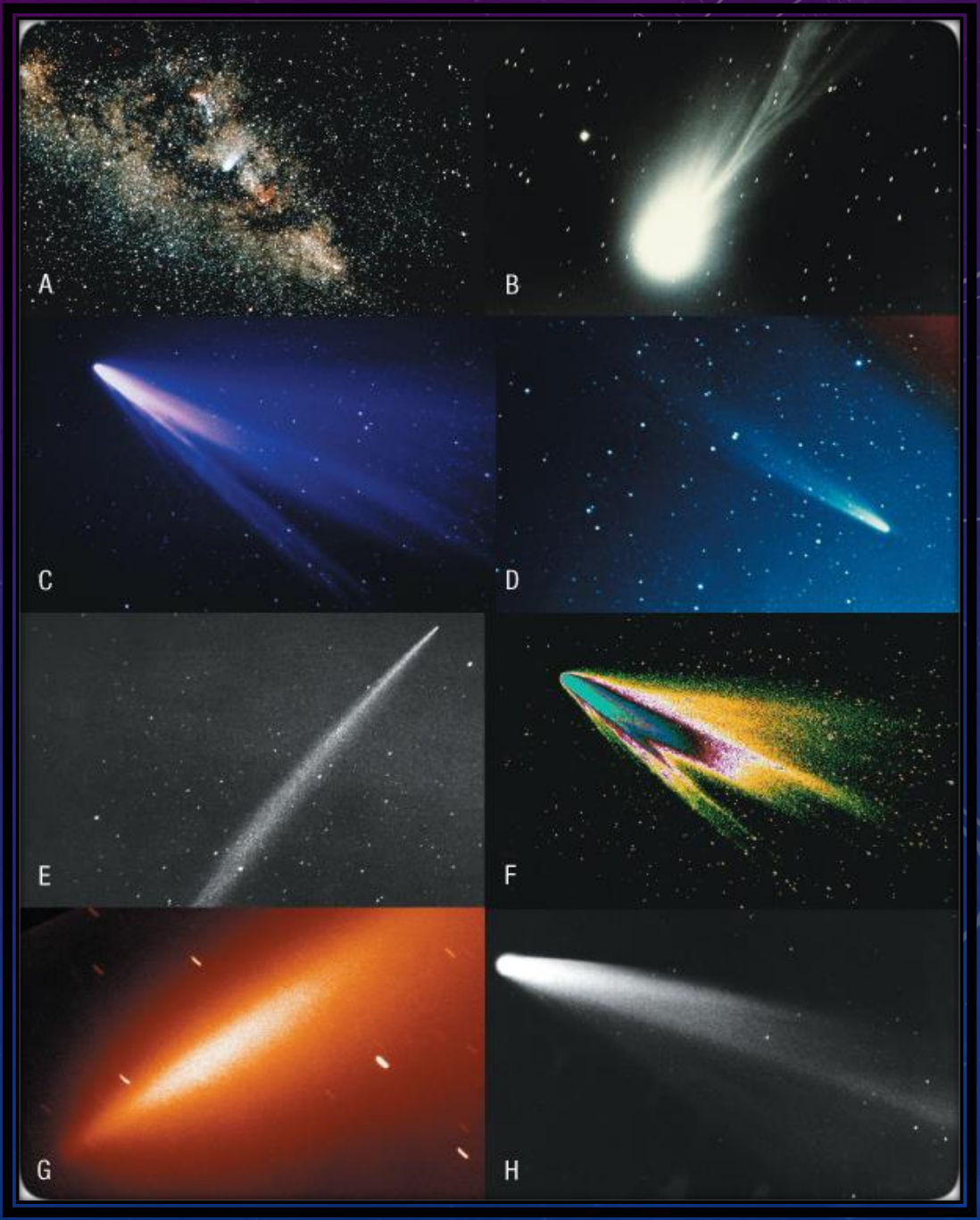
***Update on the current conditions for all currently observable or photographic comets!***

| Comets | Designation (IAU – MPC) | Orbital Status | Magnitude Visual | Trend (Brightness or Dimming) | Maximum Visual Magnitude (Predicted or Recorded) | Observations (Range in Lat.) (Alt. > 10° at Zenith) | Constellations (Night Sky Location) | Visibility (Late Winter/Early Spring 2017) Period | Visibility Conditions (Alt. ≥ 15°) |
|---|---|---|---|---|---|---|---|---|---|
| Tuttle – Giacobini – Kresak | 41P | P | *6.0 (7 April) | Expected to Outburst during it's Eastward passage through Draco! | 5 – 5.5 | 86° N - 15° S | *Circumpolar* Draco – (30 Mar to 20 Apr) Hercules (21 Apr to 1 May) | Early Evening to All Night (Late Jan – Early June) | *Observable around Draco during perihelion & perigee.* |
| Lovejoy | 2017 E4 | C | *6.3 (9 April) | A newly discovered comet (9 March). Rapid Brightness in the first month of discovery! | 6.0 | 67° N - 33° S | Hercules (1 – 12 April) Andromeda (13 – 27 April) Triangulum (28 April – 7 May) | Mid Morning before Daybreak (Early to Mid April) | Observable only in the hours around morning twilight before Sunrise! |
| PanSTARRS | 2015 ER61 | C | *6.5 (10 April) | Brightening through May with an expected Peak brightness in Early June. | 7.0 | 49° N - 85° S | Sagittarius (23 Feb to 26 Mar) Capricornus, Aquarius, Pisces (27 Mar thru 1 June) | Fixed Early Morning (1 March – Early Summer) | Observable by Early April and before midnight by mid September! |
| Johnson | 2015 V2 | C | *8.6 (13 April) | Predicted to achieve peak brightness by Mid June! | 6.5 – 7.0 | 73° N - 32° S | Hercules (10 Feb to 2 May) Boötes (3 May to 14 June) | Early Morning (1 Jan) to All night (1 Jun) | Unobservable to all north of 57°N after June 1 |
| Encke | 2P | P | *9.8 (5 April) | Fading quickly since it now past it's 2017 perihelion passage. | 6.0 | 50° N - 85° S | Aquarius (10 Mar to 9 July) *Undergoing retrograde until 12 June!* | Early Morning (Late April to Late June) | Not observable until Late April & observable to all by Late July! |
| Borisov | C/2017 E1 | C | 7.9 (7 April) | A newly discovered comet (1 March). Rapid Brightness prior to perihelion! | 9.0 | ***Lost in the Daytime Glare!*** | | Early Morning (Early June) | *Not observable until the night of 30 May.* |
| Hartley 2 | 103P | P | n/a | Lost in the Daytime Glare (Solar Elongation is less than 10°) | 10 | ***Lost in the Daytime Glare!*** | | Not observable until Late September | Unobservable (Visual Mag > 17.5) |
| Schwassmann – Wachmann 3 | 73P | P | 12.3 (5 April) | Ten known fragments in existence: (A, B, BT, C, E, G, H, J, N, & R) | 12 | 30° N - 63° S | Summer to Autumn Skies (1 Jan to 1 June) | Morning (1 Jan to 6 Mar) Before 5:45 am CST | Observable only at very, low horizons. |
| Schwassmann – Wachmann 1 | 29P | P | 13.2 (2 April) | Oscillating brightness between 11th – 14th visual Magnitude | 10 | 45° N - 85° S | Aquarius & Capricornus *Undergoing retrograde during the period (7 Apr – 7 Dec)* | Early Morning (After 3 am until 28 May) | Observable during Nautical twilight before morning daybreak! |
| LENEOS | 315P/2013 V6 | P | 14.2 (2 April) | Holding Steady in Brightness peak is predicted for mid Spring. | 12.3 (15 March) | 73° N - 48° S | Leo, Leo Minor, Coma Berenices, & Ursa Major (1 Jan to 1 June) | Mid Evening to Early Morning (1 Jan to 1 June) | Night time, but set earlier with each following day! |
| Honda – Mrkos - Pajdusakova | 45P | P | 14.8 (2 April) | Rapidly Fading from its peak brightness back on 11 Febraury. | 5.9 (10 February) | 73° N - 56° S | Mostly Leo (25 Feb to 25 June) | Before Midnight (After 20 Mar) | *Continues to be observable at Mag > 13.0 until Early May!* |

**Last known visual report on the brightest visual magnitude acquired based on either visual observations or analysis of the latest CCD images!*

# WHAT ARE COMETS?

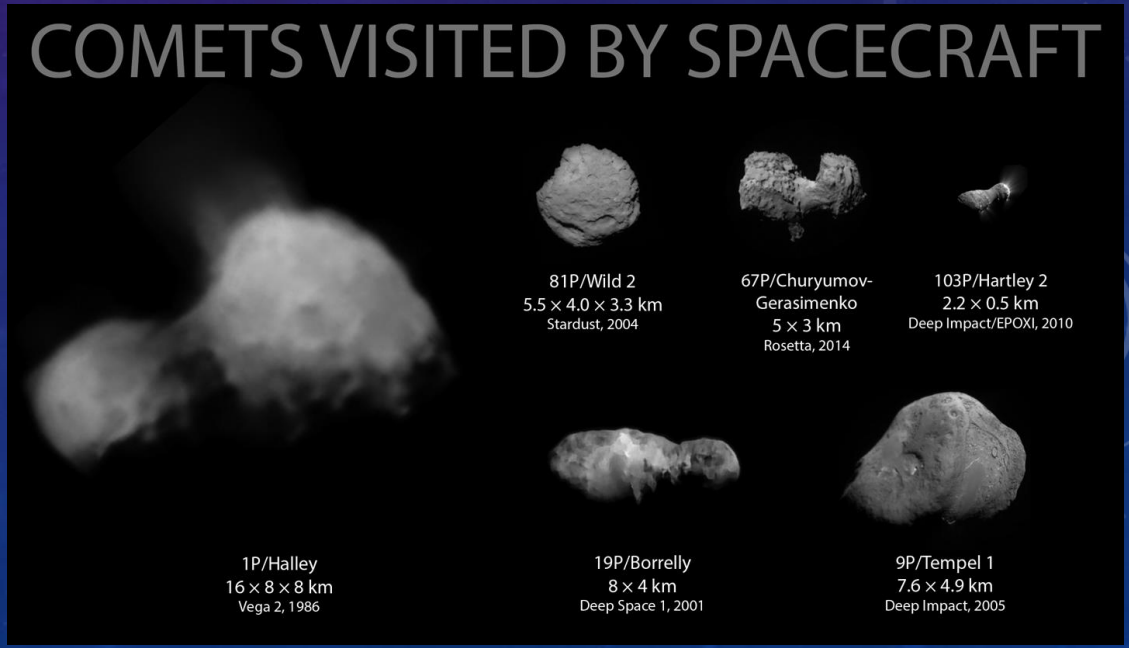
- Comets are known as minor planets like asteroids or other small space debris.
- Bodies composed of metals (rocks), dust, & volatiles (examples: $CO_2$, $H_2O$, $CN^-$, C2, C3, CS, COS, $HO^-$, etc.)
- Frozen bodies of Dirty Ice (Asteroids coated in and Saturated with Icy Volatiles)!
- Clathrytes are minerals & denser ices containing less dense volatiles imbedded within the crystal structure of the materials.
- Comets are composed of three primary elements: (central nucleus, coma, and tail(s))
- The central nucleus can range anywhere in size from a few meters across and up to tens of kilometers across.




*A) Comet Halley in Milky Way, February 1986 , B) Comet Halley, February 1986, C) Comet West, March 1976, D) Comet Kohoutek, June 1973, E) Comet Ikeya-Seki, November 1965, F) Comet West, computer enhanced, G) Comet LINEAR, July 2000, H) Comet Hale-Bopp, March 1997*

# WHAT ARE COMETS?

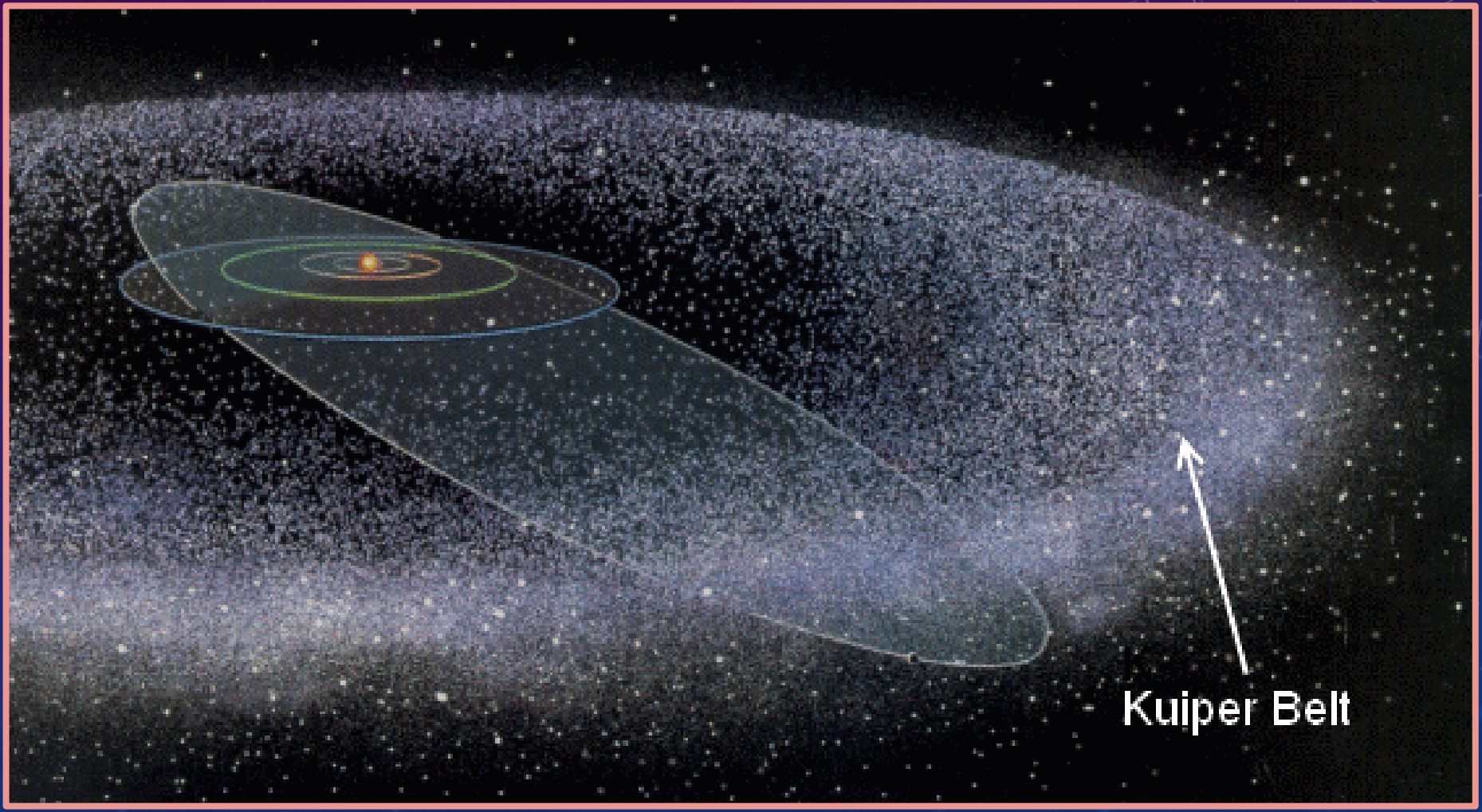
- They have no moons or rings.
- The coma can reach from a few thousands and up to over 2 million km across (example: 17P/Holmes)
- The tails can extend past 900 000 km in length can could theoretically extend up to 1 AU!
- The material from the dust tail is the primary, but not the only source of micrometeroids for meteor showers.
- There origin lie beyond the planets of the solar system to the Kuiper Belt & Oort Cloud.
- Short period comets (less than 200 years) from the Kuiper Belt & longer period comets (greater than 200 years) come from the Oort Cloud. Jupiter Comets (~3 to 20 years).
- Rotational period of cometary nuclei can vary substantially from a few seconds to several days!



# WHERE DO THEY COME FROM?

### *Kuiper Belt*

***Source of all short period comets that extends from the orbit of Neptune (30 AU) and out to about 50 AU from the Sun. It is just like the Asteroid Belt in structure, but 20x wider and upwards up 20x – 200x the mass. Many of the more massive bodies that came from the Oort cloud end up residing inside the Kuiper belt. These are huge icy bodies composed of the same or similar substances as the comets. About 100 000 KBOs up to 100 km across are hypothesized to exist with this region of the solar system.***

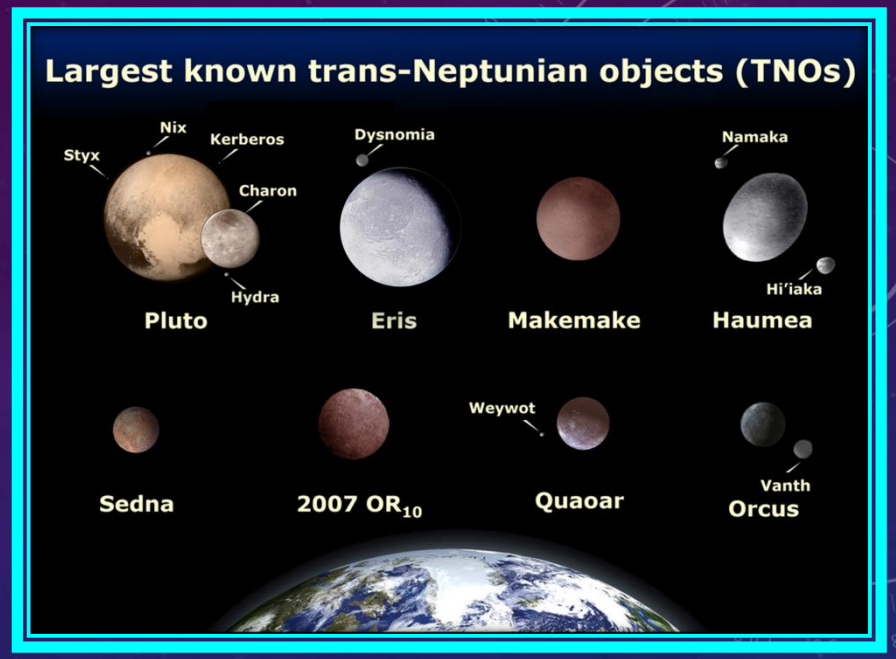


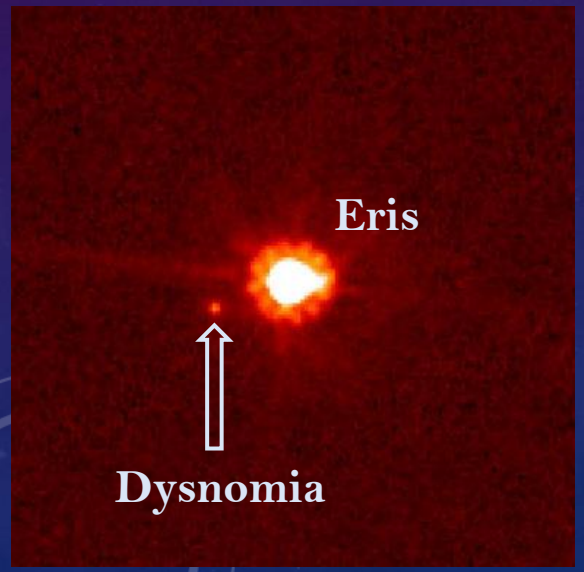
# WHERE DO THEY COME FROM?

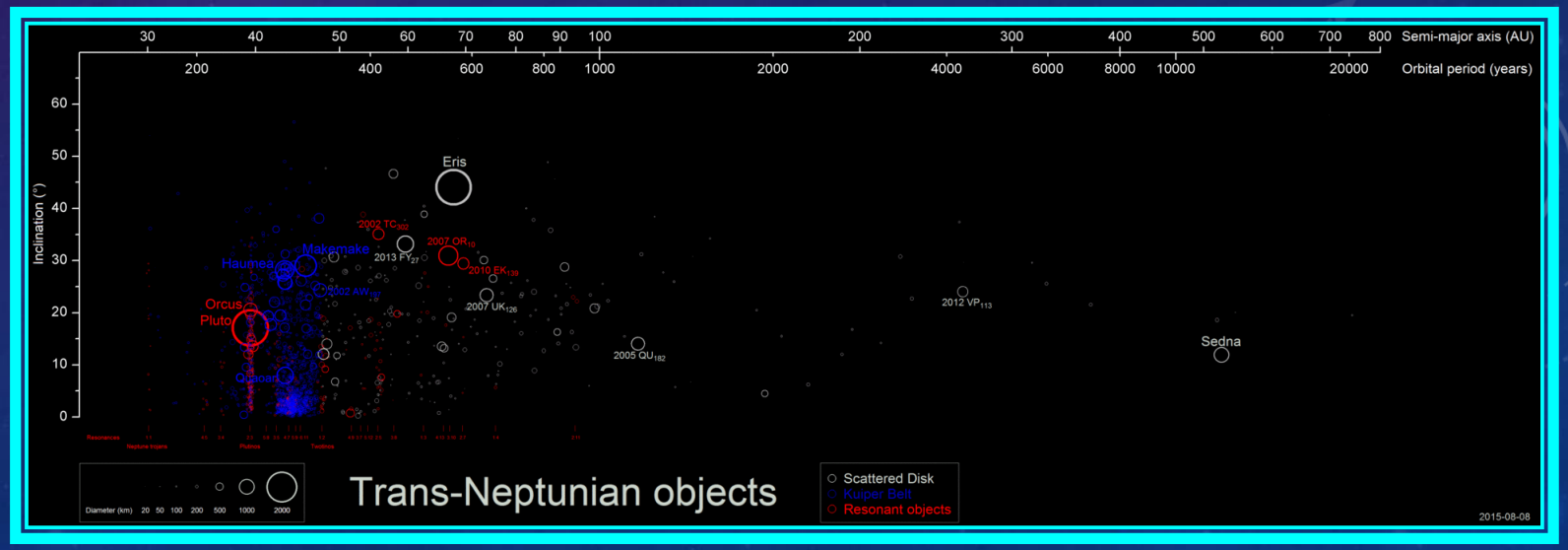
## *Scattered Disk Region*

***This is an intermediate region between the outer edge of the Kuiper Belt and the inner edge of the Oort Cloud. This region of the solar system lies beyond the Heliopause and contains very few icy bodies of which many are nearly on the same or similar scale of Pluto & Triton (Neptune's moon) in terms of size, mass, composition, & density! The orbital distances can overlap with the innermost regions of the Kuiper belt, but some of these known objects discovered to due can venture out to distances up to 500 AU and quite possibly further! Large orbital eccentricities and high orbital inclinations; up to 0.8 & 40$^{o}$ respectfully.***

***Over 200 have been identified officially as of 2011!***



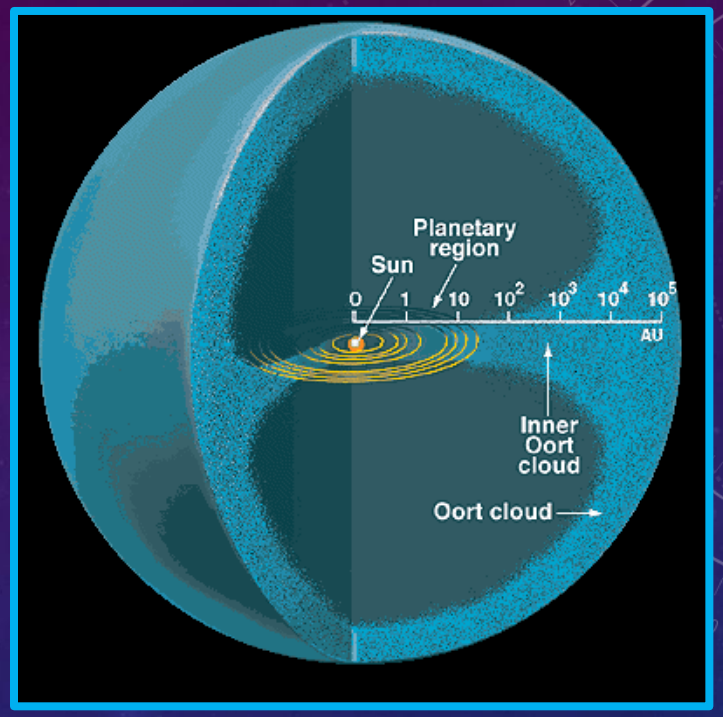



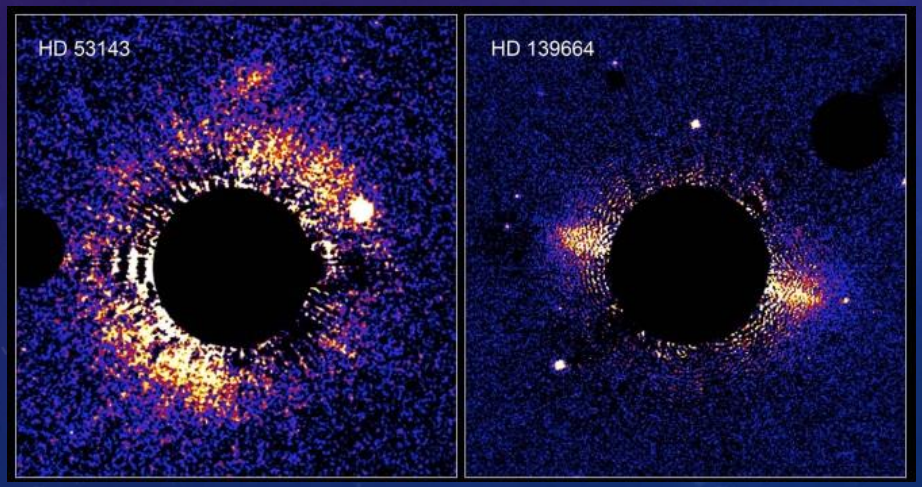



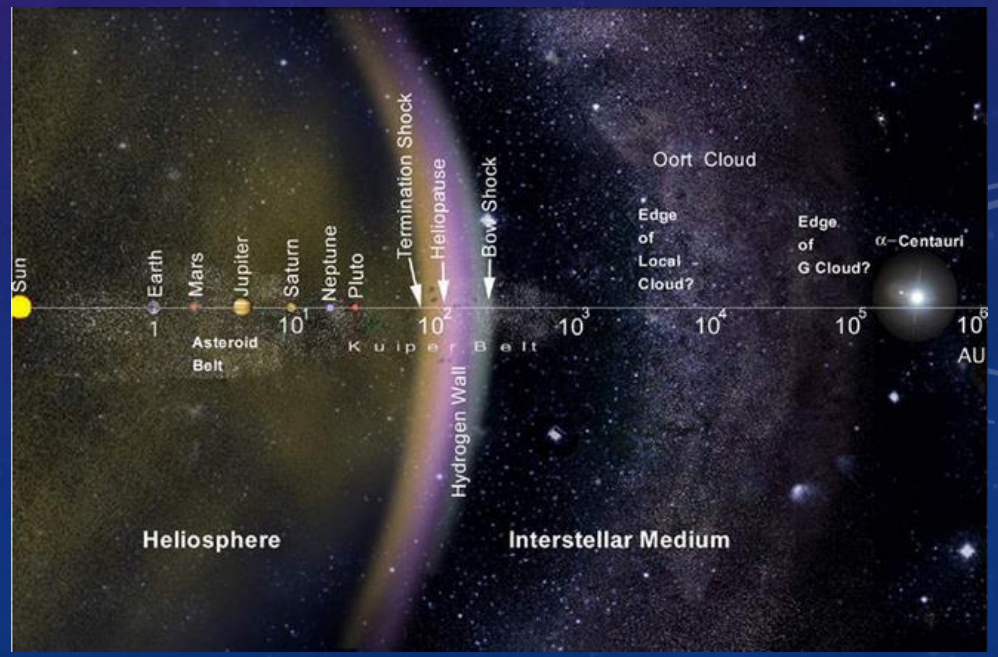
# WHERE DO THEY COME FROM?

## *Oort or Öpik – Oort Cloud*

***Oort cloud is the source of all intermediate and long period comets that extend from 2 000 AU and up to about 3.16 light years from the Sun. The Inner Oort cloud would contain the intermediate period comets while the long period comets & great comets would originate from the outer Oort cloud. Estimations on the number of cometary bodies vary substantially from several hundred billion to upwards of 2 trillion icy minor planets! All of the largest icy bodies in the solar system would have originated from this region of the solar system (example: Plutinos, Trans – Neptunian Objects, Scattered Disk Objects, comet nuclei up to 60 km across in size. Tidal gravitation forces from neighboring stars and density variations within region to region within the milky way galaxy plane would force these objects to orbits closer to the Sun!***



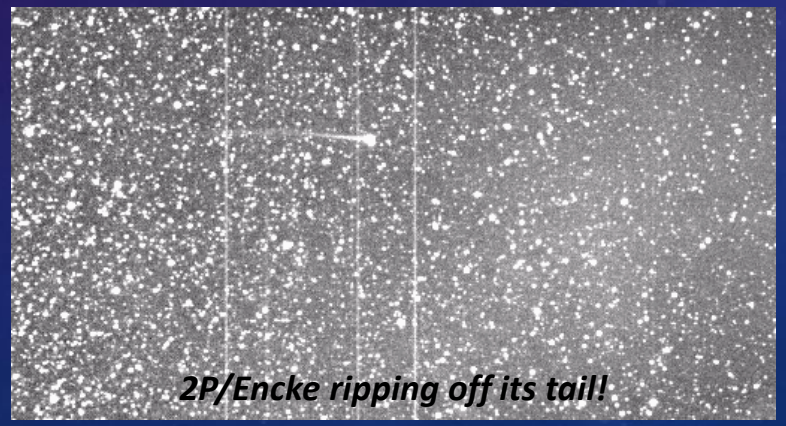
# WHERE DO THEY COME FROM?

## *Jovian (Jupiter) Family of Comets*

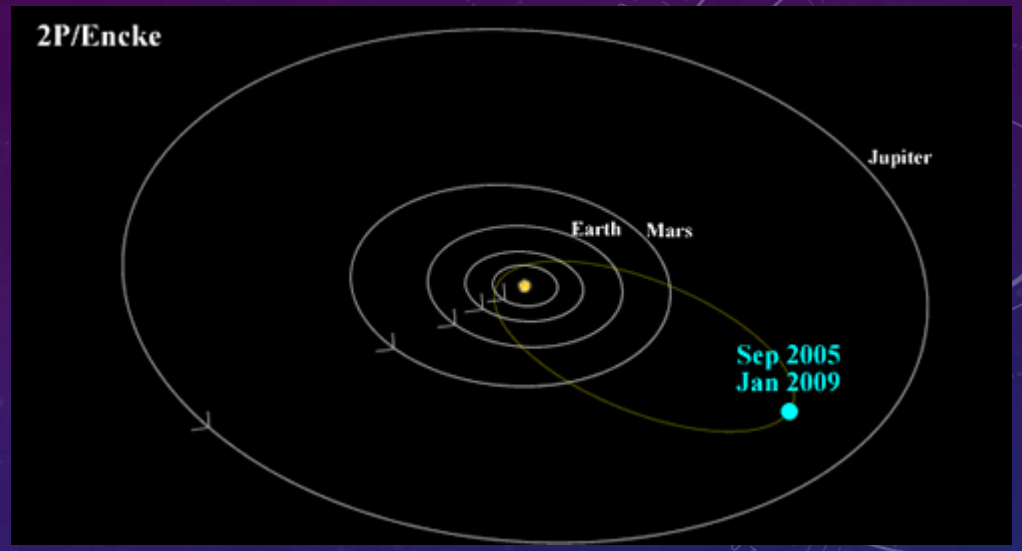
***These are nearby comets that reside between the boundary of the inner and outer planetary solar system with orbital periods between 3 – 20 years. There current orbits are influenced by the strong gravitational field of Jupiter which can adjust all or most of the orbital parameters of these bodies are their farthest positions of influence from the Sun's gravity. It is likely that all of these objects where broken off from the larger icy – rock bodies of the Kuiper Belt during large orbital or non – orbital paths about the Sun in highly eccentric orbits due to the gravitational influence of Neptune upon close approach to that planet!***

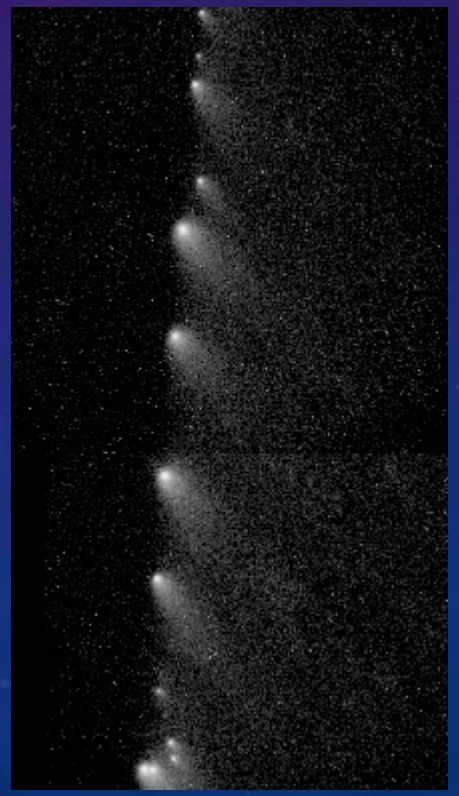
***Unlike the longer – periodic comets these bodies these comets have shallower orbital inclinations ≤18$^{o}$ and orbit in the same direction as the planets!***

***400 of these bodies are known to Science!***

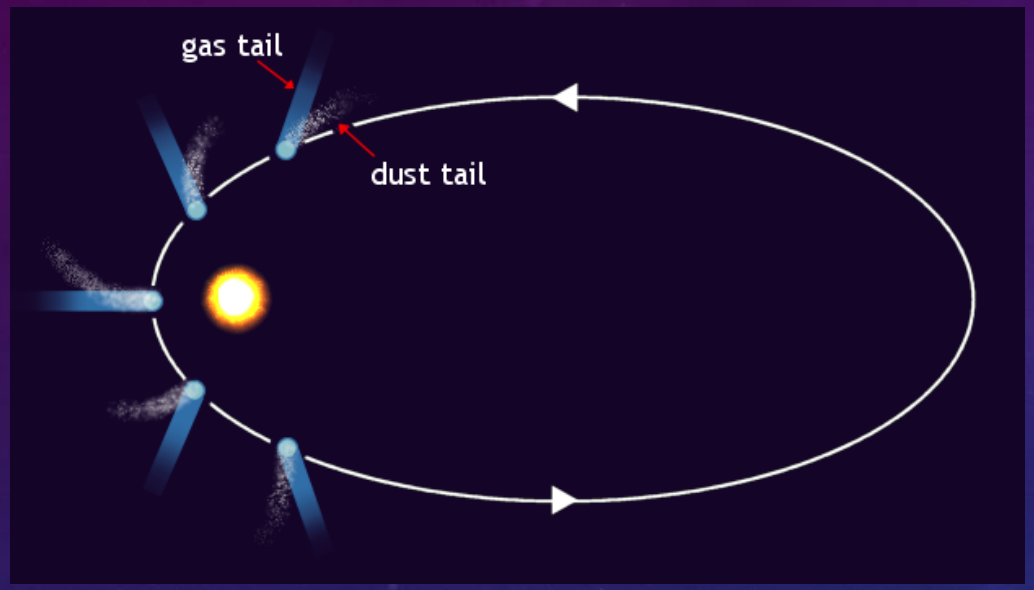


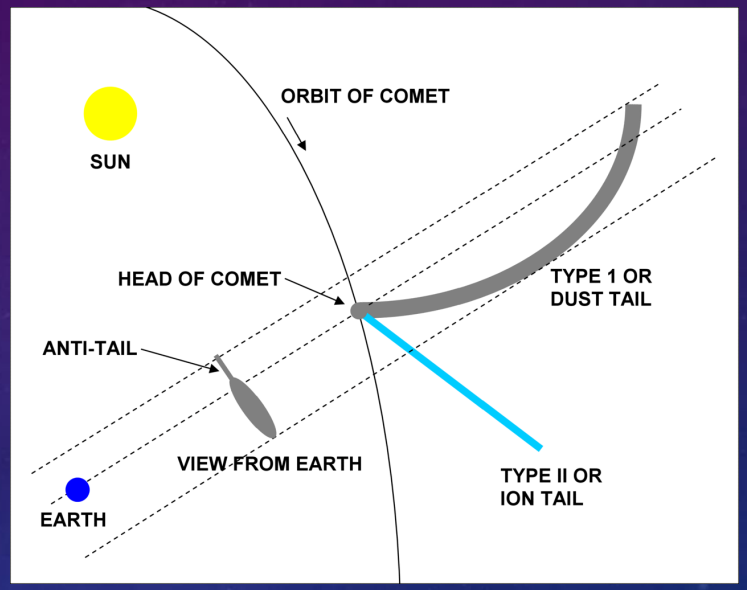
***2P/Encke ripping off its tail!***

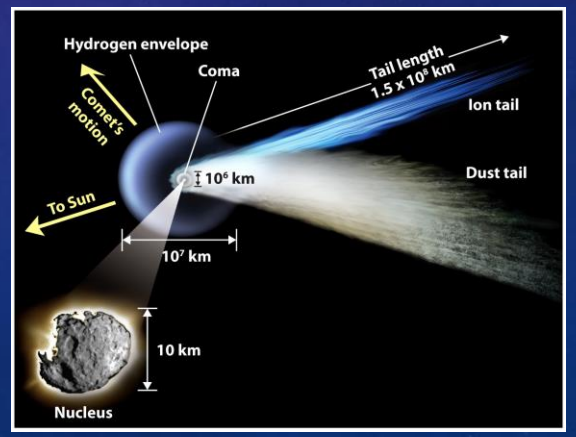


# UNDERSTANDING THE STRUCTURE OF COMETS!





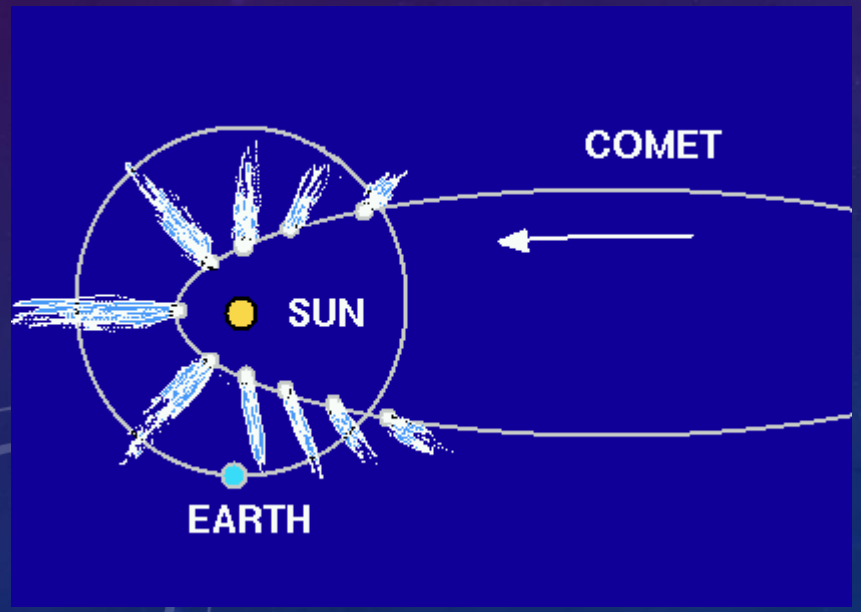

The Four Parts of a Comet!

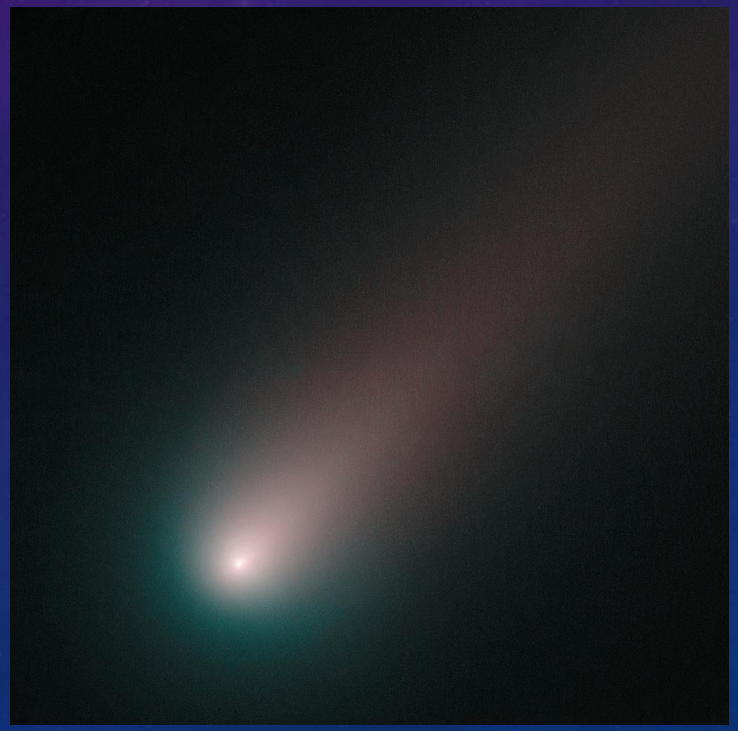
**Nucleus**
**Coma**
**Hydrogen Envelope**
**Tails (Dust, Ion, Sodium, etc.)**

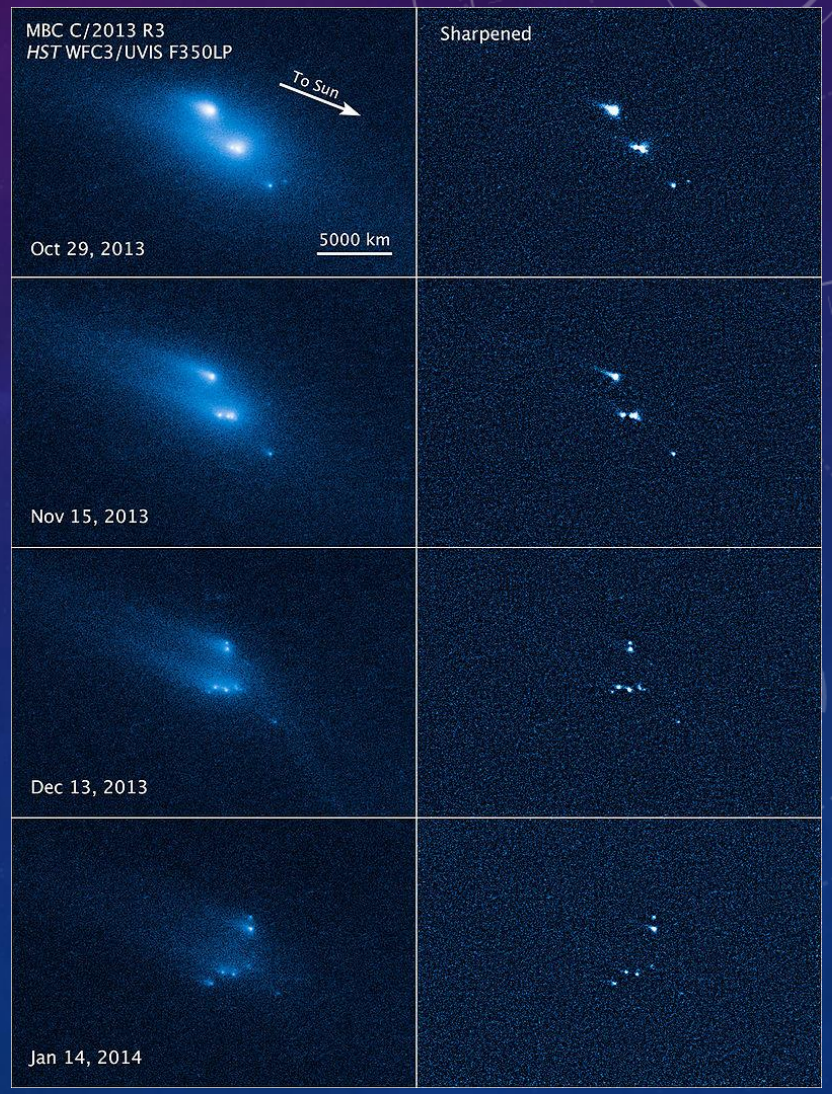
# UNDERSTANDING THE STRUCTURE OF COMETS!

## *Morphology is the Key!*

***As a comet approaches or recedes from the Sun within the planetary domain of the solar system the solar pressure and energy from the Solar Wind & its radiation pressure react with the comet nucleus. This in turn will form a variety of structures to the comet that give it its' distinctive structure thru the <u>processes of sublimation, evaporation, ionization, pressure outflow, etc.</u>***



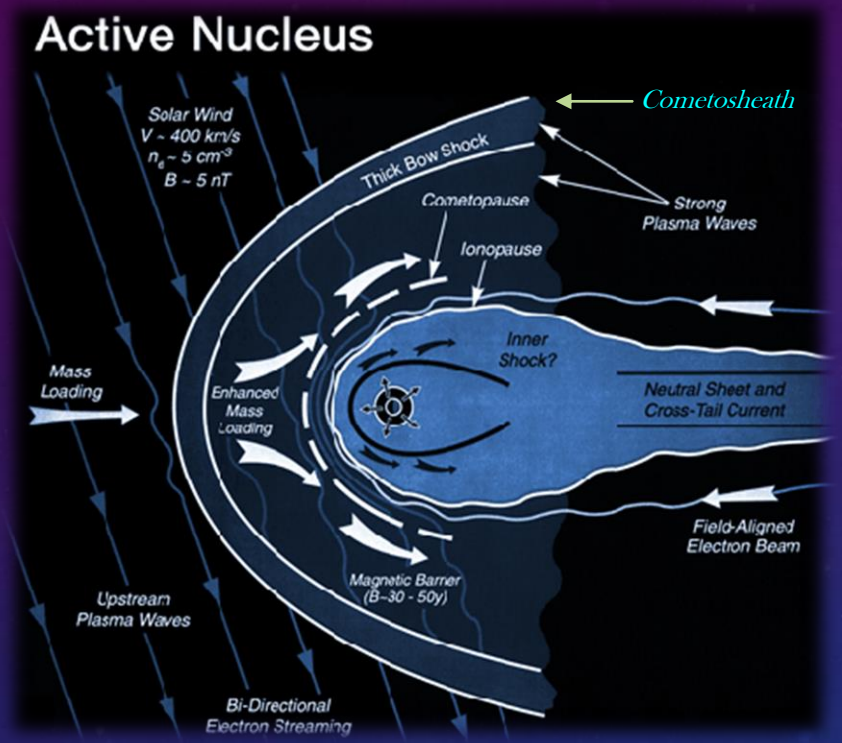


# UNDERSTANDING THE STRUCTURE OF COMETS!

## *Morphology is the Key!*

| *Structural Component* | *Definition of Component* |
|---|---|
| Nucleus | ***Comets are essentially 'dirty snowballs' or asteroids covered in and containing internal cavities (reservoirs) of frozen volatiles (ex.: H20, frozen Oxygen, Carbon compounds, etc.) and originate from outside the solar system from the Kuiper Belt (short to medium period comets) to the Oort Cloud (up to extremely long period comets). The details in composition and overall structure internal and external vary considerably and they range in size from 100m to 40 km across!***<br>***As of June 2013 there are about 4300 known so far, but they may number in the trillions!*** |
| False Nucleus | ***The central brightening of the coma showing the position of the nucleus, but only the extremely 'high pressured' jets are visible containing the escaping volatiles from such internal cavities breaking thru to the surface of the nucleus (the actual nucleus is not visible in most telescopes).*** |
| Coma | ***The trace atmosphere of dust particles, icy crystals, evaporated or sublimated molecules, ions, etc.) that surround the nucleus before being pushed away by the radiation pressure and solar wind producing the comet's tails. The re are two sub components (inner and outer comas) differing only by concentration of materials emanating from the nucleus.***<br>***The most common compounds C2 & C3 (carbon compounds) along with (CN-) cyanogen compounds make the nucleus appear greenish or some combination of blue and green to the human eye.*** |
| Ion Tail<br>(Type I) | ***The volatiles that can come from the nucleus are ionized by solar Ultraviolet radiation (UV photons) and the magnetic field of the Sun will drive the particles in a tail away from the Sun (Anti – Solar) direction at speeds up to 500 km/s.***<br>***The most common ions (CO+) carbon monoxide appears blue to the human eye.*** |
| Dust Tail (Type II) | ***Nanoscopic to tiny mesoscopic (up to millimeter sized) dust particles that pushed away from the Coma via pressure from the Solar radiation within the solar wind and can very diffuse structurally and only reradiate back long wavelength or low energy light (appearing white, yellowish, or soft – pink). The particles will spread in individual orbits around the Sun kept away from the Sun's gravity due to its' radiation pressure giving the tail its' curved shape.***<br>***Dust Tails can extend up to 100 million km (62.1 million mi) from the Nucleus and Coma!*** |
| Sodium Trail<br>(Type III) | ***Visible only in very, large telescopes there tails are composed of neutral atoms of Sodium striking out from the coma and not the nucleus possibly from either collisions between dust particles, UV solar erosion of the dust particles, or some unknown mechanism all occurring within the coma. Sodium tails can reach up to 50 million km away from the Sun along a similar path to the ion tail!*** |
| Dust trail<br>(Anti – Tail) | ***Larger dust particles that have enough mass to be more attracted to the Sun's gravity and are less likely to be influenced by the Sun's radiation pressure and are geometrically opposite to the Types I & II tails.***<br>***They will form a dust disk along the orbital path of the comet that only visible from Earth as a spike heading towards the Sun, but only visible when the comet crosses the orbital plane of the Earth!*** |
| Cometary Bow Shock | ***Once the solar wind interacts with a comet plunging thru the solar wind a bow shock forms around the outer coma much the same way the magnetic field of a planet forms a bow shock. The solar wind forms a Hydrogen envelope just outside the frontal boundary of the outer coma creating a plasma layer of hydrogen ions that release Lyman – alpha radiation as a byproduct!*** |

# UNDERSTANDING THE STRUCTURE OF COMETS!



***It is okay if you don't entirely understand what is going on here:***

*The only important fact are the particles within the solar wind and the comet plunging thru it will force a massive buildup of particles between the bow shock and the **cometopause** (the boundary of the comet's induced magnetic field) forming the outer boundary of influence for the outer coma! This think bow shock that contains the Hydrogen plasma is also known as the **cometosheath** and works similar to that of planet's **magnetosheath** where the influence of the magnetic field is weaken and the behavior of the Sun's magnetic field propagating (moving) thru the solar wind begins to dominate going from the comet or planet outwards towards the solar wind! Figure 2.2 compared to Figure 2.1 shows similarities in the Earth's magnetic field to the behavior of the Coma and induced magnetic field of the Comet as a result of interaction with the charged particles and radiation of the solar wind!*

# UNDERSTANDING THE STRUCTURE OF COMETS!

## *Basic Facts about a Comet's Nucleus:*

*I) All Comet's Are Dirty Snowballs or Icy Dirtballs*

*II) A composition of Rock, Dust, and Icy Volatiles*

*III) Complex and exotic organics known only on Earth have been confirmed to exist on one comet!*

*IV) The Volatiles are effected by the Solar Radiation and sublimate*

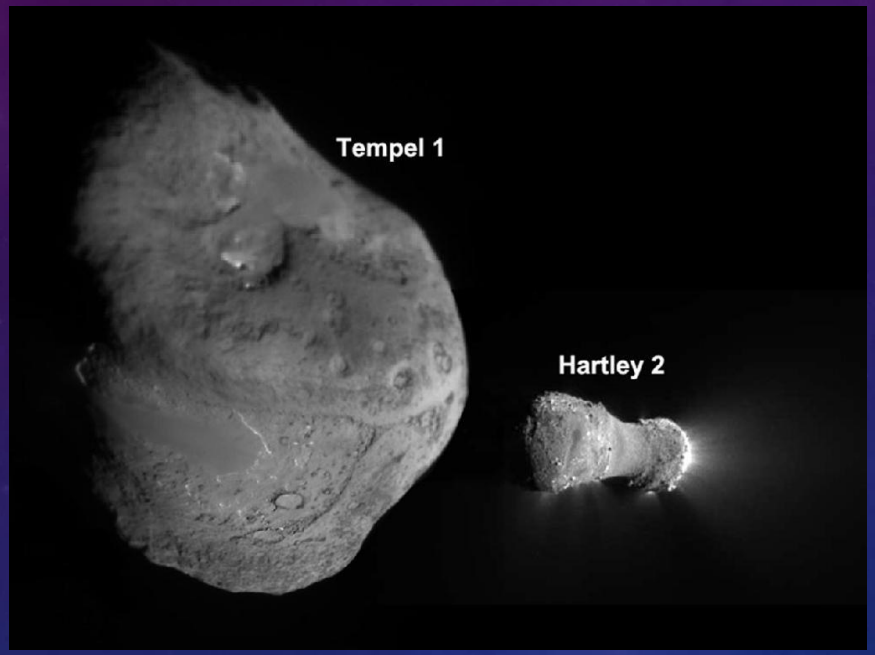
*V) The sublimated Gas form an atmosphere around the Nucleus (Coma)*

*VI) Average Albedo is 0.04 for the Nucleus (blacker than Coal)!*

*VII) Estimated Average Density: 0.6 g/cm$^3$ (60% of that of $H_2O$)*

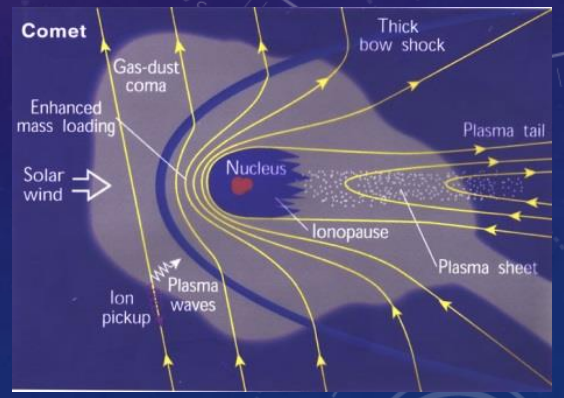
*VIII) Most Nucleus range between 1 – 10 km in size*

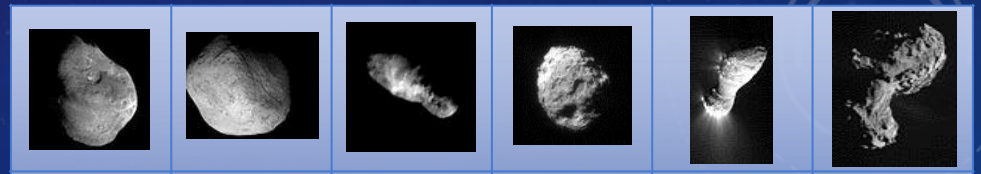
*IX) Extreme Range: (SOHO) P/2007 R5 - 100 to 200 meters & (Hale Bopp) C/1995 O1 – 60 km!*




Courtesy: NASA/JPL – Calteach/UMD, http://www.nasa.gov/mission_pages/epoxi/images/pia13629.html, 18 November 2010.

Courtesy: ESA/Rosetta
NAVCAM Top 10 at 10 km No. 7
30 September 2014 Q



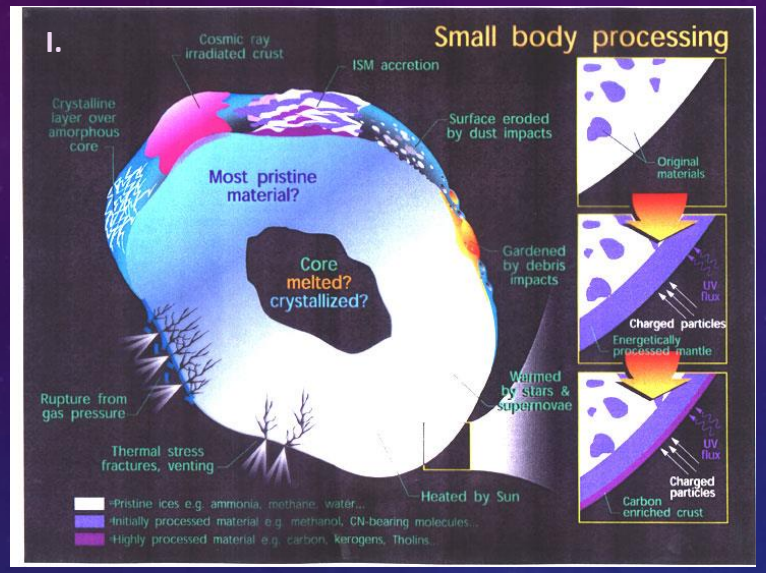
| Tempel 1 Deep Impact | Tempel 1 Stardust | Borrelly Deep Space 1 | Wild 2 Stardust | Hartley 2 Deep Impact | C-G Rosetta |
|---|---|---|---|---|---|

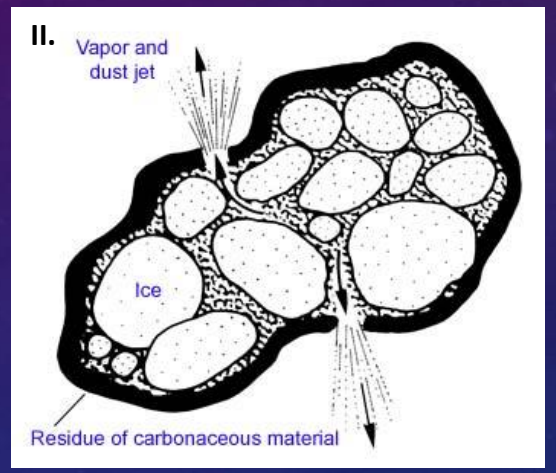
# UNDERSTANDING THE STRUCTURE OF COMETS!

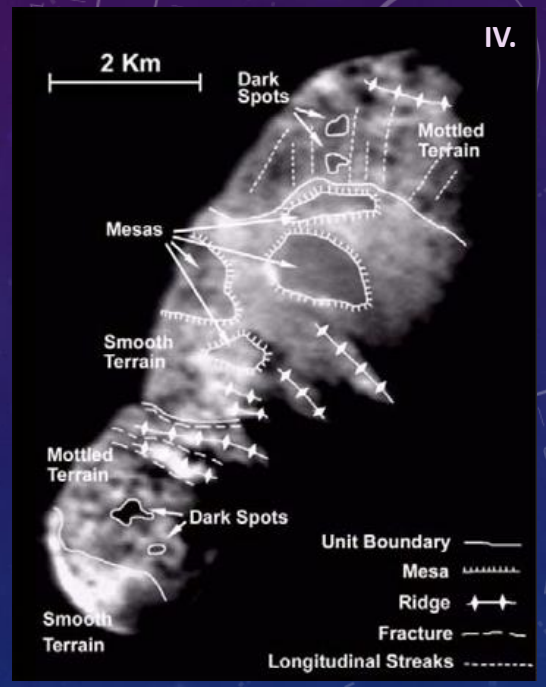
***The structure of an comet's nucleus has varying degrees of fragility depending on the distribution, size, and composition of the icy volatiles distributed on the surface and the interior reservoirs within the nucleus.***

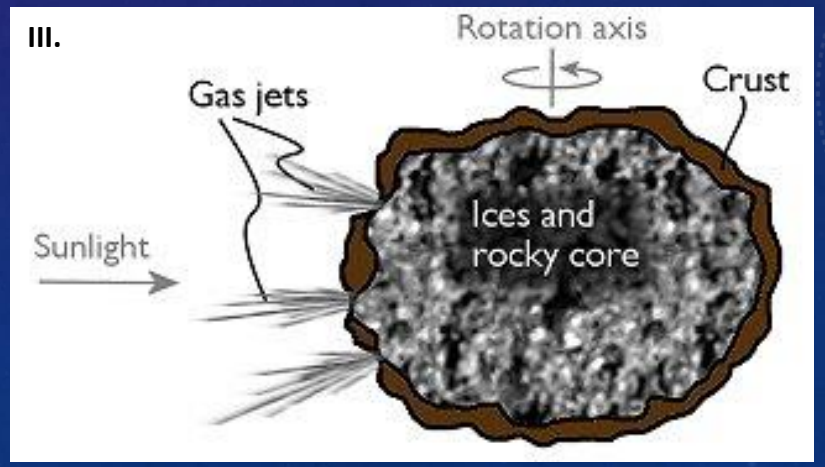
*Comet's that do survive many journeys around the Sun until there supply of volatiles is thoroughly exhausted can be reclassified as either C or S – group (stony) asteroids. A small concentration of heavier metals do exist in some nuclei based on spectral analysis. All cometary nuclei that have been studied by ground observations, orbiting observatories, and planetary spacecraft show pristine surfaces of simple chemistry with a lack of cratering.*

*The solar radiation propagates through the nucleus exerting pressure on the interior reservoirs and the volatiles sublimate into gasses that exert pressure out to the nucleus surface as gas jets along with some of the dust coating the surface. This immediately forms a localized condensate that becomes the source material for the coma and tails!*




I. Laboratory of Atmospheric and Space Physics, University of Colorado, Boulder, 2015.
II. National Maritime Museum & Royal Observatory Greenwich, 2015.
III. University of Maryland, Dept. of Geology, Planetary Geology, Fall 2014.
IV. University of Maryland, Dept. of Geology, Planetary Geology, Fall 2014.

# THE TECHNIQUES OF OBSERVING COMETS!

## *Degree of Condensation (DC)*

| DC value | Definition to numerical DC designation |
|---|---|
| 0 | ***Diffuse coma of uniform brightness*** |
| 1 | ***Diffuse coma with slight brightening towards center*** |
| 2 | ***Diffuse coma with definite brightening towards center*** |
| 3 | ***Centre of coma much brighter than edges, though still diffuse*** |
| 4 | ***Diffuse condensation at centre of coma*** |
| 5 | ***Condensation appears as a diffuse spot at centre of coma – described as moderately condensed*** |
| 6 | ***Condensation appears as a bright diffuse spot at centre of coma*** |
| 7 | ***Condensation appears like a star that cannot be focused – described as strongly condensed*** |
| 8 | ***Coma virtually invisible*** |
| 9 | ***Stellar or disk like in appearance*** |

***All observations of comets are broken down into three factors:***

1) *Estimating magnitudes for light curves to predict future brightness, coma observations, and observations that concern with a comet's tail(s).*

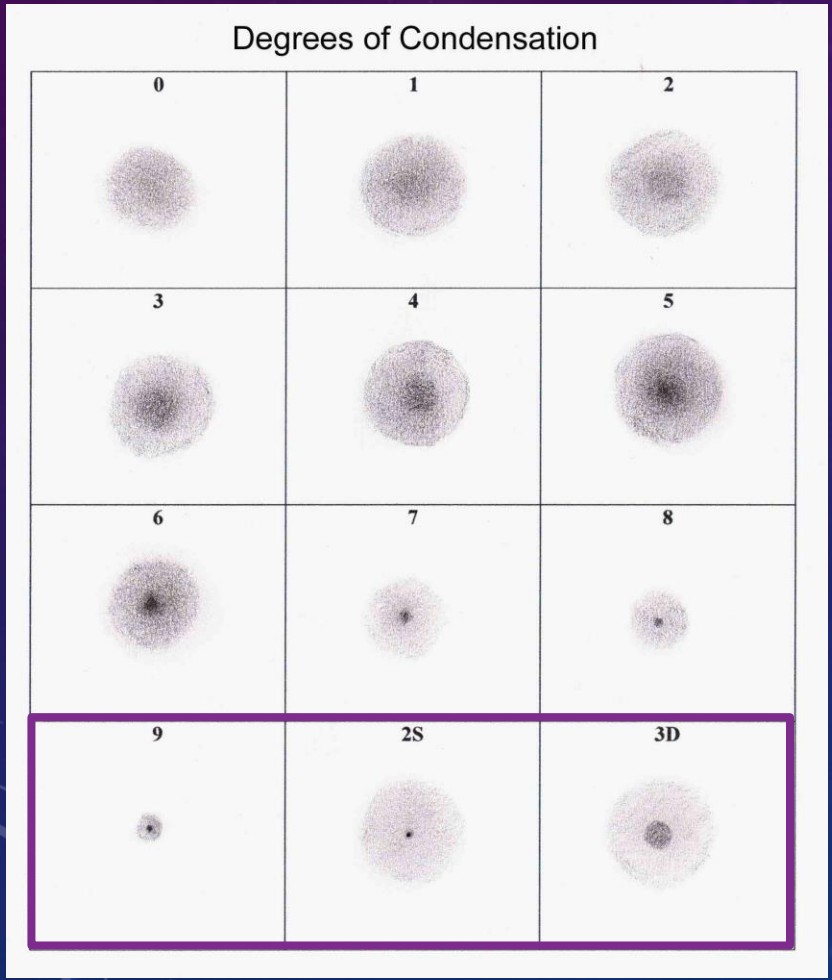
2) *For the coma or a comet's head there two characteristic features that are important for study:*

   - *Degree of condensation (DC)*
   - *Coma size measured in arcminutes.*

3) *The classification system for determining the DC is based on a positive integer system from 0 to 9 as shown below.*

# THE TECHNIQUES OF OBSERVING COMETS!

*Degree of Condensation (DC)*

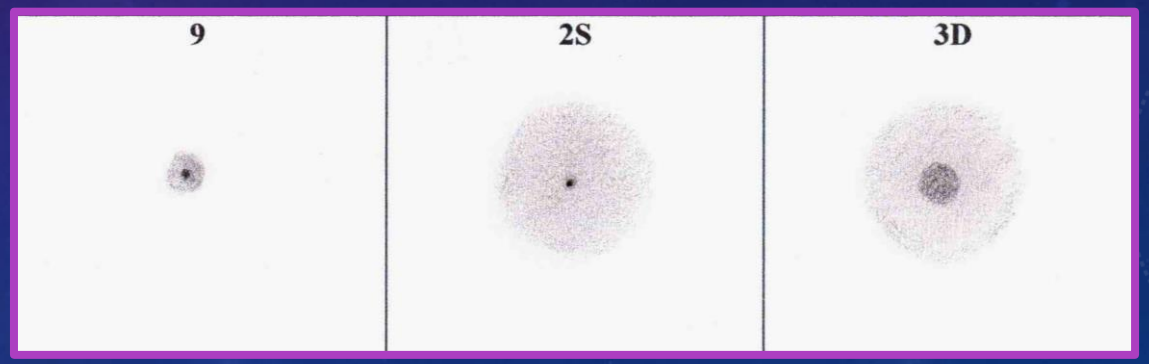



***The chart displayed shows a visual comparison to determining the degree of condensation for a comet's coma!***

***Note the two extra designations:***

*2S: A Sharp, distinct stellar center with an extremely dissipated outer coma barely visible form the night background.*

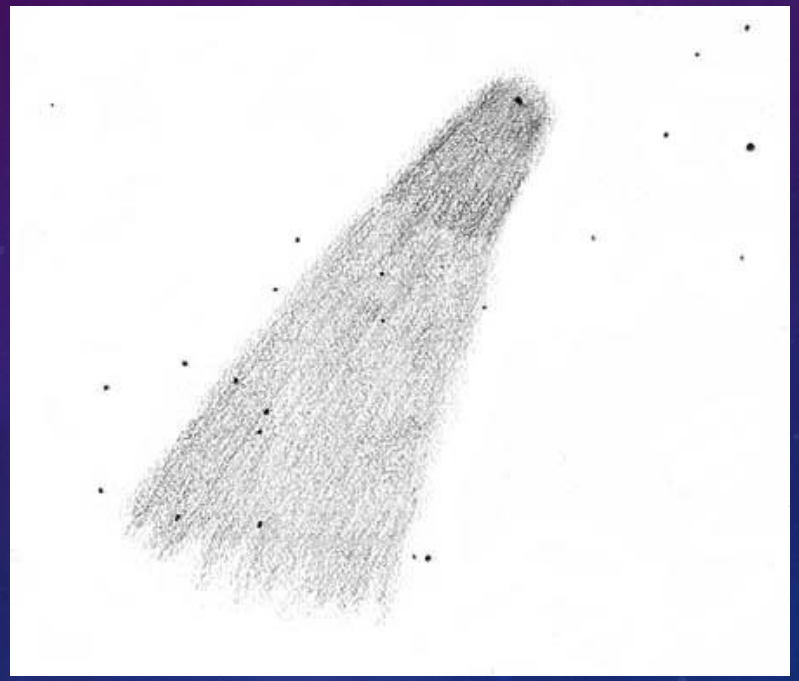
*3D: The central condensate disperses with an extremely faint outer coma very little contrast from the background. The condensate is sharply distinguishable from the outer coma.*




*The chart is courtesy of the Isle of Man Astronomy Club.*
*http://www.iomastronomy.org/sections/comets/comet.html*
***6 March 2015***

# THE TECHNIQUES OF OBSERVING COMETS!

*Donati's Comet*
George Phillips Bond
Harvard Observatory 15" refractor
1858

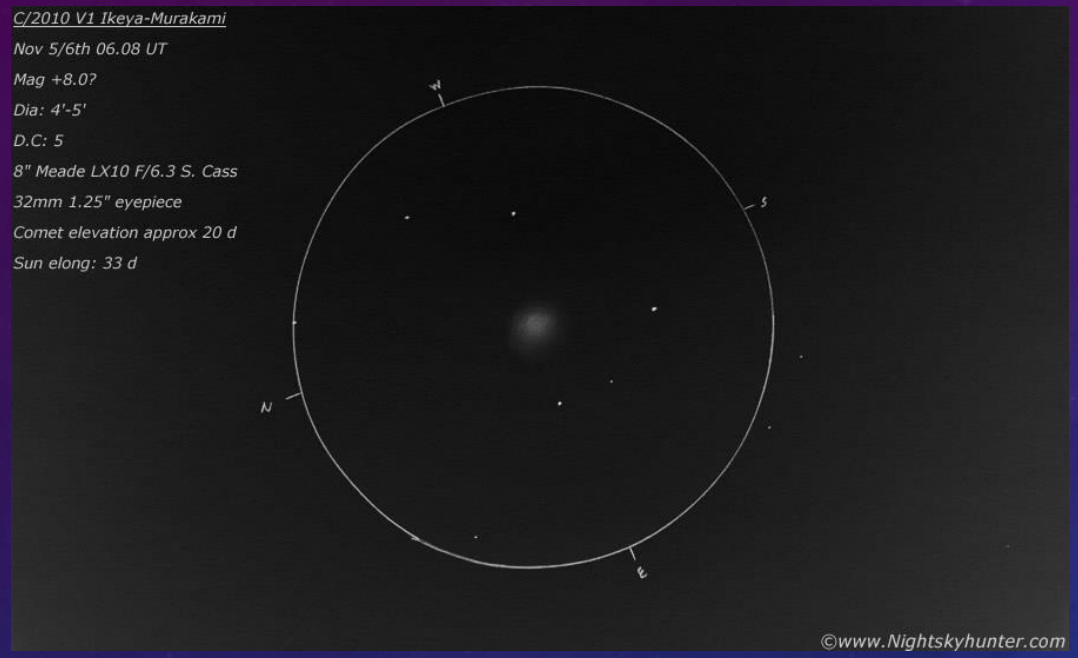


*Comet Bradfield*
Eric Jamison
6" Astrophysics f/9 refractor
23 November 1987

Catching the Comet:

1. Observations of the Coma are the easiest.
2. Most comets do not produce distinctly visible tails for the naked eye! (binos or telescope)
3. Judgements on the visual magnitude can vary substantially based on biased human observations and photometry measurements in a single night!
4. The Dust tail is the easiest to observe; the ion tail is difficult unless extreme activity (Outbursts – either continuous, single or multiple events).
5. There can be more than one dust tail and the ion plus dust tail is very pronounced in comets with small coma, but large comas are very distinct over tails! (Maybe!)

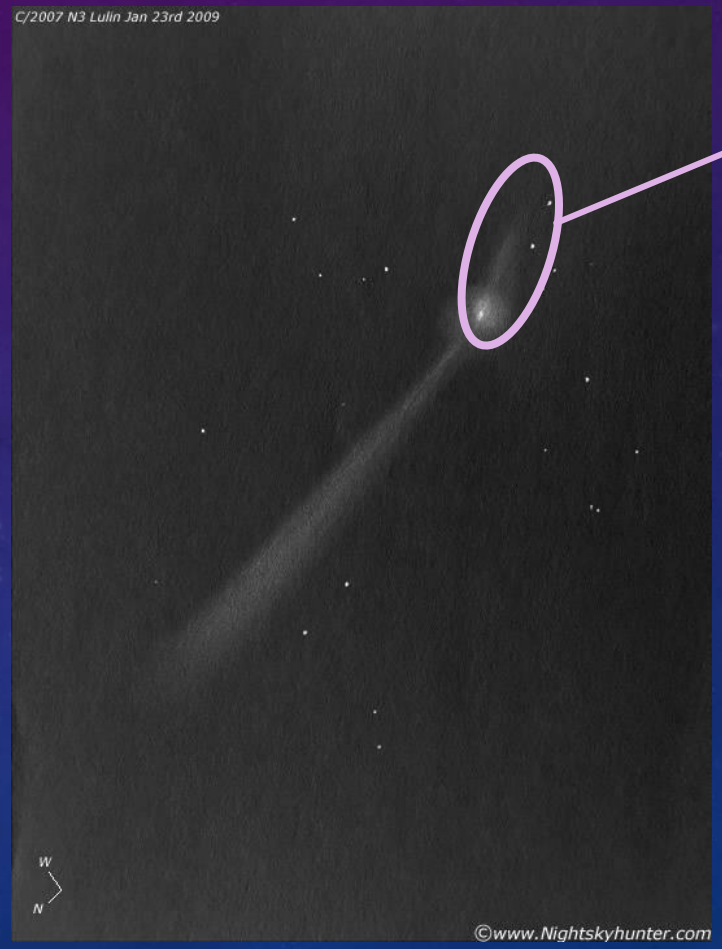
# THE TECHNIQUES OF OBSERVING COMETS!




Foreshortening Effect!

The appearance of the comet's tail due to the geometric orientation between the Earth and a Comet.

(100% means the comet's tail is parallel with the face of the Earth where as 0% means the tail is exactly perpendicular with respect to the face of the Earth!)




***Do Not Assume you are observing the 'Anti – Tail'!***

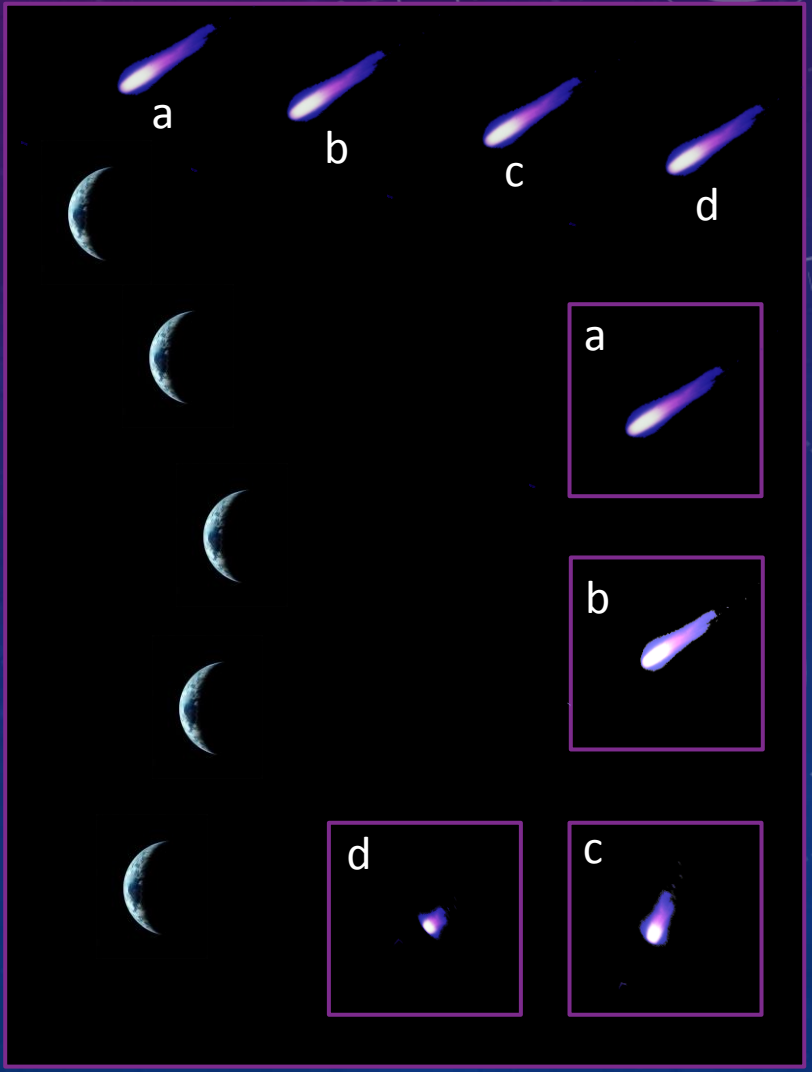
# THE TECHNIQUES OF OBSERVING COMETS!

## Foreshortening Effect!

The appearance of the comet's tail due to the geometric orientation between the Earth and a Comet.

(100% means the comet's tail is parallel with the face of the Earth where as 0% means the tail is exactly perpendicular with respect to the face of the Earth!)

a) 100%
b) 60%
c) 30%
d) 5 – 10 %



# THE TECHNIQUES OF OBSERVING COMETS!

*How to measure visual magnitude?*

**Sidgwick's or In – Out method** – An observer memorizes the brightness of the stars around a comet in a particular star field with the angular size of the in – focus comet. Rack out the telescope in order for the coma to have the same diameter as the surrounding stars. Several observations are required to reach a definite brightness value and it works well for diffuse comets!

**Bobrovnikoff's or Out – Out method** – Simultaneously defocus the comet with the comparison stars for side by side, direct comparison. It works best for very bright comets providing a very steep brightness gradient for determining visual magnitude! Works well for highly condensed comets!

**Beyer's method** – The comet's coma is defocused in conjunction with the stars until all objects are out of focus with the background of space. Incremental refocusing will determine the brightness of comet with respect to the surrounding stars! Works well for very condensed comets with a more stellar – like appearance, but smaller angular diameter.

# THE TECHNIQUES OF OBSERVING COMETS!

*How to measure visual magnitude?*

**Morris's or modified Out method** – Formulated by Charles Morris & Stephen James O'Meara.
Bridges the cap between the Sidgwick & Bobrovnikoff methods for moderately condensed comets.

The comet is placed out of focus to flatten the brightness profile. It is easier to determine the average surface brightness along with the out of focus angular diameter. Take the comparison stars and place them out of focus for determining a more precise visual magnitude value. More difficult to master than all other techniques.

**The In – Focus Method** – A Centuries old technique in visual comparing the brightness of a comet with the neighboring stars with everything in focus. Works well for compact, stellar – like comets to prevent any underestimation of visual brightness. Can work well with other methods to determine more accurate values for the visual magnitude of historical comets before the 20$^{th}$ century!

# THE TECHNIQUES OF PREDICTING COMETS!

*How to plot a comet across the sky? Orbital Elements*

e: eccentricity – elliptical shape of an orbit!

1. e = 0 it is circular
2. 0.01 to 0.99 from slightly oval to extremely oval
3. e = 1 it is a parabolic path
4. e > 1 it is a hyperbolic path

a: semi – major axis (measured in AUs)

*Not to be confused with perihelion, aphelion, apogee, or perigee!*

q: perihelion distance (measured in AUs)

i: orbital inclination

*(The tilt to the plane of the ecliptic – plane of the Earth's orbit measured in degrees!)*

node: longitude of the ascending node

peri: the argument of perihelion

M: mean anomaly

$t_p$: time of perihelion passage

period: orbital period (measured in years)

n: mean motion (measured in degrees/day)

Q: aphelion distance (measured in AUs)

alternate orbits: [epoch=2017-Feb-16.0] K161/3 (default)

Orbital Elements at Epoch 2457800.5 (2017-Feb-16.0) TDB
Reference: JPL K161/3 (heliocentric ecliptic J2000)

| Element | Value | Uncertainty (1-sigma) | Units |
|---|---|---|---|
| e | .8238953972755227 | 1.2329e-05 | |
| a | 3.023863411065427 | 0.00021374 | au |
| q | .5325162646987597 | 1.2083e-06 | au |
| i | 4.247657615424339 | 2.7125e-05 | deg |
| node | 88.9779101589004 | 0.00044566 | deg |
| peri | 326.282838936663 | 0.00084336 | deg |
| M | 8.760312004620179 | 0.00099446 | deg |
| $t_p$ | 2457753.763223487858 (2016-Dec-31.26322349) | 0.00035648 | JED |
| period | 1920.621039010655 | 0.20363 | d |
| | 5.26 | 0.0005575 | yr |
| n | .1874393712699525 | 1.9873e-05 | deg/d |
| Q | 5.515210557432094 | 0.00038983 | au |

Orbit Determination Parameters

| | |
|---|---|
| # obs. used (total) | 548 |
| data-arc span | 94 days |
| first obs. used | 2016-11-05 |
| last obs. used | 2017-02-07 |
| planetary ephem. | DE431 |
| condition code | 5 |
| fit RMS | .68 |
| data source | ORB |
| producer | Davide Farnocchia |
| solution date | 2017-Feb-07 12:39:44 |

Additional Information

Earth MOID = .0602718 au
Jupiter MOID = .106329 au
T_jup = 2.582

Additional Model Parameters

| Parameter | Value | Uncertainty (1-sigma) |
|---|---|---|
| A1 [EST] | -2.41743305373026 6E-8 | 2.606E-9 |
| A2 [EST] | -1.545756903308335E-8 | 2.188E-9 |

[ show covariance matrix ]

[ Ephemeris | Orbit Diagram | Orbital Elements | Physical Parameters | Discovery Circumstances | Close-Approach Data ]

Physical Parameter Table

| Parameter | Symbol | Value | Units | Sigma | Reference | Notes |
|---|---|---|---|---|---|---|
| comet total magnitude | M1 | 14. | mag | n/a | ICQ 2001 Handbook | |
| comet total magnitude slope | K1 | 26.0 | | n/a | ICQ 2001 Handbook | |
| comet nuclear magnitude | M2 | 18. | mag | n/a | ICQ 2001 Handbook | |
| comet nuclear magnitude slope | K2 | 15.0 | | n/a | ICQ 2001 Handbook | |
| diameter | diameter | 1.6 | km | n/a | Lamy,P.L.;Toth,I.;Fernandez,Y.R.;Weaver,H.A. (2004) Comets II, pp. 223-264 | |

45P/Honda-Mrkos-Pajdusakova Discovered 1948-Dec-03 by Honda, Minora at Kurashiki, Japan
Reference: comet.dis Last Updated: 2003-08-29

[ show close-approach data ]

Alternate Designations

| Perihelion Year (est.) | New-Style Desig | Roman Numeral | Year/ Letter |
|---|---|---|---|
| 1990.7 | | 1990 XIV | 1990f |
| 1985.4 | | 1985 III | 1985c |
| 1980.2 | | 1980 I | 1980c |
| 1974.9 | | 1974 XVI | 1974f |
| 1969.7 | | 1969 V | 1969e |
| 1964.4 | | 1964 VII | 1964d |
| 1953.9 | 45P/1954 C1 | 1954 III | 1954a |
| 1948.6 | 45P/1948 X1 | 1948 XII | 1948n |

***NASA/JPL Small Body Database Browser***

***Comet: 45P/Honda – Mrkos - Pajdusakova***

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*(The tilt to the plane of the ecliptic – plane of the Earth's orbit measured in degrees!)*

node: longitude of the ascending node

peri: the argument of perihelion

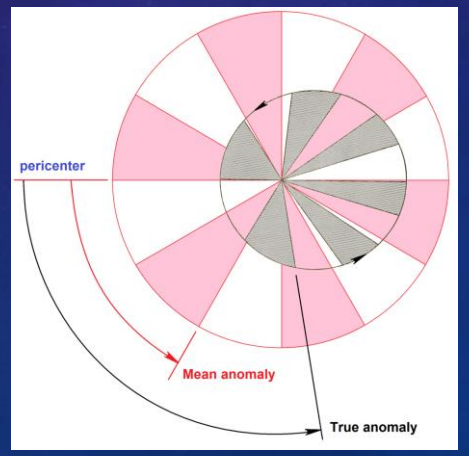
M: mean anomaly

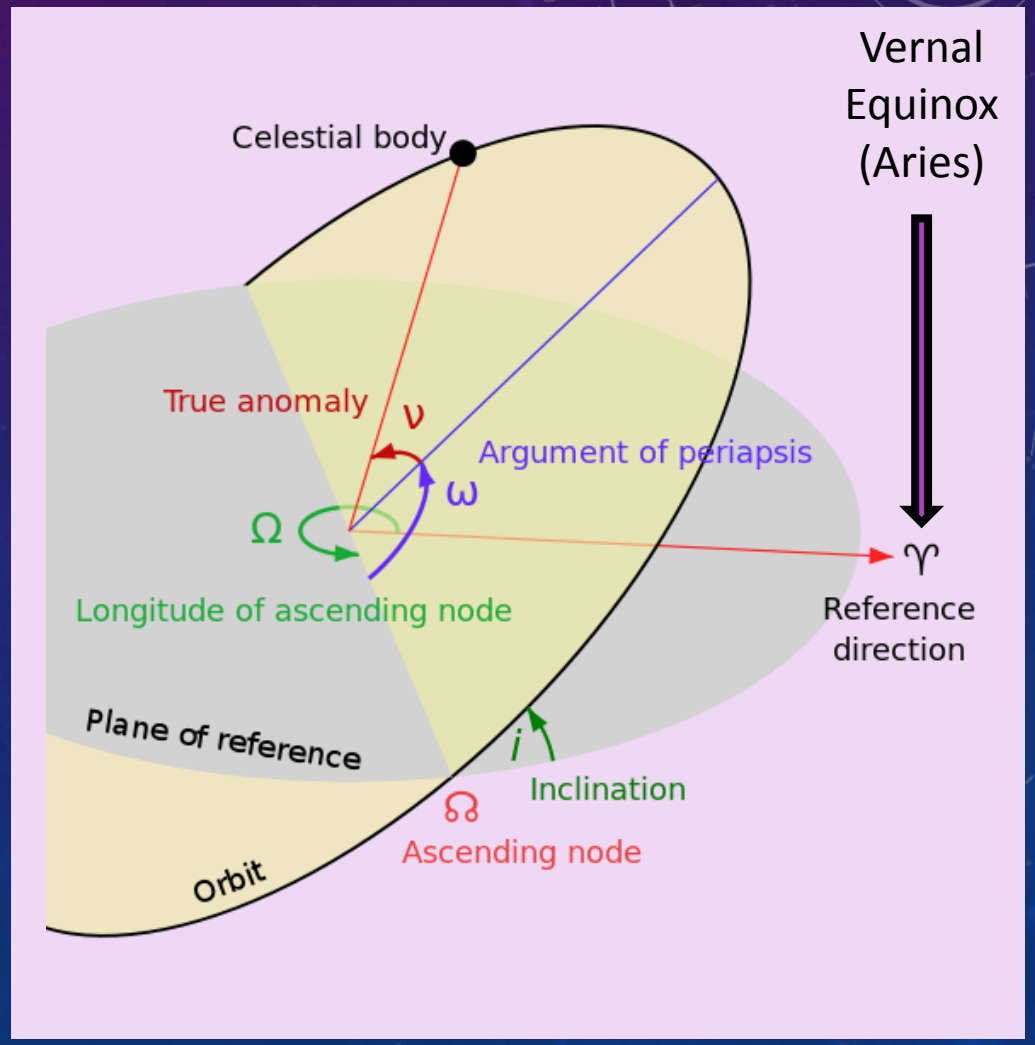
$t_p$: time of perihelion passage

period: orbital period (measured in years)

n: mean motion (measured in degrees/day)

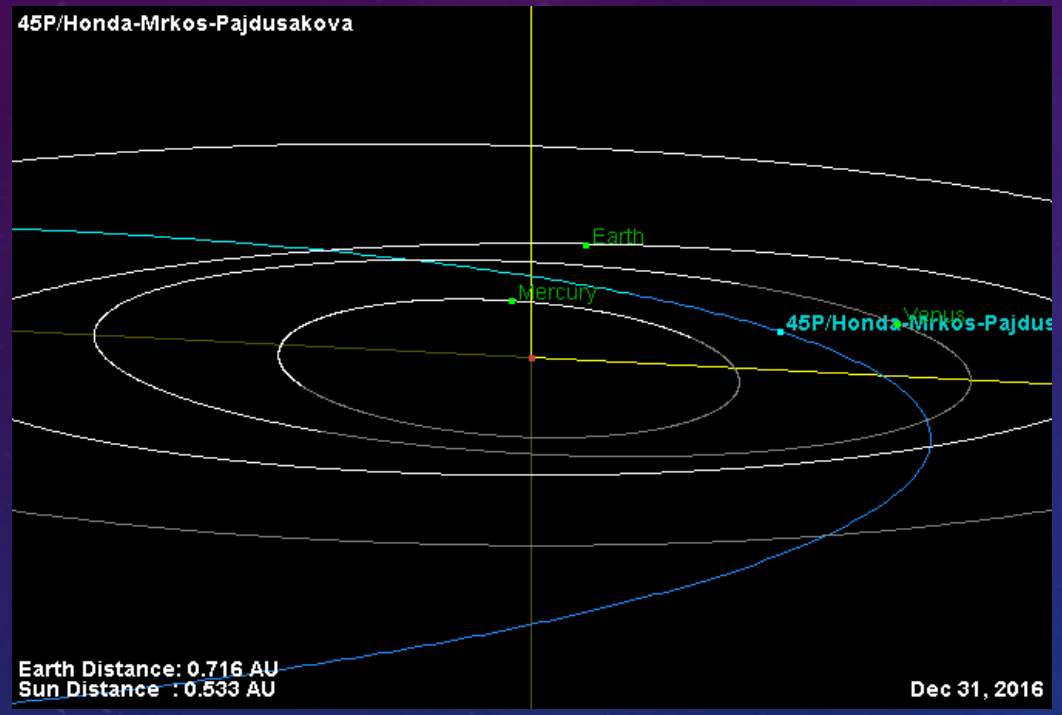
Q: aphelion distance (measured in AUs)

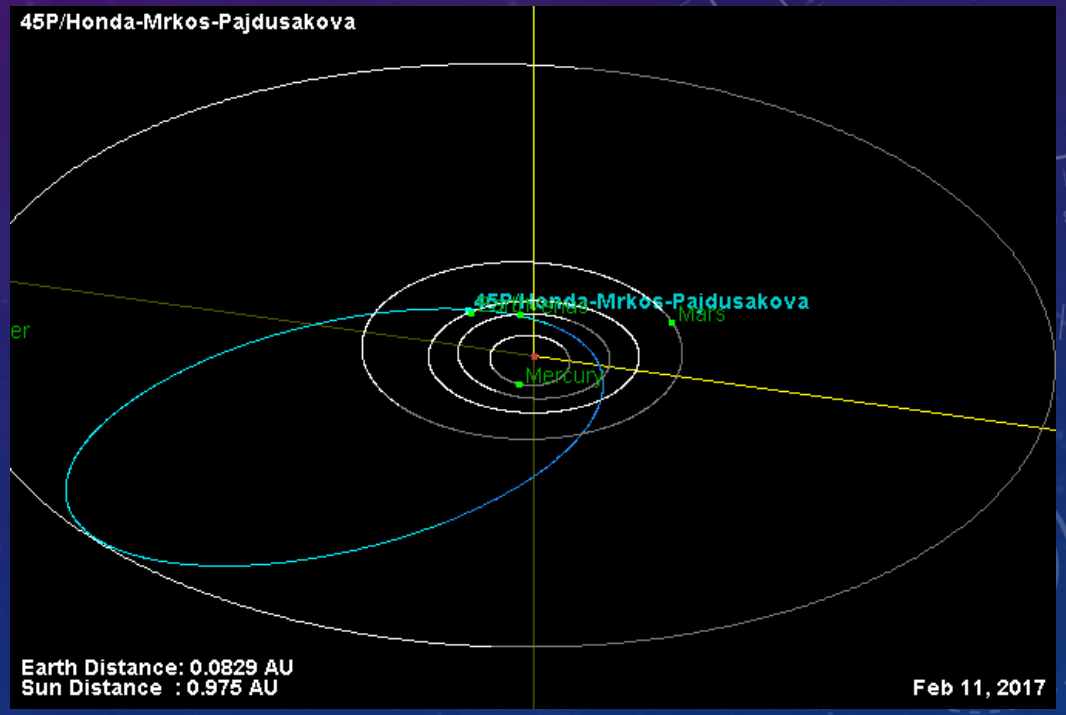


# THE TECHNIQUES OF PREDICTING COMETS!

*How to plot a comet across the sky? Orbital Elements*




***NASA/JPL Small Body Database Browser***

***Comet: 45P/Honda – Mrkos - Pajdusakova***

# THE TECHNIQUES OF PREDICTING COMETS!

## *How to plot a comet across the sky? Ephemeris Data Terminology*

| *Ephemeris Term* | *Definition (plus additional comments)* |
|---|---|
| Date | Month and Year using the standard Gregorian calendar. |
| UT or TT | Terrestrial Time or Universal Time Coordinated (Day of the Month) as a substitute for the astronomical Julian date. |
| RA (2000) | Right Ascension based on the Epoch J2000 (longitudinal coordinate for the celestial sky) measured in hours, minutes, and seconds. |
| Dec (2000) | Declination based on the Epoch J2000 (latitudinal coordinate for the night sky) measured in degrees, arcminutes, and arcseconds. |
| Delta | The distance from Earth measured in AUs (1 AU = 1 Astronomical Unit = 92 955 807 mi = 149 597 871 km as the mean distance between the Earth and Sun). |
| R | The solar distance measured in AUs (the distance between the comet or comet – like body and the Sun)! |
| Elongation {El. ( ˚ )} | Solar elongation which is the angle of separation between the observed object and the Sun as measured across the night sky as measured in degrees. |
| Phase (Ph.) | Phase angle between the Sun, the celestial object, and the observer on the surface of the Earth. Also known as the Sun – Object – Observer angle. |
| $M_1$ | M1: The visual magnitude of the celestial object as observed on the surface of the Earth at sea level.<br>*(Note M1 values predicted by the Minor Planet Center can differ from actual visual reports obtain in the field!)* |
| $M_{pred}$ | *The predicted absolute magnitude which is calculated from a series of initial observations upon the discovery or recapture of a periodic comet which can change if the comet gets brighter or fainter as the internal conditions of the comet's nucleus changes during it's close approach around the Sun!* |
| $M_2$ | The nuclear magnitude of the Comet which is also the visual magnitude of the false nucleus.<br>*(Rarely shown on a Comet's ephemeris data spreadsheet unless all values show a visual brightness value above 19th magnitude!)* |
| "/min | The progression or motion across the sky as measured in arcseconds per minute. |
| P.A. | Position angle while undergoing motion in the celestial sky.<br>*(P.A. is the same method applied to binary stars with starts at N goes counterclockwise in an easterly direction!)* |
| Moon Phase | *A Numerical value for designating the phases of the Moon on a scale of (0.00 – 1.00): A New Moon = 0.00, Waxing or Waning Crescent = (0.01 - 0.49), Half Moon (1st or Last Quarter = 0.50), Waxing or Waning Gibbous = (0.50 – 0.99), & Full Moon = 1.00* |
| Foreshortening (% Fore.) | The appearance of the comet's tail due to the geometric orientation between the Earth and a Comet.<br>*(100% means the comet's tail is parallel with the face of the Earth where as 0% means the tail is exactly perpendicular with respect to the face of the Earth!)* |
| Altitude {Alt. ( ˚ )} | Altitude is the angle of position for any celestial object visible in the night sky with respect to the horizon regardless of cardinal direction . The angle has a range of only (0˚ to 90˚) although (0˚ to -90˚) can be applied to objects not visible. The altitude position will change throughout the sidereal day. |
| Azimuth {Azi. ( ˚ )} | Azimuth is the establish angle of position for any celestial object visible in the night sky. The range starts at the North (0˚) heading clockwise eastward with the following cardinal positions: *NNE (22.5˚), NE (45˚), ENE (67.5˚), E (90˚), ESE (112.5˚), SE (135˚), SSE (157.5˚), S (180˚), SSW (202.5˚), SW (225˚), WSW ( 247.5˚), W (270˚), WNW (292.5˚), NW (315˚), & NNW (337.5˚)* |

# THE TECHNIQUES OF PREDICTING COMETS!

*How to plot a comet across the sky? Spreadsheet of Ephemeris Data (UTC 06hrs – CST Midnight or 00hrs)*

**45P/Honda-Mrkos-Pajdusakova**

Perturbed ephemeris below is based on elements from MPEC 2017-C71.

***Time of Perihelion Passage!***

0045P

| Date | UT h m s | R.A. (J2000) | Decl. | Delta | r | El. | Ph. | m2 | Sky Motion "/min | P.A. | Object Azi. | Alt. | Sun Alt. | Moon Phase | Dist. | Alt. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 2016 12 01 | 060000 | 19 22 00.3 | -24 39 54 | 1.274 | 0.808 | 39.4 | 50.7 | | 1.82 | 082.4 | 085 | -49 | -82 | 0.03 | 021 | -66 |
| 2016 12 02 | 060000 | 19 25 10.3 | -24 34 09 | 1.259 | 0.795 | 39.1 | 51.5 | | 1.85 | 082.1 | 085 | -50 | -82 | 0.07 | 011 | -57 |
| 2016 12 03 | 060000 | 19 28 22.3 | -24 28 04 | 1.245 | 0.781 | 38.8 | 52.3 | | 1.87 | 081.7 | 086 | -50 | -82 | 0.13 | 007 | -46 |
| 2016 12 04 | 060000 | 19 31 36.3 | -24 21 38 | 1.230 | 0.767 | 38.6 | 53.2 | | 1.89 | 081.4 | 086 | -50 | -83 | 0.20 | 015 | -35 |
| 2016 12 05 | 060000 | 19 34 52.1 | -24 14 50 | 1.215 | 0.754 | 38.3 | 54.2 | | 1.91 | 081.0 | 086 | -50 | -83 | 0.28 | 027 | -24 |
| 2016 12 06 | 060000 | 19 38 09.6 | -24 07 39 | 1.199 | 0.740 | 38.1 | 55.1 | | 1.93 | 080.6 | 086 | -50 | -83 | 0.38 | 038 | -12 |
| 2016 12 07 | 060000 | 19 41 28.8 | -24 00 06 | 1.183 | 0.727 | 37.8 | 56.2 | | 1.95 | 080.2 | 087 | -50 | -83 | 0.49 | 051 | +00 |
| 2016 12 08 | 060000 | 19 44 49.4 | -23 52 10 | 1.167 | 0.714 | 37.6 | 57.3 | | 1.97 | 079.8 | 087 | -50 | -83 | 0.60 | 063 | +13 |
| 2016 12 09 | 060000 | 19 48 11.5 | -23 43 49 | 1.150 | 0.701 | 37.3 | 58.4 | | 1.99 | 079.4 | 087 | -50 | -83 | 0.71 | 077 | +25 |
| 2016 12 10 | 060000 | 19 51 34.8 | -23 35 05 | 1.133 | 0.688 | 37.1 | 59.7 | | 2.00 | 079.0 | 087 | -50 | -83 | 0.81 | 090 | +39 |
| 2016 12 11 | 060000 | 19 54 59.0 | -23 25 56 | 1.116 | 0.676 | 36.9 | 61.0 | | 2.02 | 078.6 | 088 | -50 | -83 | 0.89 | 104 | +52 |
| 2016 12 12 | 060000 | 19 58 24.1 | -23 16 22 | 1.098 | 0.664 | 36.7 | 62.3 | | 2.03 | 078.2 | 088 | -50 | -83 | 0.95 | 118 | +65 |
| 2016 12 13 | 060000 | 20 01 49.8 | -23 06 22 | 1.080 | 0.652 | 36.5 | 63.8 | | 2.0[illegible] | 077.7 | 088 | -51 | -83 | 0.99 | 132 | +76 |
| 2016 12 14 | 060000 | 20 05 15.8 | -22 55 58 | 1.062 | 0.641 | 36.3 | 65.3 | | 2.05 | 077.3 | 089 | -51 | -83 | 1.00 | 147 | +77 |
| 2016 12 15 | 060000 | 20 08 41.8 | -22 45 09 | 1.043 | 0.630 | 36.1 | 66.9 | | 2.06 | 076.8 | 089 | -51 | -83 | 0.98 | 160 | +67 |
| 2016 12 16 | 060000 | 20 12 07.5 | -22 33 54 | 1.024 | 0.619 | 35.9 | 68.6 | | 2.06 | 076.3 | 089 | -51 | -83 | 0.93 | 172 | +55 |
| 2016 12 17 | 060000 | 20 15 32.6 | -22 22 14 | 1.005 | 0.609 | 35.6 | 70.3 | | 2.06 | 075.8 | 090 | -51 | -83 | 0.86 | 170 | +42 |
| 2016 12 18 | 060000 | 20 18 56.7 | -22 10 10 | 0.985 | 0.599 | 35.4 | 72.2 | | 2.05 | 075.3 | 090 | -51 | -83 | 0.78 | 158 | +29 |
| 2016 12 19 | 060000 | 20 22 19.4 | -21 57 41 | 0.965 | 0.590 | 35.2 | 74.1 | | 2.05 | 074.8 | 090 | -51 | -83 | 0.68 | 146 | +17 |
| 2016 12 20 | 060000 | 20 25 40.1 | -21 44 49 | 0.945 | 0.582 | 35.0 | 76.1 | | 2.03 | 074.2 | 091 | -51 | -83 | 0.58 | 134 | +06 |
| 2016 12 21 | 060000 | 20 28 58.5 | -21 31 34 | 0.925 | 0.573 | 34.8 | 78.3 | | 2.02 | 073.6 | 091 | -51 | -83 | 0.48 | 123 | -06 |
| 2016 12 22 | 060000 | 20 32 14.0 | -21 17 57 | 0.904 | 0.566 | 34.6 | 80.5 | | 2.00 | 073.0 | 092 | -51 | -83 | 0.39 | 112 | -17 |
| 2016 12 23 | 060000 | 20 35 26.0 | -21 03 59 | 0.883 | 0.559 | 34.3 | 82.8 | | 1.97 | 072.3 | 092 | -51 | -83 | 0.30 | 100 | -28 |
| 2016 12 24 | 060000 | 20 38 34.0 | -20 49 42 | 0.862 | 0.553 | 34.1 | 85.1 | | 1.94 | 071.6 | 093 | -51 | -83 | 0.22 | 089 | -38 |
| 2016 12 25 | 060000 | 20 41 37.3 | -20 35 07 | 0.840 | 0.548 | 33.8 | 87.6 | | 1.90 | 070.8 | 093 | -51 | -82 | 0.14 | 078 | -49 |
| 2016 12 26 | 060000 | 20 44 35.3 | -20 20 15 | 0.819 | 0.543 | 33.5 | 90.1 | | 1.85 | 070.0 | 094 | -51 | -82 | 0.08 | 067 | -59 |
| 2016 12 27 | 060000 | 20 47 27.4 | -20 05 08 | 0.797 | 0.539 | 33.2 | 92.7 | | 1.80 | 069.1 | 094 | -52 | -82 | 0.04 | 056 | -69 |
| 2016 12 28 | 060000 | 20 50 12.9 | -19 49 47 | 0.775 | 0.536 | 32.9 | 95.4 | | 1.75 | 068.0 | 095 | -52 | -82 | 0.01 | 045 | -77 |
| 2016 12 29 | 060000 | 20 52 51.2 | -19 34 15 | 0.754 | 0.534 | 32.5 | 98.1 | | 1.69 | 066.9 | 095 | -52 | -82 | 0.00 | 033 | -79 |
| 2016 12 30 | 060000 | 20 55 21.7 | -19 18 32 | 0.732 | 0.533 | 32.2 | 100.9 | | 1.62 | 065.6 | 096 | -52 | -82 | 0.01 | 022 | -71 |
| 2016 12 31 | 060000 | 20 57 43.8 | -19 02 40 | 0.710 | 0.533 | 31.7 | 103.7 | | 1.55 | 064.2 | 096 | -52 | -82 | 0.04 | 010 | -61 |
| 2017 01 01 | 060000 | 20 59 56.9 | -18 46 39 | 0.688 | 0.533 | 31.3 | 106.6 | | 1.47 | 062.5 | 097 | -53 | -82 | 0.09 | 004 | -50 |
| 2017 01 02 | 060000 | 21 02 00.5 | -18 30 32 | 0.667 | 0.534 | 30.8 | 109.4 | | 1.39 | 060.5 | 098 | -53 | -82 | 0.15 | 015 | -38 |
| 2017 01 03 | 060000 | 21 03 53.9 | -18 14 19 | 0.645 | 0.536 | 30.3 | 112.3 | | 1.31 | 058.3 | 099 | -53 | -81 | 0.24 | 028 | -26 |
| 2017 01 04 | 060000 | 21 05 36.9 | -17 58 00 | 0.624 | 0.539 | 29.7 | 115.2 | | 1.22 | 055.5 | 099 | -54 | -81 | 0.33 | 040 | -14 |
| 2017 01 05 | 060000 | 21 07 09.0 | -17 41 35 | 0.603 | 0.543 | 29.1 | 118.1 | | 1.14 | 052.3 | 100 | -54 | -81 | 0.44 | 054 | -01 |
| 2017 01 06 | 060000 | 21 08 29.7 | -17 25 03 | 0.582 | 0.548 | 28.5 | 121.0 | | 1.06 | 048.4 | 101 | -54 | -81 | 0.55 | 067 | +11 |
| 2017 01 07 | 060000 | 21 09 38.7 | -17 08 24 | 0.561 | 0.553 | 27.8 | 123.9 | | 0.98 | 043.7 | 102 | -55 | -81 | 0.66 | 081 | +24 |
| 2017 01 08 | 060000 | 21 10 35.9 | -16 51 36 | 0.541 | 0.559 | 27.1 | 126.7 | | 0.91 | 038.1 | 103 | -55 | -81 | 0.77 | 095 | +38 |
| 2017 01 09 | 060000 | 21 11 20.8 | -16 34 37 | 0.521 | 0.566 | 26.3 | 129.5 | | 0.85 | 031.3 | 104 | -56 | -80 | 0.86 | 109 | +51 |
| 2017 01 10 | 060000 | 21 11 53.2 | -16 17 25 | 0.502 | 0.573 | 25.5 | 132.3 | | 0.80 | 023.4 | 105 | -57 | -80 | 0.93 | 124 | +64 |
| 2017 01 11 | 060000 | 21 12 13.0 | -15 59 56 | 0.482 | 0.581 | 24.7 | 135.1 | | 0.77 | 014.4 | 107 | -57 | -80 | 0.98 | 138 | +75 |
| 2017 01 12 | 060000 | 21 12 19.8 | -15 42 07 | 0.463 | 0.590 | 23.8 | 137.8 | | 0.76 | 004.8 | 108 | -58 | -80 | 1.00 | 153 | +79 |
| 2017 01 13 | 060000 | 21 12 13.6 | -15 23 52 | 0.445 | 0.599 | 22.8 | 140.4 | | 0.78 | 355.2 | 109 | -59 | -80 | 0.99 | 167 | +70 |
| 2017 01 14 | 060000 | 21 11 53.9 | -15 05 07 | 0.427 | 0.609 | 21.8 | 143.1 | | 0.83 | 346.2 | 111 | -59 | -80 | 0.96 | 178 | +58 |
| 2017 01 15 | 060000 | 21 11 20.6 | -14 45 45 | 0.409 | 0.619 | 20.8 | 145.6 | | 0.90 | 338.1 | 113 | -60 | -79 | 0.91 | 165 | +46 |
| 2017 01 16 | 060000 | 21 10 33.3 | -14 25 39 | 0.391 | 0.629 | 19.7 | 148.1 | | 0.99 | 331.3 | 114 | -61 | -79 | 0.83 | 151 | +34 |
| 2017 01 17 | 060000 | 21 09 31.5 | -14 04 41 | 0.374 | 0.640 | 18.6 | 150.6 | | 1.09 | 325.6 | 116 | -62 | -79 | 0.75 | 138 | +22 |
| 2017 01 18 | 060000 | 21 08 14.9 | -13 42 42 | 0.357 | 0.652 | 17.5 | 153.0 | | 1.22 | 321.0 | 119 | -62 | -79 | 0.66 | 126 | +11 |

**45P/Honda-Mrkos-Pajdusakova**

Perturbed ephemeris below is based on elements from MPEC 2017-C71.

***Time of Perigee Passage!***

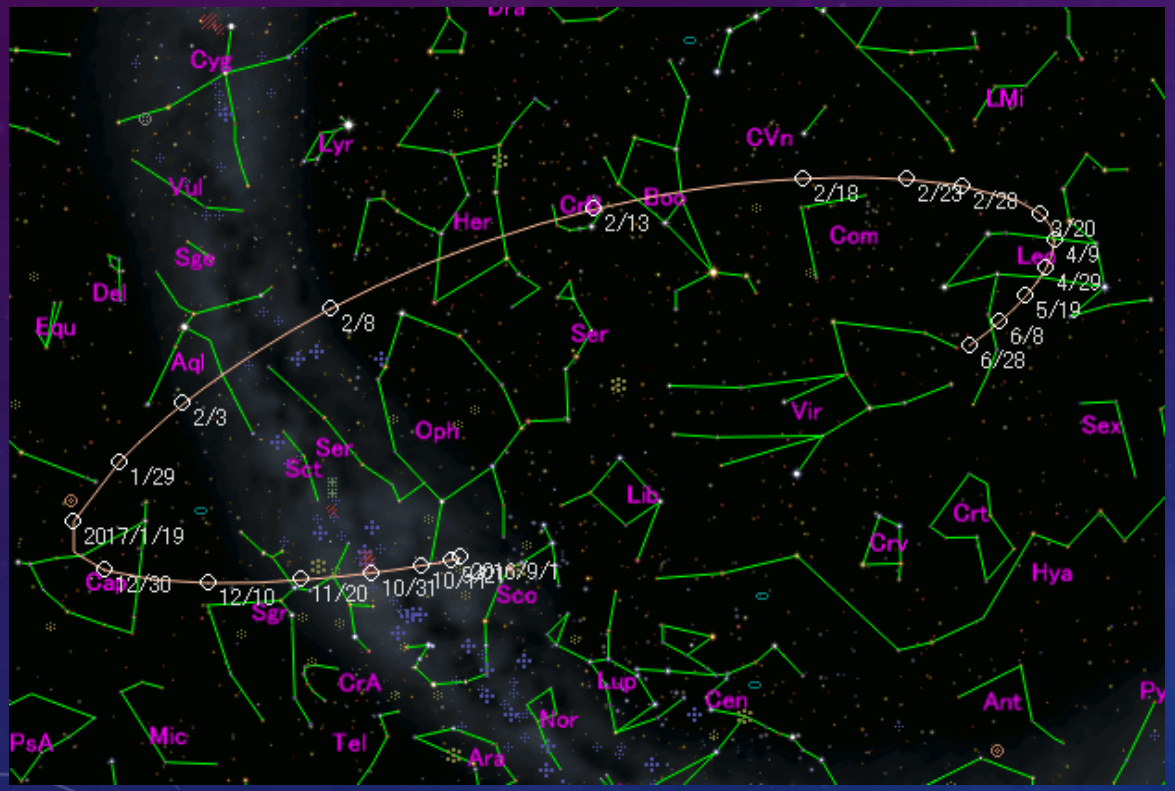
0045P

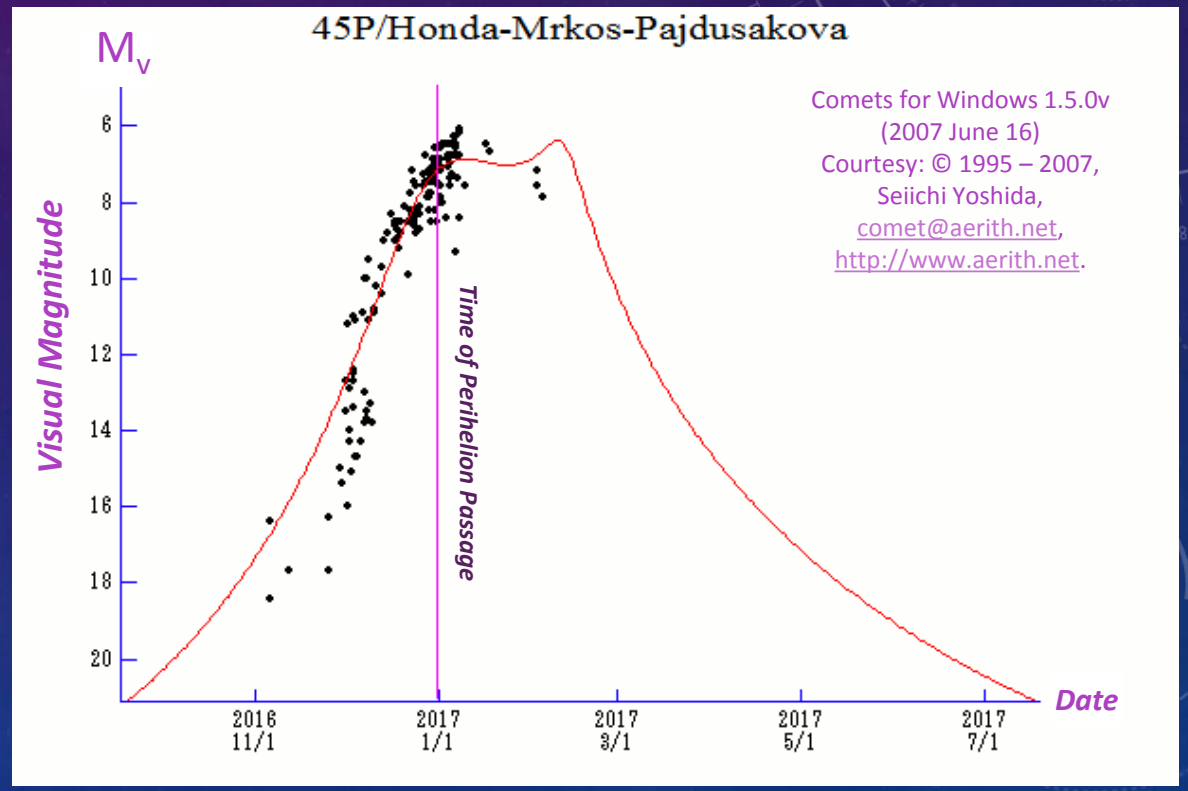
| Date | UT h m s | R.A. (J2000) | Decl. | Delta | r | El. | Ph. | m2 | Sky Motion "/min | P.A. | Object Azi. | Alt. | Sun Alt. | Moon Phase | Dist. | Alt. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 2017 01 19 | 060000 | 21 06 42.8 | -13 19 30 | 0.341 | 0.664 | 16.3 | 155.4 | | 1.36 | 317.3 | 121 | -63 | -79 | 0.56 | 113 | -01 |
| 2017 01 20 | 060000 | 21 04 54.4 | -12 54 55 | 0.325 | 0.676 | 15.1 | 157.6 | | 1.53 | 314.3 | 124 | -64 | -78 | 0.47 | 101 | -11 |
| 2017 01 21 | 060000 | 21 02 48.7 | -12 28 40 | 0.309 | 0.688 | 14.0 | 159.8 | | 1.70 | 312.0 | 127 | -65 | -78 | 0.38 | 089 | -22 |
| 2017 01 22 | 060000 | 21 00 24.8 | -12 00 30 | 0.294 | 0.701 | 12.8 | 161.9 | | 1.90 | 310.1 | 130 | -65 | -78 | 0.29 | 076 | -33 |
| 2017 01 23 | 060000 | 20 57 41.1 | -11 30 06 | 0.279 | 0.713 | 11.7 | 163.7 | | 2.13 | 308.6 | 134 | -66 | -78 | 0.21 | 064 | -43 |
| 2017 01 24 | 060000 | 20 54 35.8 | -10 57 04 | 0.264 | 0.726 | 10.7 | 165.4 | | 2.38 | 307.4 | 138 | -67 | -77 | 0.13 | 051 | -54 |
| 2017 01 25 | 060000 | 20 51 07.0 | -10 20 58 | 0.250 | 0.740 | 10.0 | 166.7 | | 2.66 | 306.5 | 143 | -67 | -77 | 0.08 | 039 | -64 |
| 2017 01 26 | 060000 | 20 47 11.9 | -09 41 15 | 0.236 | 0.753 | 9.5 | 167.5 | | 2.98 | 305.8 | 148 | -68 | -77 | 0.03 | 026 | -73 |
| 2017 01 27 | 060000 | 20 42 47.3 | -08 57 17 | 0.222 | 0.767 | 9.6 | 167.7 | | 3.35 | 305.2 | 154 | -68 | -77 | 0.01 | 014 | -78 |
| 2017 01 28 | 060000 | 20 37 49.2 | -08 08 19 | 0.209 | 0.780 | 10.1 | 167.2 | | 3.78 | 304.8 | 160 | -68 | -76 | 0.00 | 008 | -73 |
| 2017 01 29 | 060000 | 20 32 12.7 | -07 13 23 | 0.196 | 0.794 | 11.3 | 165.9 | | 4.2[illegible] | 304.6 | 167 | -68 | -76 | 0.02 | 019 | -63 |
| 2017 01 30 | 060000 | 20 25 51.6 | -06 11 22 | 0.183 | 0.808 | 13.0 | 164.1 | | 4.87 | 304.4 | 174 | -67 | -76 | 0.06 | 033 | -52 |
| 2017 01 31 | 060000 | 20 18 38.3 | -05 00 53 | 0.171 | 0.822 | 15.2 | 161.6 | | 5.57 | 304.3 | 181 | -66 | -76 | 0.12 | 047 | -40 |
| 2017 02 01 | 060000 | 20 10 23.2 | -03 40 15 | 0.159 | 0.836 | 18.0 | 158.6 | | 6.40 | 304.2 | 188 | -64 | -75 | 0.19 | 063 | -27 |
| 2017 02 02 | 060000 | 20 00 54.3 | -02 07 27 | 0.147 | 0.850 | 21.2 | 155.2 | | 7.40 | 304.1 | 195 | -62 | -75 | 0.29 | 078 | -15 |
| 2017 02 03 | 060000 | 19 49 56.7 | -00 20 05 | 0.136 | 0.864 | 25.0 | 151.2 | | 8.60 | 304.0 | 201 | -59 | -75 | 0.40 | 094 | -02 |
| 2017 02 04 | 060000 | 19 37 11.7 | +01 44 33 | 0.126 | 0.879 | 29.4 | 146.6 | | 10.04 | 303.9 | 207 | -56 | -75 | 0.51 | 110 | +11 |
| 2017 02 05 | 060000 | 19 22 16.7 | +04 09 20 | 0.116 | 0.893 | 34.4 | 141.4 | | 11.75 | 303.6 | 212 | -52 | -74 | 0.62 | 126 | +24 |
| 2017 02 06 | 060000 | 19 04 44.4 | +06 56 48 | 0.107 | 0.907 | 40.3 | 135.4 | | 13.73 | 303.1 | 217 | -47 | -74 | 0.73 | 140 | +37 |
| 2017 02 07 | 060000 | 18 44 04.6 | +10 08 19 | 0.099 | 0.921 | 46.9 | 128.5 | | 15.95 | 302.2 | 222 | -41 | -74 | 0.83 | 149 | +49 |
| 2017 02 08 | 060000 | 18 19 46.8 | +13 42 27 | 0.093 | 0.936 | 54.6 | 120.8 | | 18.26 | 300.9 | 226 | -34 | -74 | 0.90 | 146 | +61 |
| 2017 02 09 | 060000 | 17 51 27.8 | +17 33 00 | 0.088 | 0.950 | 63.1 | 112.2 | | 20.39 | 299.0 | 230 | -25 | -73 | 0.96 | 133 | +72 |
| 2017 02 10 | 060000 | 17 19 04.9 | +21 27 22 | 0.084 | 0.965 | 72.3 | 102.9 | | 21.99 | 296.2 | 233 | -17 | -73 | 0.99 | 116 | +76 |
| 2017 02 11 | 060000 | 16 43 11.1 | +25 07 22 | 0.083 | 0.979 | 82.0 | 93.2 | | 22.68 | 292.7 | 236 | -07 | -73 | 1.00 | 097 | +70 |
| 2017 02 12 | 060000 | 16 05 05.2 | +28 13 51 | 0.084 | 0.993 | 91.7 | 83.4 | | 22.29 | 288.4 | 239 | +02 | -72 | 0.98 | 078 | +60 |
| 2017 02 13 | 060000 | 15 26 42.1 | +30 33 26 | 0.087 | 1.008 | 101.1 | 74.1 | | 20.93 | 283.7 | 241 | +11 | -72 | 0.94 | 061 | +49 |
| 2017 02 14 | 060000 | 14 50 02.0 | +32 02 59 | 0.092 | 1.022 | 109.7 | 65.5 | | 18.94 | 278.9 | 244 | +20 | -72 | 0.89 | 047 | +38 |
| 2017 02 15 | 060000 | 14 16 35.7 | +32 48 32 | 0.098 | 1.036 | 117.4 | 57.8 | | 16.69 | 274.5 | 246 | +28 | -72 | 0.82 | 040 | +26 |
| 2017 02 16 | 060000 | 13 47 08.7 | +33 00 39 | 0.105 | 1.051 | 124.2 | 51.1 | | 14.48 | 270.5 | 248 | +34 | -71 | 0.74 | 040 | +15 |
| 2017 02 17 | 060000 | 13 21 46.3 | +32 50 08 | 0.114 | 1.065 | 130.1 | 45.3 | | 12.47 | 267.0 | 250 | +40 | -71 | 0.65 | 047 | +05 |
| 2017 02 18 | 060000 | 13 00 09.8 | +32 25 45 | 0.123 | 1.079 | 135.1 | 40.2 | | 10.71 | 264.1 | 252 | +45 | -71 | 0.55 | 058 | -06 |
| 2017 02 19 | 060000 | 12 41 49.6 | +31 53 42 | 0.133 | 1.094 | 139.5 | 35.9 | | 9.22 | 261.7 | 254 | +50 | -70 | 0.46 | 070 | -16 |
| 2017 02 20 | 060000 | 12 26 14.8 | +31 18 04 | 0.144 | 1.108 | 143.3 | 32.2 | | 7.97 | 259.6 | 256 | +54 | -70 | 0.37 | 083 | -27 |
| 2017 02 21 | 060000 | 12 12 57.1 | +30 41 22 | 0.155 | 1.122 | 146.6 | 29.0 | | 6.93 | 257.8 | 258 | +58 | -70 | 0.28 | 096 | -37 |
| 2017 02 22 | 060000 | 12 01 32.4 | +30 05 03 | 0.167 | 1.136 | 149.5 | 26.3 | | 6.06 | 256.3 | 260 | +61 | -69 | 0.19 | 109 | -48 |
| 2017 02 23 | 060000 | 11 51 41.0 | +29 29 58 | 0.179 | 1.150 | 151.9 | 23.9 | | 5.33 | 255.0 | 262 | +64 | -69 | 0.12 | 122 | -58 |
| 2017 02 24 | 060000 | 11 43 06.7 | +28 56 29 | 0.191 | 1.164 | 154.0 | 21.9 | | 4.72 | 253.8 | 264 | +66 | -69 | 0.06 | 135 | -67 |
| 2017 02 25 | 060000 | 11 35 36.7 | +28 24 47 | 0.203 | 1.179 | 155.8 | 20.2 | | 4.20 | 252.7 | 266 | +69 | -68 | 0.02 | 147 | -73 |
| 2017 02 26 | 060000 | 11 29 00.6 | +27 54 53 | 0.216 | 1.193 | 157.2 | 18.7 | | 3.76 | 251.7 | 269 | +71 | -68 | 0.00 | 156 | -71 |
| 2017 02 27 | 060000 | 11 23 10.0 | +27 26 43 | 0.229 | 1.207 | 158.4 | 17.6 | | 3.38 | 250.7 | 271 | +73 | -68 | 0.00 | 159 | -63 |
| 2017 02 28 | 060000 | 11 17 58.2 | +27 00 12 | 0.242 | 1.220 | 159.4 | 16.6 | | 3.05 | 249.8 | 274 | +75 | -67 | 0.03 | 153 | -52 |

***This is Data Output from the IAU Minor Planet Center***
***(Minor Planet & Comet Ephemeris Service)***
***George Observatory Code 735 – Sometimes the comet is not observable!***

# THE TECHNIQUES OF PREDICTING COMETS!

*How to plot a comet across the sky?*

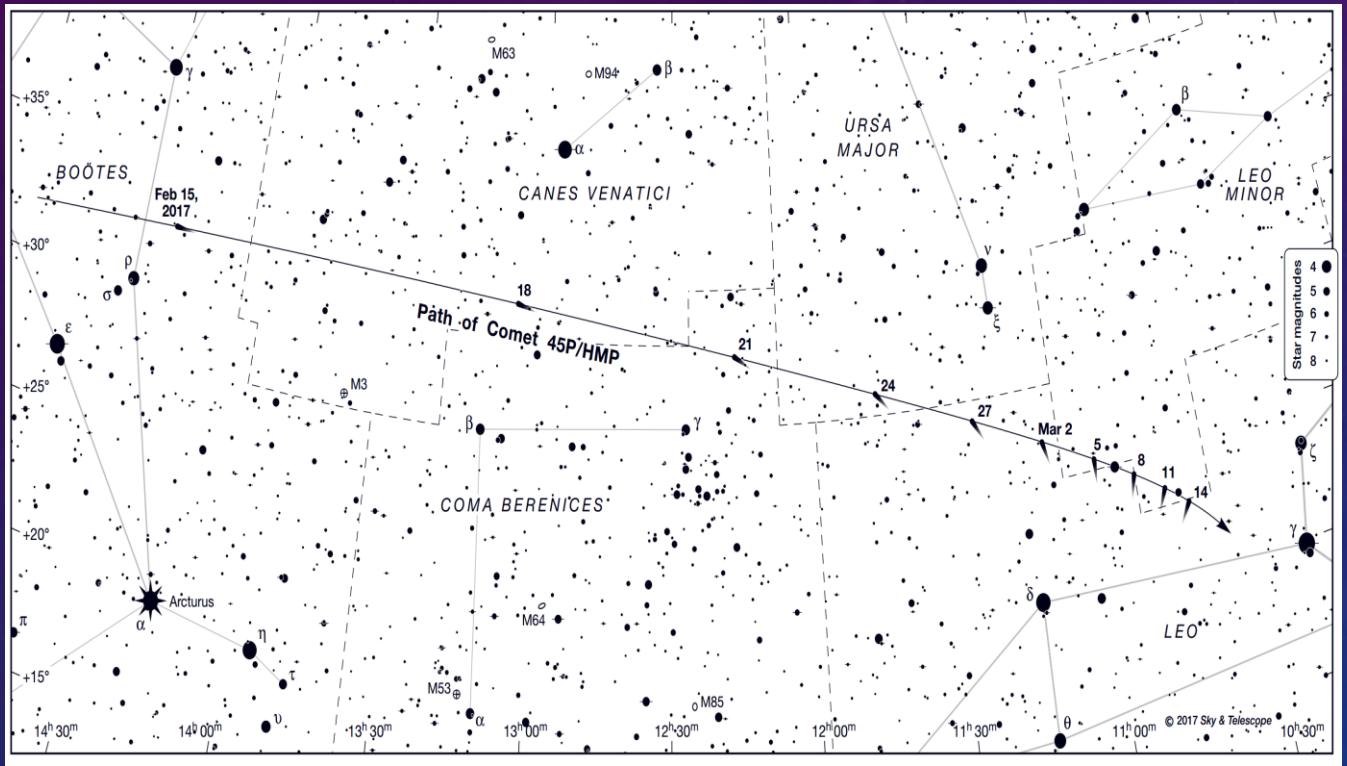


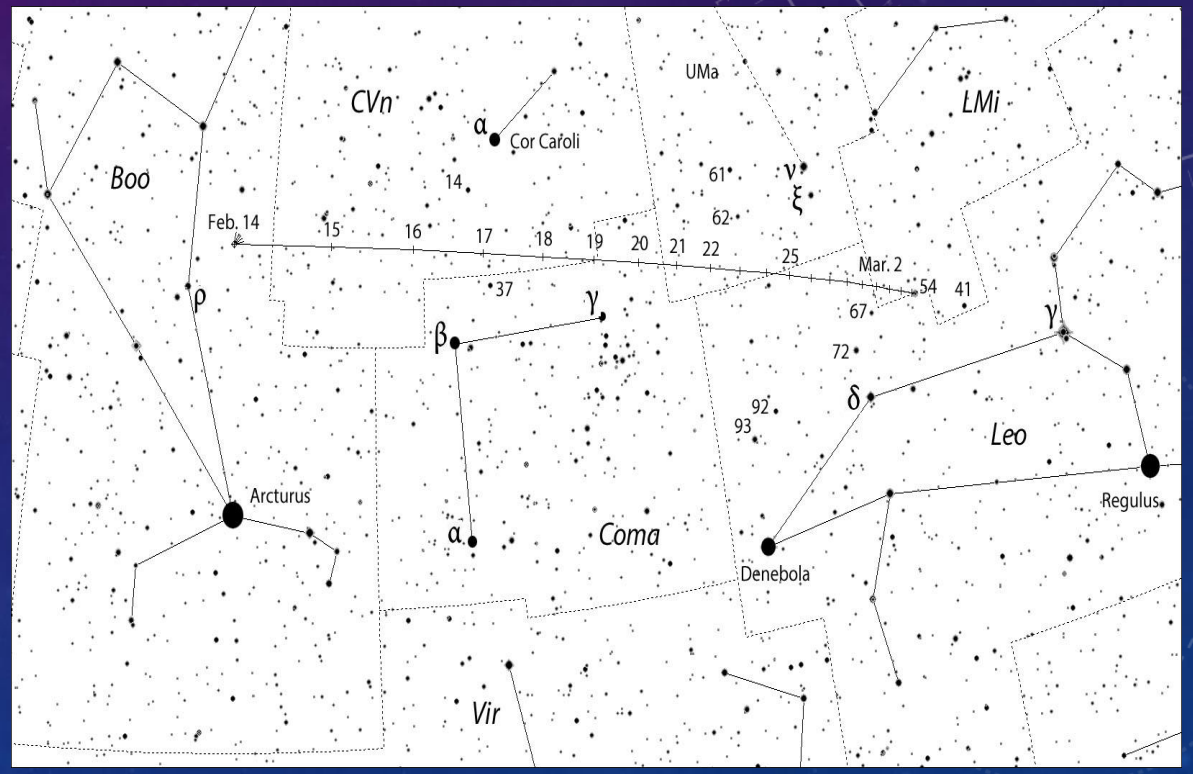




*A Good Sky Chart plotting the elements and a photometry profile for when it is the best range of dates to observe at maximum brightness or to chart the changes in brightness!*

# THE TECHNIQUES OF PREDICTING COMETS!

*How to plot a comet across the sky?*

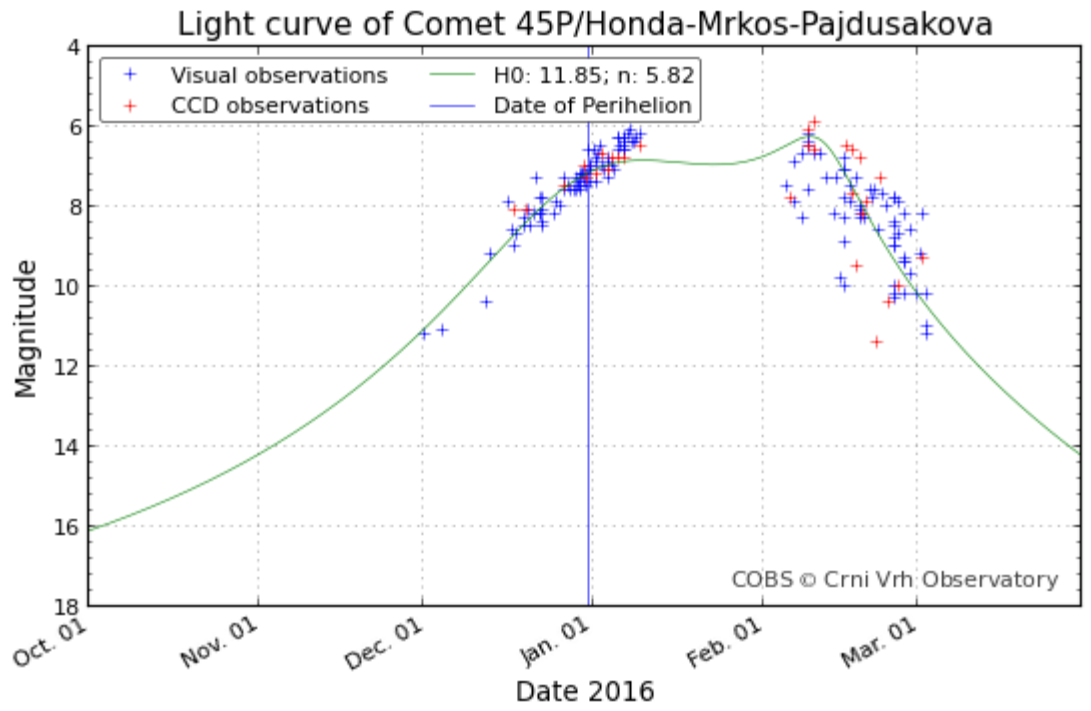


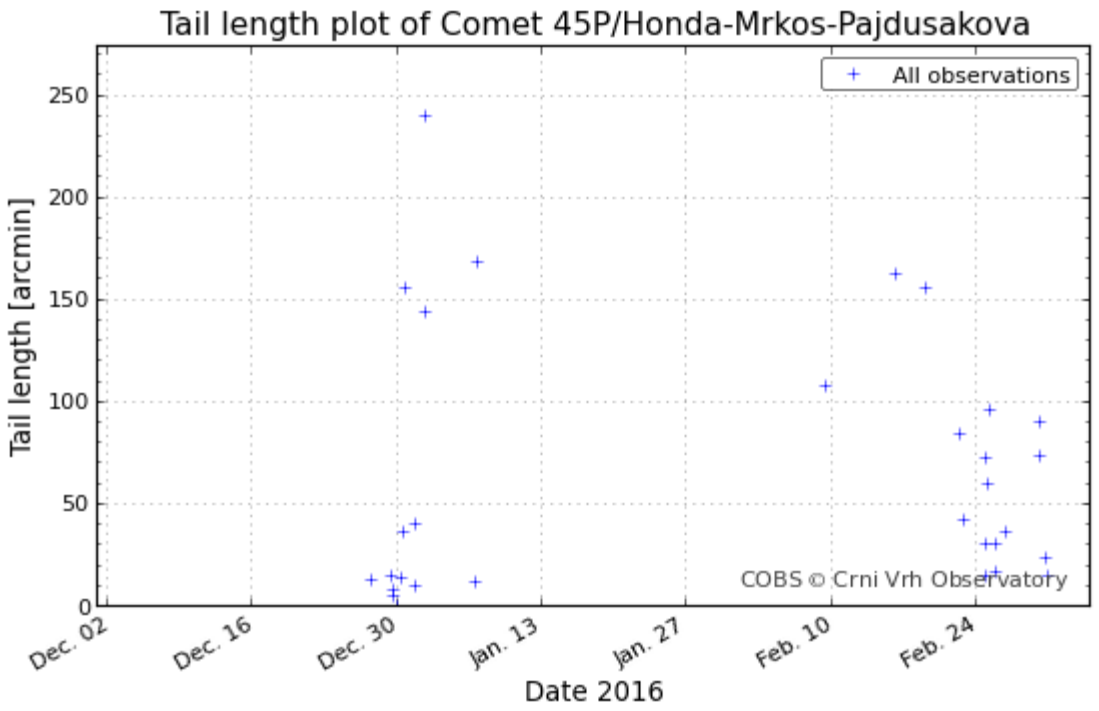




(Both Images) Courtesy: Sky & Telescope, 2017.

Comet: 45P/Honda – Mrkos – Pajdusakova
Perihelion: 31 December 2016 (0.533 AU – 79,736,800 km or 49,516,553 mi)
Perigee: 11 February 2017 (0.083 AU – 12,416,800 km or 7,710,833 mi)

# THE TECHNIQUES OF ANALYZING COMETS!



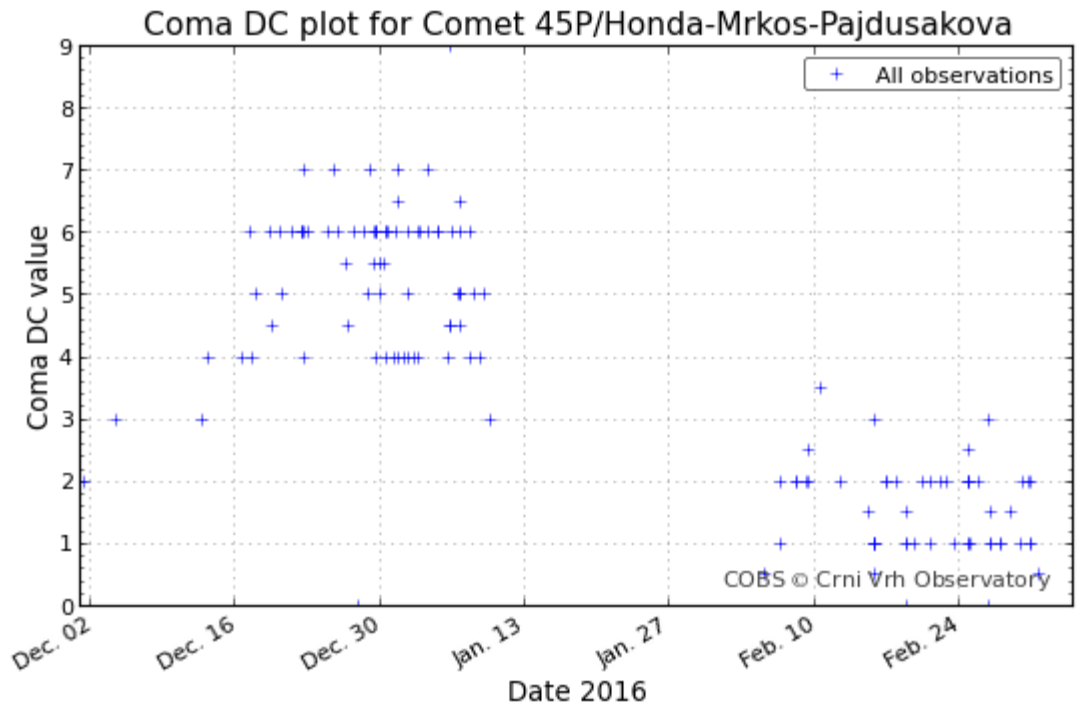



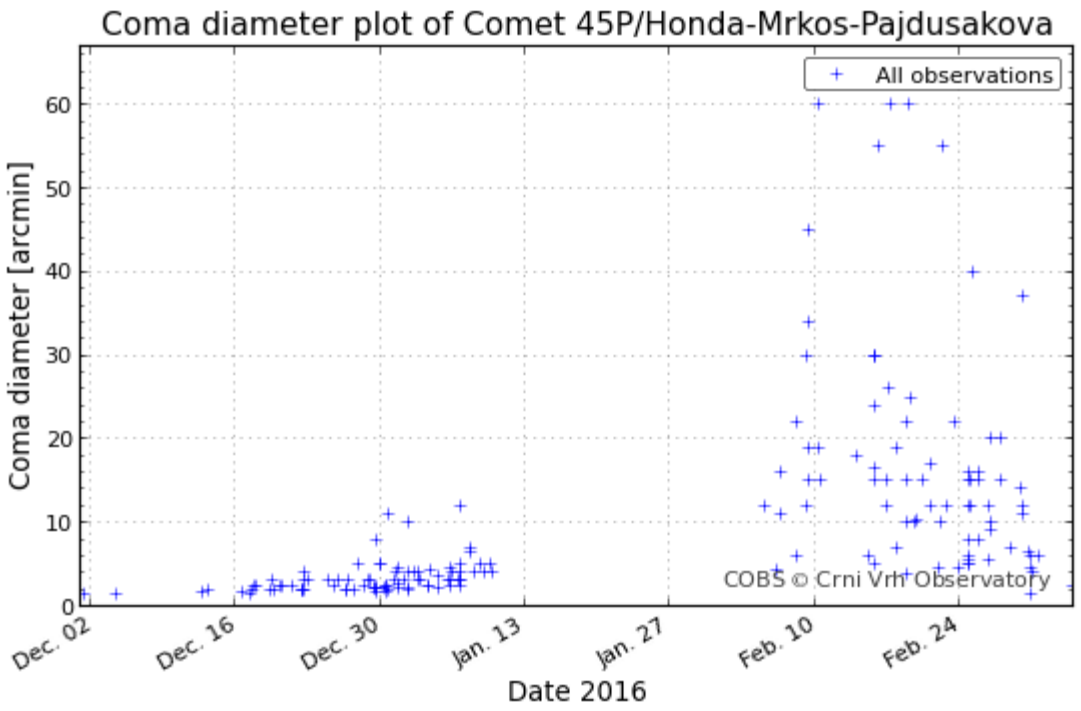

Many of the features to a comet can be plotted based on visual reports and photographic observations as indicated by the 'blue – colored' crosshairs in both of the charts above! Among the physical features that can be plotted as parameters that are distinct in the analysis of comets for predicting future behavior are the following: Light Curve, Tail Length, DC and Size of Coma, and the position angle for a comet!

Based on the plots above Comet 45P the visual reports are fitting with the predicted light curve and the reports of the tail length vary widely from 5 – 240 arcminutes. Note the gradual decrease in the reported tail length as the comet is now further past perihelion!

Courtesy: COBS (Comet Observations Database), http://www.cobs.si/analysis, Cache: 8 March, 2017, 2010.

# THE TECHNIQUES OF OBSERVING & ANALYZING COMETS!

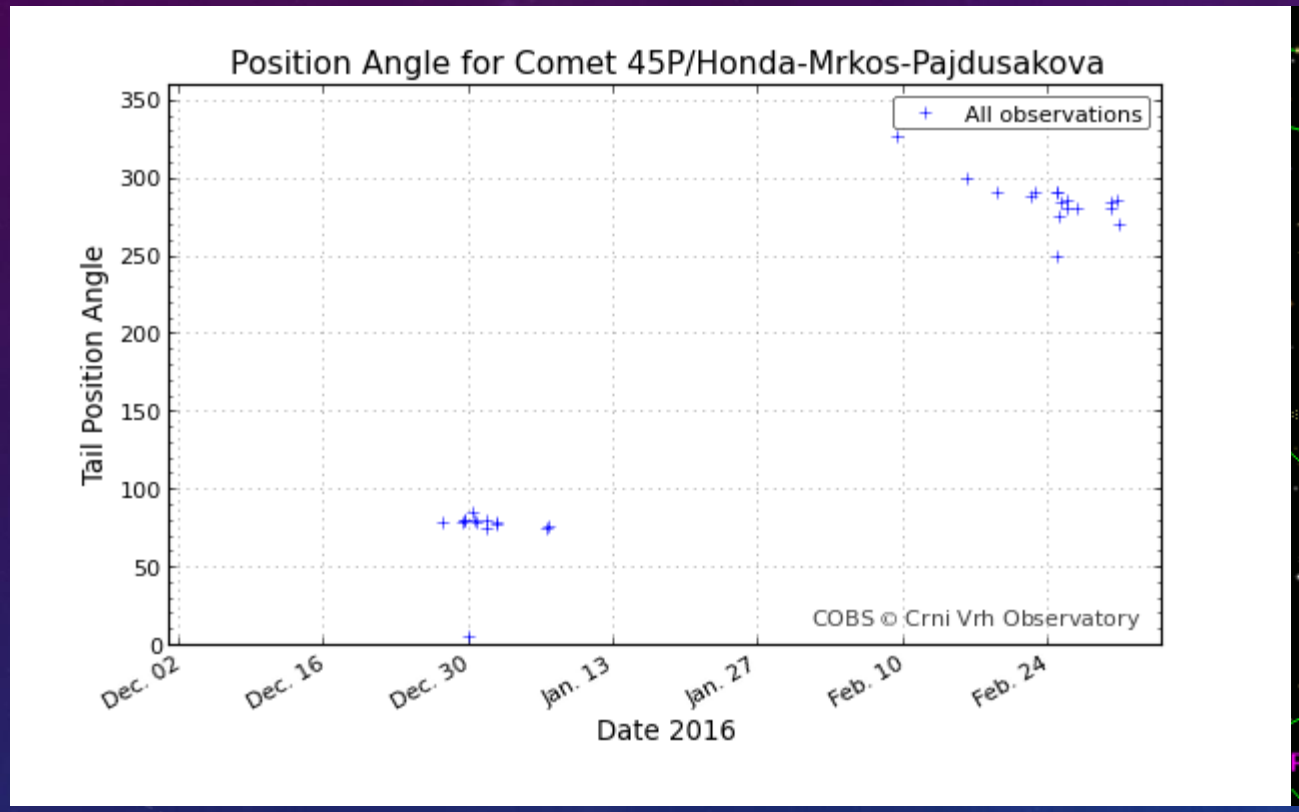


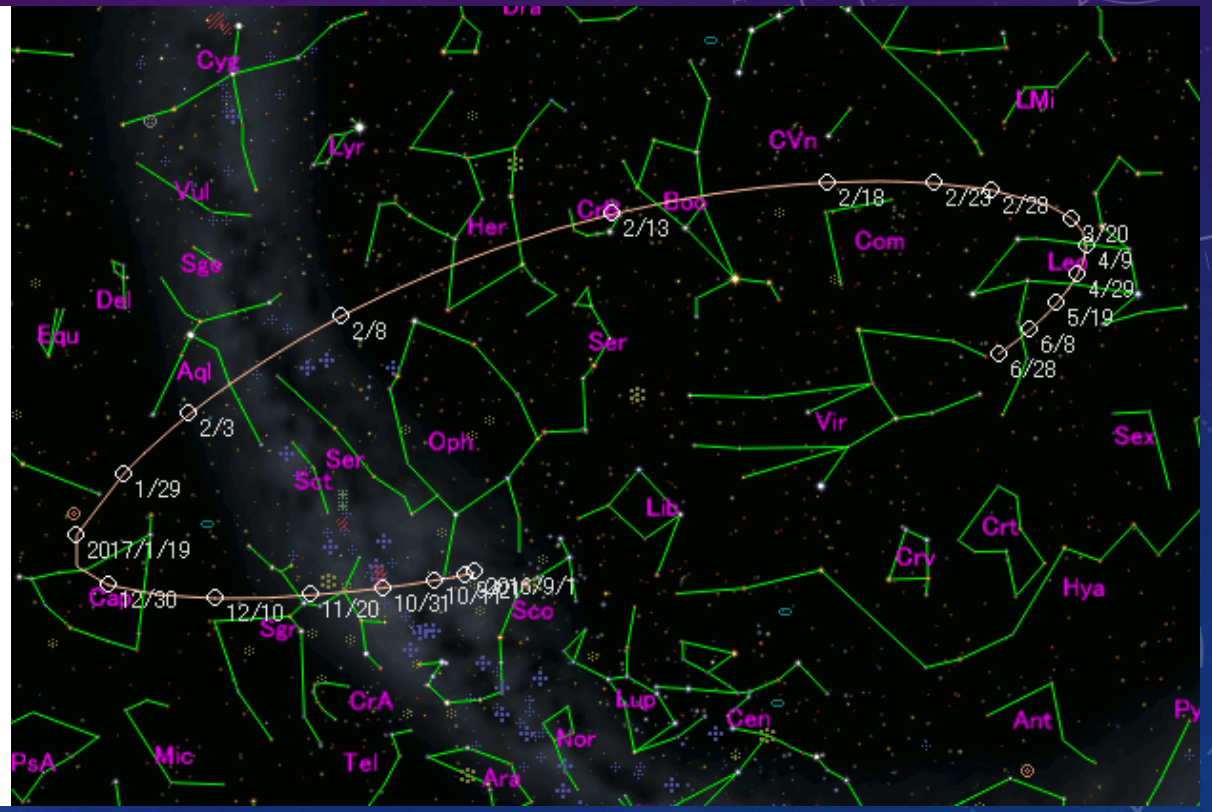




Be aware that the horizontal axis for these plots in spite of being designated as 'Date 2016' the dates above are plotted from 5 Dec 2016 through 20 Feb 2017! Based on the plots above Comet 45P before perihelion passage appeared to show a wide change in its coma structure with reports indicating DC values from 3 – 7 and 1 – 3.5 after perihelion passage while the Coma diameter appears to show a smaller diameter between 0.5 – 8 arcminutes before perihelion and sizes between 4 – 60 arcminutes after perihelion. These variations are likely due to human interpretation of visual observation and photographic analysis and the orientation of the comet in its orbit around the Sun with respect to the Earth's position in its orbit about the Sun! Maximum Coma Diameter of 60 minutes fits perfectly with 45P at perigee on 11 February 2017!

Courtesy: COBS (Comet Observations Database), http://www.cobs.si/analysis, Cache: 8 March, 2017, 2010.

# THE TECHNIQUES OF OBSERVING & ANALYZING COMETS!



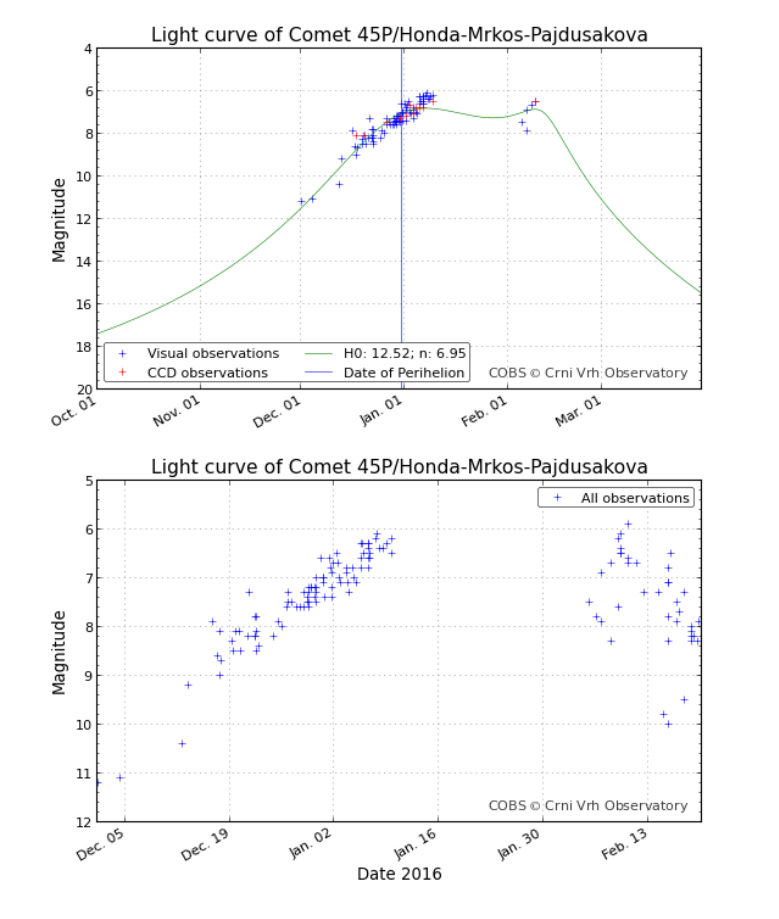




Comet 45P like any comet in which a tail is report can look towards the orientation of its tail with respect to the direction of the North Celestial Pole much the same way that the 'Position Angle' is applied to stellar binaries. Based on the few field reports plotted above the comet's P.A. (Position Angle) was fixed at a very, narrow range between 70 – 90 degrees indicated that with respect to the North Celestial Pole (NCP) the tale. The interpretation being that the tale was oriented in a eastward to east northeastward while travelling through the skies of the constellation of Capricornus prior to the time of perihelion passage!

In the time around and after perigee the P.A. changes to a range 250 – 325 degrees indicating a shift in the tails position from west southwestward just before and around perigee to being northwestward in the weeks after perigee while 45P continues to progress across the constellations of the Spring night sky!

Courtesy: COBS (Comet Observations Database), http://www.cobs.si/analysis, Cache: 22 February, 2017, 2010.

# THE TECHNIQUES OF OBSERVING & ANALYZING COMETS!




Comet: 45P/Honda – Mrkos – Pajdusakova

Visual Magnitude Projections & Predictions

**$m_1$ = 14.2 + 5 log d + 23.0 log r [ ,0] ( - 2016 Dec. 31)**
**$m_1$ = 12.0 + 5 log d + 15.0 log r [0, ] (2016 Dec. 31 - )**

**Delta (d) is the left column & r is the right column**

| Date | Delta | r | M1 |
|---|---|---|---|
| 12/24/2016 | 0.862 | 0.553 | 7.960214 |
| 12/25/2016 | 0.840 | 0.548 | 7.813349 |
| 12/26/2016 | 0.819 | 0.543 | 7.666816 |
| 12/27/2016 | 0.797 | 0.539 | 7.533833 |
| 12/28/2016 | 0.775 | 0.536 | 7.417299 |
| 12/29/2016 | 0.754 | 0.534 | 7.320306 |
| 12/30/2016 | 0.732 | 0.533 | 7.237281 |
| 12/31/2016 | 0.710 | 0.533 | 7.171018 |
| 1/1/2017 | 0.688 | 0.533 | 7.08885 |
| 1/2/2017 | 0.667 | 0.534 | 7.033748 |
| 1/3/2017 | 0.645 | 0.536 | 6.98527 |
| 1/4/2017 | 0.624 | 0.539 | 6.949754 |
| 1/5/2017 | 0.603 | 0.543 | 6.923584 |
| 1/6/2017 | 0.582 | 0.548 | 6.906323 |
| 1/7/2017 | 0.561 | 0.553 | 6.885691 |

| Date | Delta | r | M1 |
|---|---|---|---|
| 2/4/2017 | 0.126 | 0.879 | 6.661686 |
| 2/5/2017 | 0.116 | 0.893 | 6.585062 |
| 2/6/2017 | 0.107 | 0.907 | 6.511028 |
| 2/7/2017 | 0.099 | 0.921 | 6.44207 |
| 2/8/2017 | 0.093 | 0.936 | 6.411552 |
| 2/9/2017 | 0.088 | 0.950 | 6.388267 |
| 2/10/2017 | 0.084 | 0.965 | 6.389306 |
| 2/11/2017 | 0.083 | 0.979 | 6.457131 |
| 2/12/2017 | 0.084 | 0.993 | 6.575635 |
| 2/13/2017 | 0.087 | 1.008 | 6.749504 |
| 2/14/2017 | 0.092 | 1.022 | 6.960703 |
| 2/15/2017 | 0.098 | 1.036 | 7.186527 |
| 2/16/2017 | 0.105 | 1.051 | 7.429987 |
| 2/17/2017 | 0.114 | 1.065 | 7.694768 |
| 2/18/2017 | 0.123 | 1.079 | 7.944847 |

| | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 2016 | 12 | 24 | 060000 | 20 | 38 | 34.0 | -20 | 49 | 42 | 0.862 | 0.553 | 34.1 | 85.1 |
| 2016 | 12 | 25 | 060000 | 20 | 41 | 37.3 | -20 | 35 | 07 | 0.840 | 0.548 | 33.8 | 87.6 |
| 2016 | 12 | 26 | 060000 | 20 | 44 | 35.3 | -20 | 20 | 15 | 0.819 | 0.543 | 33.5 | 90.1 |
| 2016 | 12 | 27 | 060000 | 20 | 47 | 27.4 | -20 | 05 | 08 | 0.797 | 0.539 | 33.2 | 92.7 |
| 2016 | 12 | 28 | 060000 | 20 | 50 | 12.9 | -19 | 49 | 47 | 0.775 | 0.536 | 32.9 | 95.4 |
| 2016 | 12 | 29 | 060000 | 20 | 52 | 51.2 | -19 | 34 | 15 | 0.754 | 0.534 | 32.5 | 98.1 |
| 2016 | 12 | 30 | 060000 | 20 | 55 | 21.7 | -19 | 18 | 32 | 0.732 | 0.533 | 32.2 | 100.9 |
| 2016 | 12 | 31 | 060000 | 20 | 57 | 43.8 | -19 | 02 | 40 | 0.710 | 0.533 | 31.7 | 103.7 |
| 2017 | 01 | 01 | 060000 | 20 | 59 | 56.9 | -18 | 46 | 39 | 0.688 | 0.533 | 31.3 | 106.6 |
| 2017 | 01 | 02 | 060000 | 21 | 02 | 00.5 | -18 | 30 | 32 | 0.667 | 0.534 | 30.8 | 109.4 |
| 2017 | 01 | 03 | 060000 | 21 | 03 | 53.9 | -18 | 14 | 19 | 0.645 | 0.536 | 30.3 | 112.3 |
| 2017 | 01 | 04 | 060000 | 21 | 05 | 36.9 | -17 | 58 | 00 | 0.624 | 0.539 | 29.7 | 115.2 |
| 2017 | 01 | 05 | 060000 | 21 | 07 | 09.0 | -17 | 41 | 35 | 0.603 | 0.543 | 29.1 | 118.1 |
| 2017 | 01 | 06 | 060000 | 21 | 08 | 29.7 | -17 | 25 | 03 | 0.582 | 0.548 | 28.5 | 121.0 |
| 2017 | 01 | 07 | 060000 | 21 | 09 | 38.7 | -17 | 08 | 24 | 0.561 | 0.553 | 27.8 | 123.9 |

| | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 2017 | 02 | 04 | 060000 | 19 | 37 | 11.7 | +01 | 44 | 3 | 0.126 | 0.879 | 29.4 | 146.6 |
| 2017 | 02 | 05 | 060000 | 19 | 22 | 16.7 | +04 | 09 | 2 | 0.116 | 0.893 | 34.4 | 141.4 |
| 2017 | 02 | 06 | 060000 | 19 | 04 | 44.4 | +06 | 56 | 4 | 0.107 | 0.907 | 40.3 | 135.4 |
| 2017 | 02 | 07 | 060000 | 18 | 44 | 04.6 | +10 | 08 | 1 | 0.099 | 0.921 | 46.9 | 128.5 |
| 2017 | 02 | 08 | 060000 | 18 | 19 | 46.8 | +13 | 42 | 2 | 0.093 | 0.936 | 54.6 | 120.8 |
| 2017 | 02 | 09 | 060000 | 17 | 51 | 27.8 | +17 | 33 | 0 | 0.088 | 0.950 | 63.1 | 112.2 |
| 2017 | 02 | 10 | 060000 | 17 | 19 | 04.9 | +21 | 27 | 2 | 0.084 | 0.965 | 72.3 | 102.9 |
| 2017 | 02 | 11 | 060000 | 16 | 43 | 11.1 | +25 | 07 | 2 | 0.083 | 0.979 | 82.0 | 93.2 |
| 2017 | 02 | 12 | 060000 | 16 | 05 | 05.2 | +28 | 13 | 5 | 0.084 | 0.993 | 91.7 | 83.4 |
| 2017 | 02 | 13 | 060000 | 15 | 26 | 42.1 | +30 | 33 | 2 | 0.087 | 1.008 | 101.1 | 74.1 |
| 2017 | 02 | 14 | 060000 | 14 | 50 | 02.0 | +32 | 02 | 5 | 0.092 | 1.022 | 109.7 | 65.5 |
| 2017 | 02 | 15 | 060000 | 14 | 16 | 35.7 | +32 | 48 | 3 | 0.098 | 1.036 | 117.4 | 57.8 |
| 2017 | 02 | 16 | 060000 | 13 | 47 | 08.7 | +33 | 00 | 3 | 0.105 | 1.051 | 124.2 | 51.1 |
| 2017 | 02 | 17 | 060000 | 13 | 21 | 46.3 | +32 | 50 | 0 | 0.114 | 1.065 | 130.1 | 45.3 |
| 2017 | 02 | 18 | 060000 | 13 | 00 | 09.8 | +32 | 25 | 4 | 0.123 | 1.079 | 135.1 | 40.2 |

Perihelion: Date – 12/31/2016
Visual Mag. Predicted: 7.2
Perigee: Date – 2/11/2017
Visual Mag. Predicted: 6.46

Predicted Brightness Max. may differ from either date!
*(Visual Mag. 6.39 on 9 – 10 Feb 2017)*

# THE TECHNIQUES OF OBSERVING & ANALYZING COMETS!

## Actual Observations

### Around the time of Perihelion

Visual Report (Brightest Results)
$M_v$: 6.6 on 12/31/2016 @ 17:04 UTC
Yukihiro Sugiyama, Japan

CCD Report (Brightest Results)
$M_1$: 6.7 on 01/02/2017 @ 14:88 UTC
Artyom Novichonok, Kislovodsk, Russia
Software Use: Astrometrica 4.9
Star Catalogue: Tycho 2 Catalogue
CCD Imager with 0.4m f/5 refractor
Estimated Size of Coma: 4 arcminutes
Estimated DC: 4

### Around the time of Perigee

Visual Report (Brightest Results)
$M_v$: 6.7 on 2/11/2017 @ 12:48 UTC
Salvador Aguirre, Hermosillo, Sonora, Mexico

CCD Report (Brightest Results)
$M_1$: 5.9 on 02/10/2017 @ 12:00 UTC
Thomas Lehmann, Weimar, Germany
Star Catalogue: Tycho 2 Catalogue
CCD Imager with 10.2 cm F/5 refractor
Estimated Size of Coma: 60 arcminutes

## Comet: 45P/Honda – Mrkos – Pajdusakova

### Visual Magnitude Projections & Predictions

**$m_1$ = 14.2 + 5 log d + 23.0 log r [ ,0] ( - 2016 Dec. 31)**
**$m_1$ = 12.0 + 5 log d + 15.0 log r [0, ] (2016 Dec. 31 - )**

**Delta (d) is the left column & r is the right column**

| Date | Delta | r | M1 |
|---|---|---|---|
| 12/24/2016 | 0.862 | 0.553 | 7.960214 |
| 12/25/2016 | 0.840 | 0.548 | 7.813349 |
| 12/26/2016 | 0.819 | 0.543 | 7.666816 |
| 12/27/2016 | 0.797 | 0.539 | 7.533833 |
| 12/28/2016 | 0.775 | 0.536 | 7.417299 |
| 12/29/2016 | 0.754 | 0.534 | 7.320306 |
| 12/30/2016 | 0.732 | 0.533 | 7.237281 |
| 12/31/2016 | 0.710 | 0.533 | 7.171018 |
| 1/1/2017 | 0.688 | 0.533 | 7.08885 |
| 1/2/2017 | 0.667 | 0.534 | 7.033748 |
| 1/3/2017 | 0.645 | 0.536 | 6.98527 |
| 1/4/2017 | 0.624 | 0.539 | 6.949754 |
| 1/5/2017 | 0.603 | 0.543 | 6.923584 |
| 1/6/2017 | 0.582 | 0.548 | 6.906323 |
| 1/7/2017 | 0.561 | 0.553 | 6.885691 |

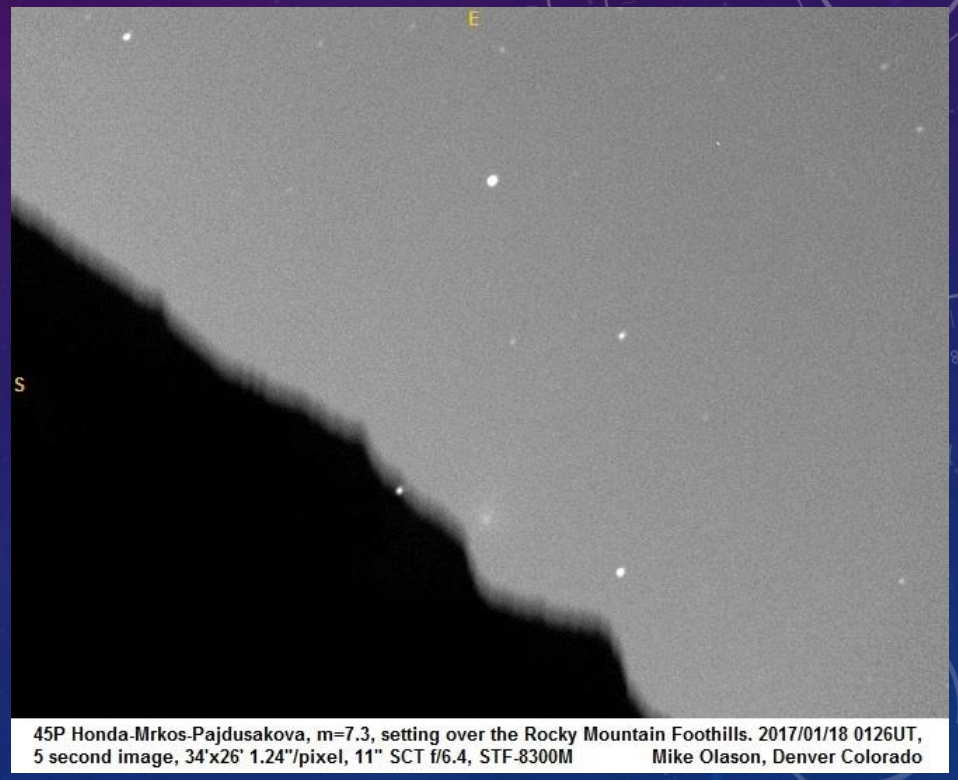
| Date | Delta | r | M1 |
|---|---|---|---|
| 2/4/2017 | 0.126 | 0.879 | 6.661686 |
| 2/5/2017 | 0.116 | 0.893 | 6.585062 |
| 2/6/2017 | 0.107 | 0.907 | 6.511028 |
| 2/7/2017 | 0.099 | 0.921 | 6.44207 |
| 2/8/2017 | 0.093 | 0.936 | 6.411552 |
| 2/9/2017 | 0.088 | 0.950 | 6.388267 |
| 2/10/2017 | 0.084 | 0.965 | 6.389306 |
| 2/11/2017 | 0.083 | 0.979 | 6.457131 |
| 2/12/2017 | 0.084 | 0.993 | 6.575635 |
| 2/13/2017 | 0.087 | 1.008 | 6.749504 |
| 2/14/2017 | 0.092 | 1.022 | 6.960703 |
| 2/15/2017 | 0.098 | 1.036 | 7.186527 |
| 2/16/2017 | 0.105 | 1.051 | 7.429987 |
| 2/17/2017 | 0.114 | 1.065 | 7.694768 |
| 2/18/2017 | 0.123 | 1.079 | 7.944847 |

Perihelion: Date – 12/31/2016
Visual Mag. Predicted: 7.2
Perigee: Date – 2/11/2017
Visual Mag. Predicted: 6.46

Predicted Brightness Max. may differ from either date!
*(Visual Mag. 6.39 on 9 – 10 Feb 2017)*

# THE TECHNIQUES OF OBSERVING & ANALYZING COMETS!

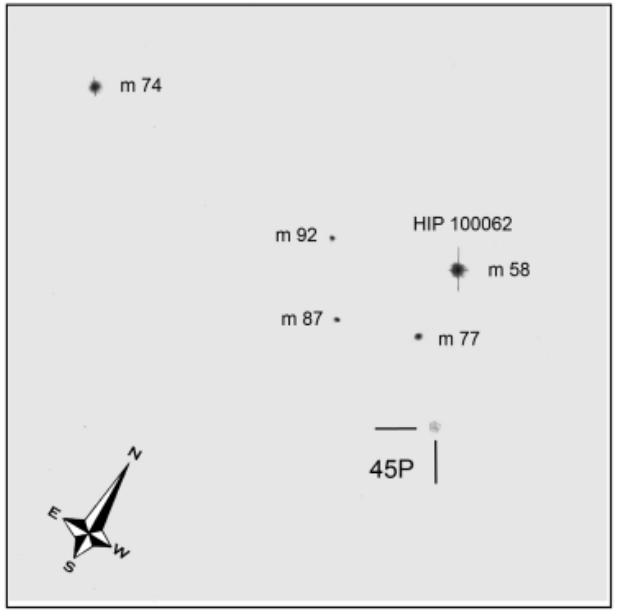
Comet: 45P/Honda – Mrkos – Pajdusakova



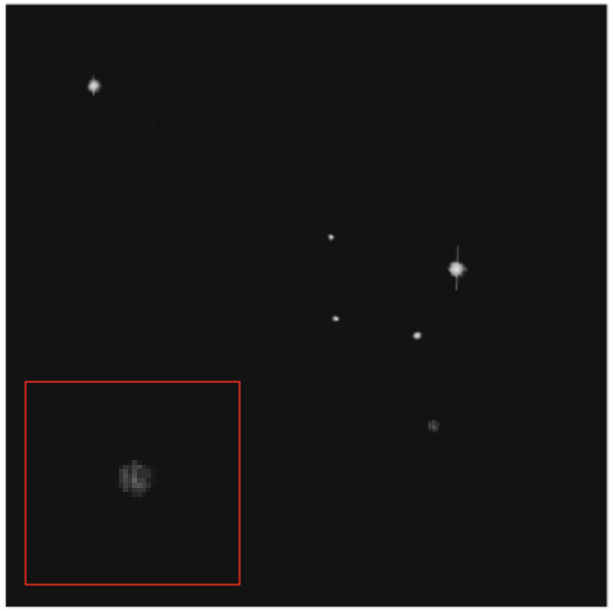

*Here are two images of taken of comet 45P over a period of 7 months 18 days where the reported brightness continues to fade by time of night when the comet will rise and the changes in visual magnitude for the comet. Notice the left image shows 45P with a distinct condensed, greenish coma an a long dust tail with no foreshortening effect. The right image was taken in the early morning hours before sunrise with a fading coma against the twilight and not so visible tail.*

# THE TECHNIQUES OF OBSERVING & ANALYZING COMETS!

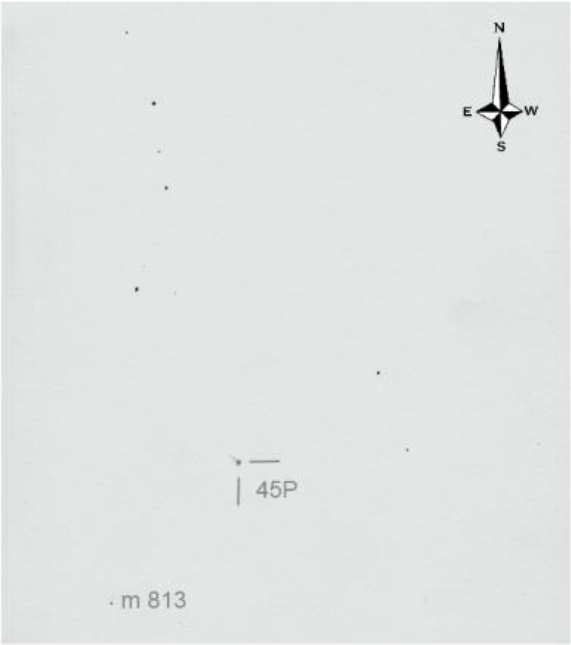
Comet: 45P/Honda – Mrkos – Pajdusakova



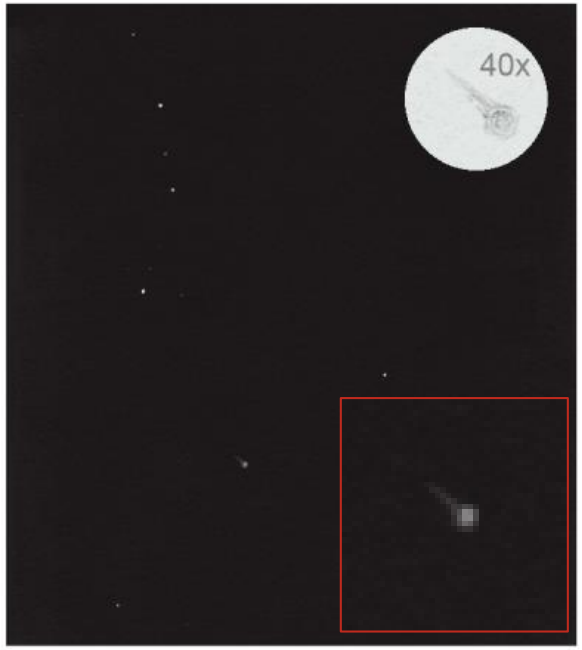

45P (Honda-Mrkos-Pajdusakova)
Bino Vixen 2x126mm 25x



17/12/2016 17h40 UTC
FOS : 60' - Michel Deconinck




45P (Honda-Mrkos-Pajdusakova)
Bino Vixen 2x126mm 25x & 40x

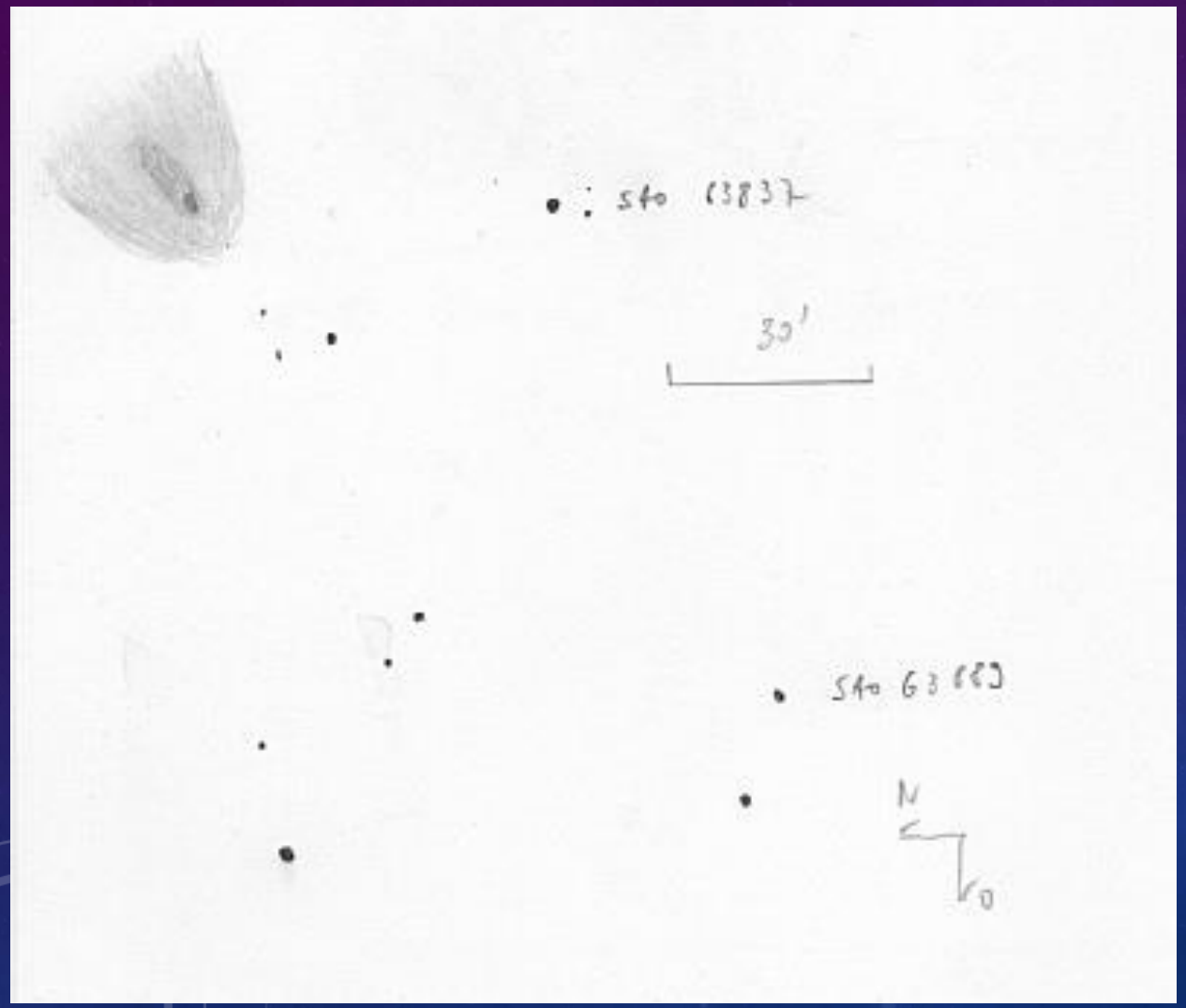



27/12/2016 17h50 UTC
FOS : 60' - Michel Deconinck

*Note the drawings by amateur astronomer Michael Doconinck. Each images has a 'field of view' equal to 60' or 60 arcminutes (about two, average full Moon widths) across. The two images have a time separation of 10 days with the coma on the left lacking both an inner brightness nor is there any indication of a false nucleus. The DC for the coma in the left image is equal to a value of 1 while in the right image the DC values increases to about 2 or 3 depending on how you classify the centralization of brightness from the rest of the coma. Also notice that the tail is now visible in this image with the tail length being less than 1 arcminute in length.*

# THE TECHNIQUES OF OBSERVING & ANALYZING COMETS!

Comet: 45P/Honda – Mrkos – Pajdusakova




*Courtesy*
*of*
*Uwe Pilz*
*Leipzing, Germany*
*17 February 2017*

*Here is the difference with 45P in the middle of February 2017 with the outer coma extending outwards with a greatly extended, inner coma both showing a bow shock effect as the comet plunges through the inner solar system at a top speed of 55.113 km/s (34.225 mi/s) at perihelion on 31 December 2016. The comet in this sketch was made during the time of perigee passage at a velocity 36.851 km/s (22.884 mi/s). The passage across the sky at the time of this sketch peaked at 22.68 "/min around 11 February at it's closest approach to Earth!*

*Foreshortening values for the Tail of 45P:*

*1 Jan 2017 – 4%*
*15 Jan 2017 – 43%*
***27 Jan 2017 – 79%*** ***(Maximum Effect)***
*1 Feb 2017 – 65%*

*11 - 12 Feb 2017 - 0% (No Tail Visible)*
*1 Mar 2017 – 72%*
***4 – 7 Mar 2017 – 75%***
*1 Apr 2017 – 61%*

*15 Apr 2017 – 57%*
*1 June 2017 – 57%*

*(22 April to 23 May) 2017 – 55%*

# LETS GO PICK SOME COMETS!

41P/Tuttle – Giacobini – Kresak

*26 March 2017*

*Roland Fichtl*

*Discoverers: Horace Parnell Tuttle*
*Michel Giacobini*
*Ľubor Kresák*

Discovery Date (Original) : 3 May 1858 (Tuttle)
Rediscovery Dates: 1 June 1907 (Giacobini)
24 April 1951 (Kresák)

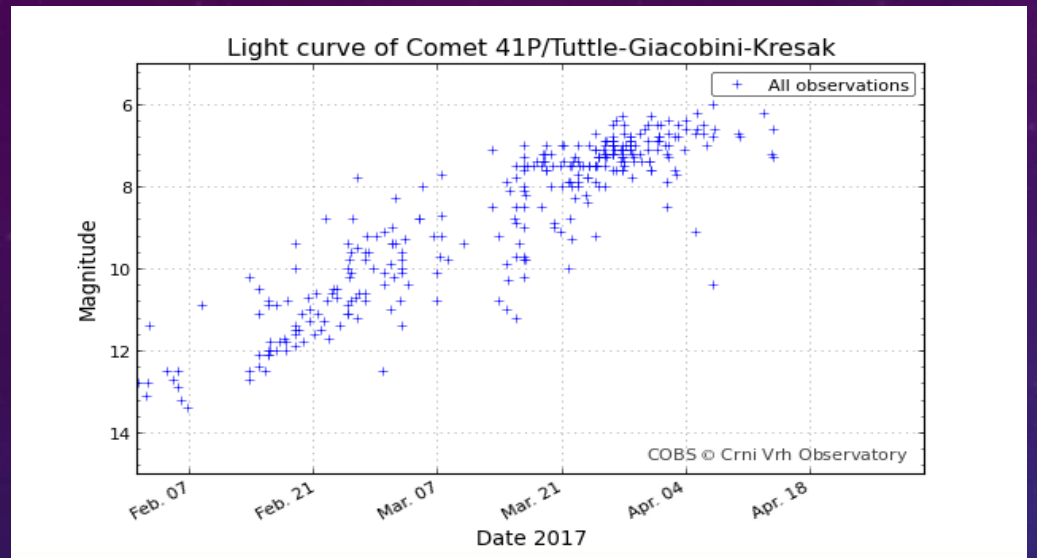
**Instruments: 15 inch refractor (1858)**
*(Great Harvard Observatory, Cambridge, Massachusetts, USA)*
**30 inch refractor (1907)**
*(Nice Observatory, Mont Gros, Nice, France)*
**60 cm Zeiss Parabolic reflector w/ Maksutov Camera (1951)**
*(Skalnaté Pleso Observatory, Modern Day Solvakia, EU)*

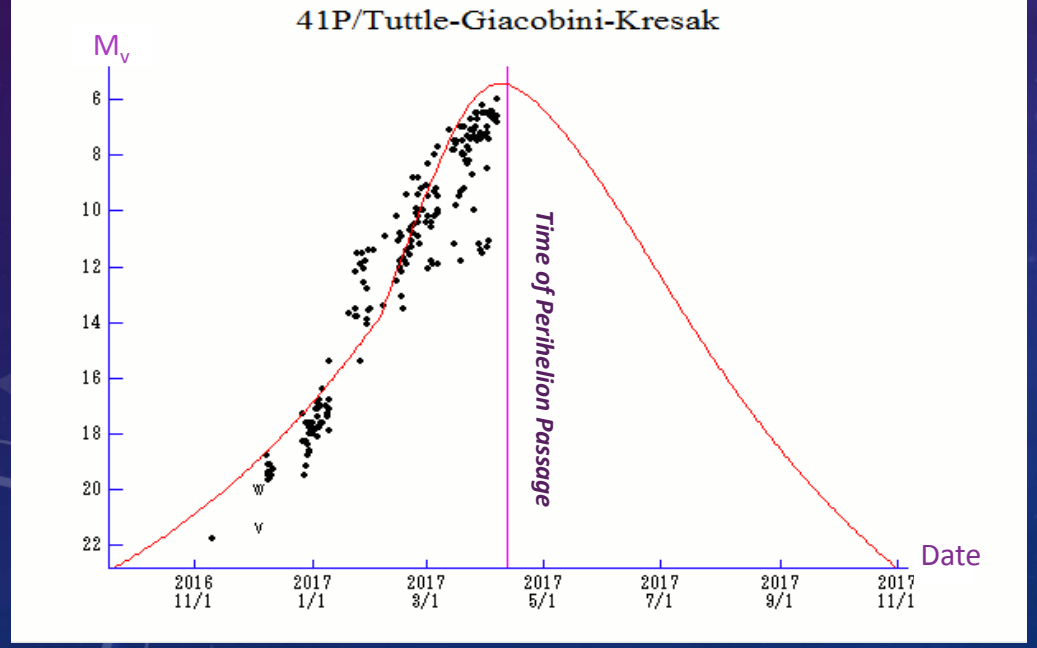
Epoch (Time – based reference point): 6 March 2006
Aphelion: 5.122 AU
Perihelion: 1.048 AU
Semi – Major Axis: 3.085 AU
Eccentricity: 0.6604 (Very Elliptical Orbit)
Orbital Inclination: $9.2294^0$ or ($9^0$ 13' 45.84")
Minimum Orbital Intersection Distance (MOID)

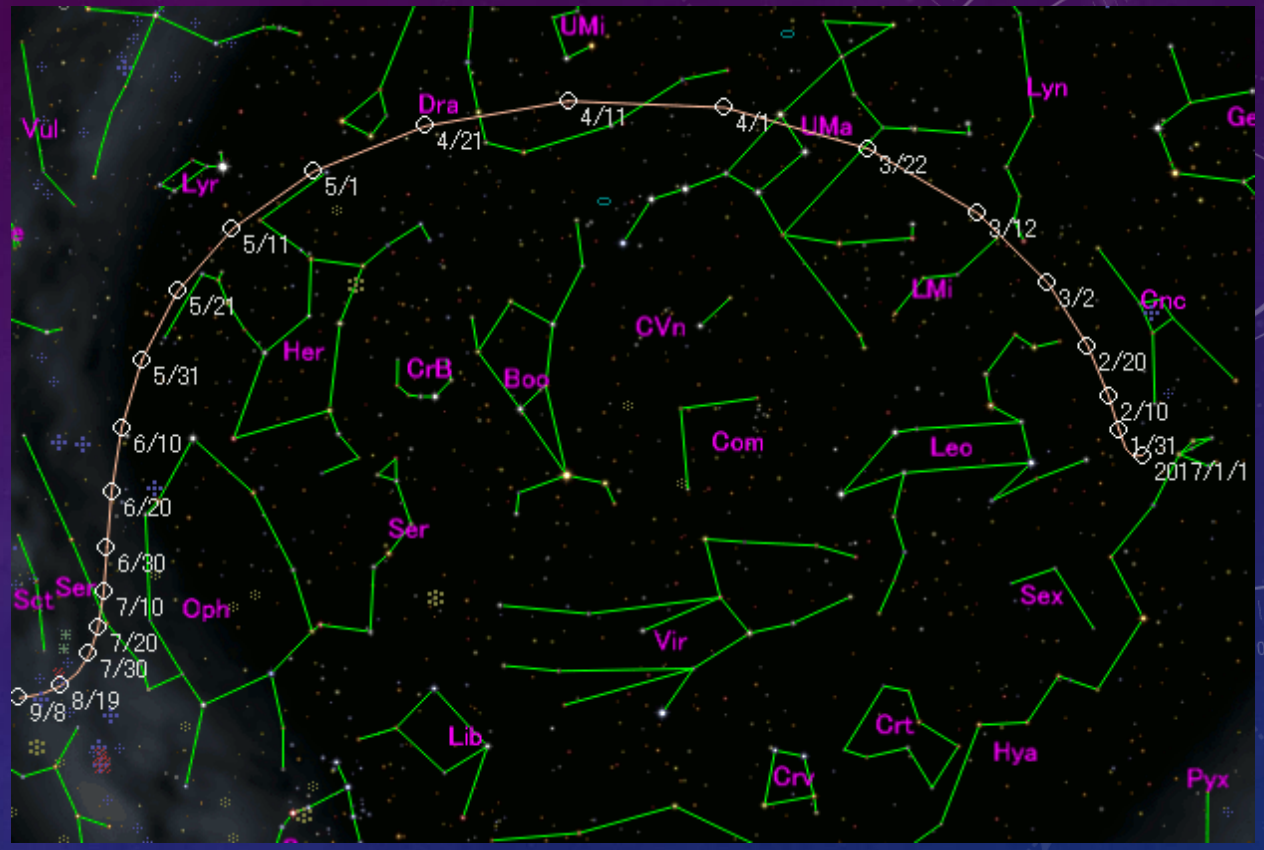
- *Perigee – 0.13 AU*
- *Perijove (closest distance to Jupiter) – 0.48 AU*

*Next Perihelion Date: 12 April 2017*

# LETS GO PICK SOME COMETS!




## Visual Magnitude Projections & Predictions

| | | |
|---|---|---|
| $m_1 = 13.5 + 5 \log d + 18.0 \log r$ | *[ ,-65] | ( - 2017 Feb. 7) |
| $m_1 = 8.5 + 5 \log d + 55.0 \log r$ | *[-65, 0] | (2017 Feb. 7 - 2017 Apr. 13) |
| $m_1 = 9.0 + 5 \log d + 30.0 \log r$ | *[ 0, ] | (2017 Apr. 13 - ) |

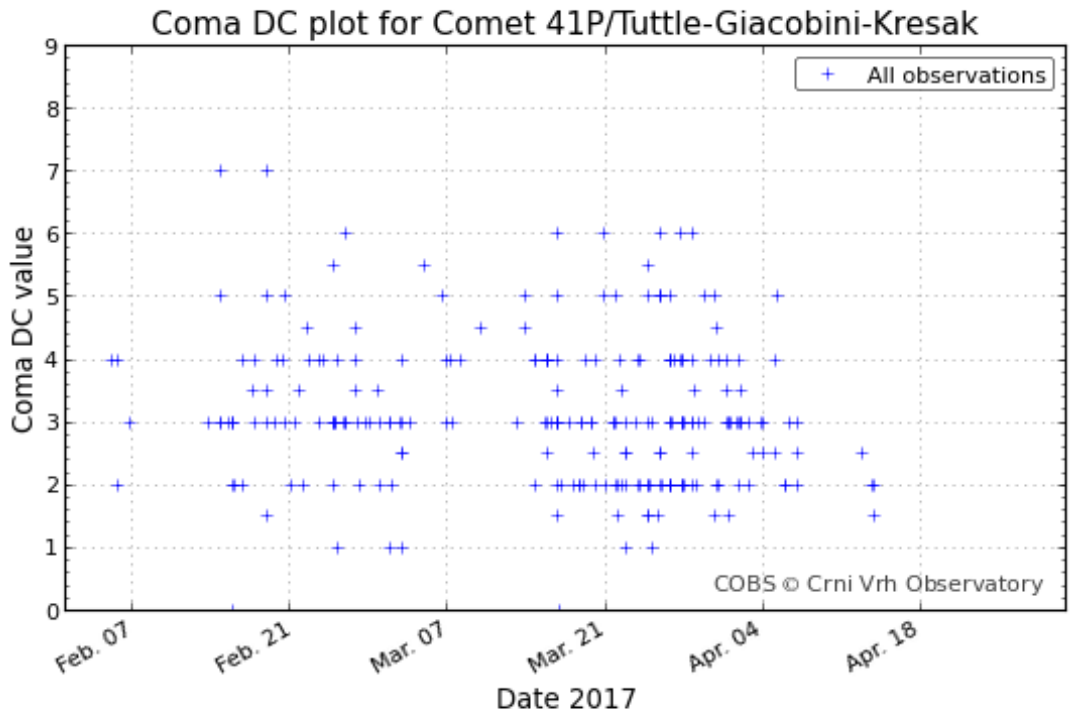
Time of Perigee Passage: 0.142 AU on (30 March – 3 April) 2017
(21,242,897.6 km or 13,199,684.8 mi)

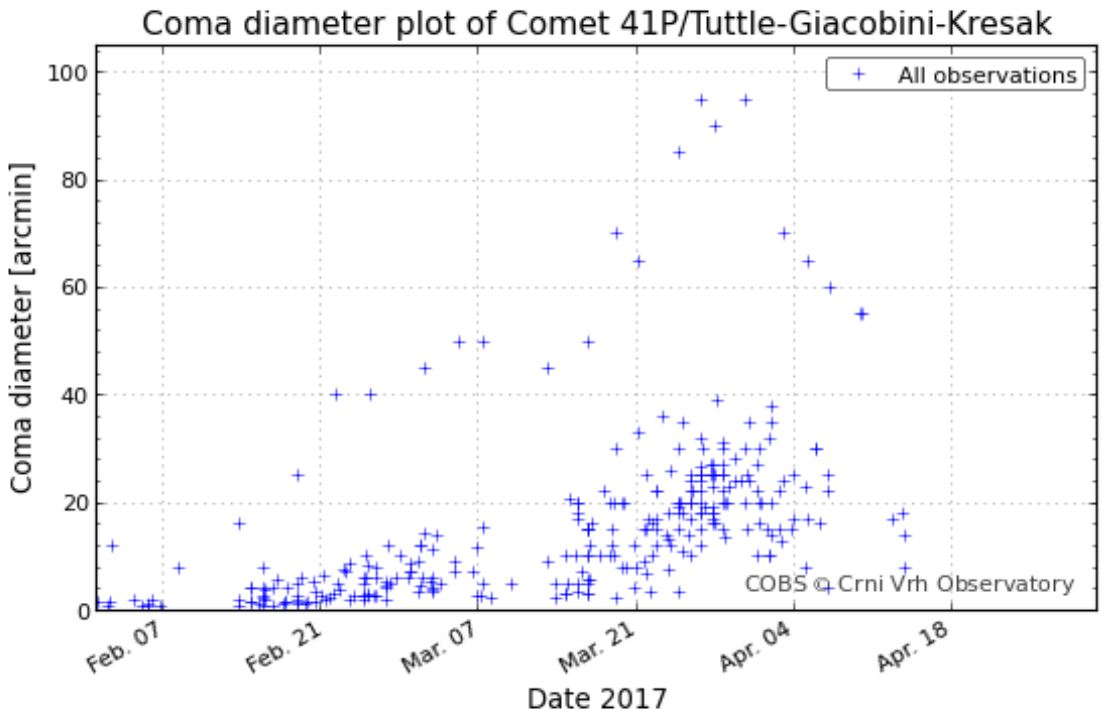
Time of Perihelion Passage: 1.045 AU on (11 – 14) April 2017
(156,329,774.9 km or 97,138,525.6 mi)

Predicted Brightest Visual Mag.: 6.6 on (4 – 11) April 2017

*Note that the square brackets above indicate the days (-) before perihelion and (+) after perihelion. Day 0 is the central date of perihelion passage!

# LETS GO PICK SOME COMETS!



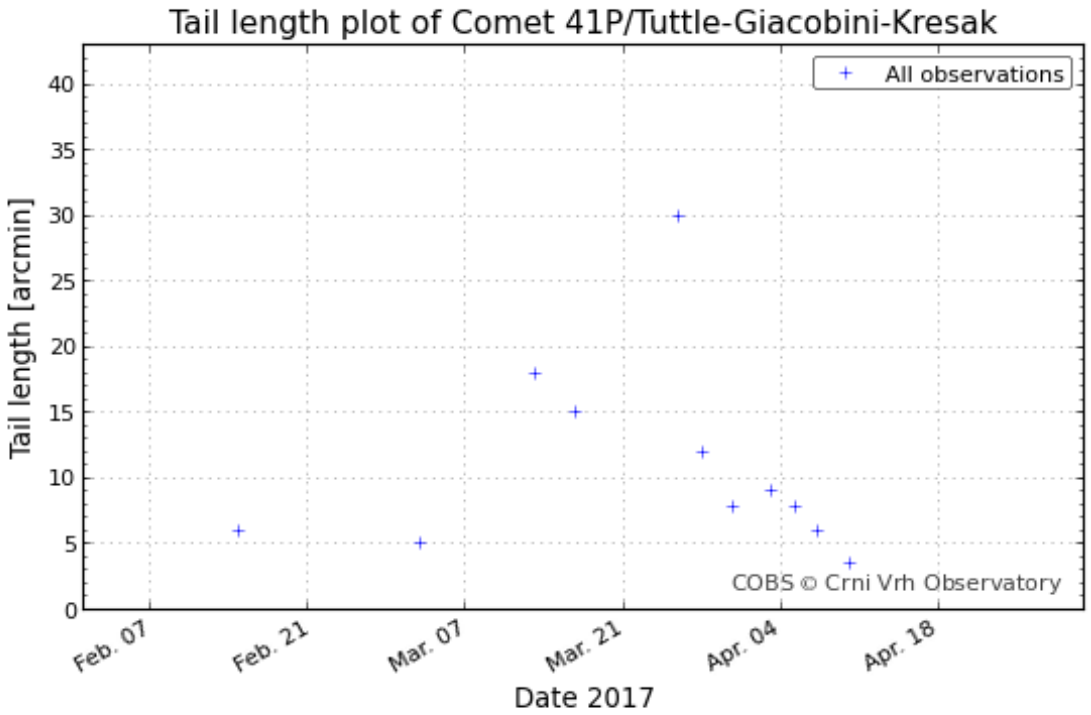

Note that the most important component to any comet is it's coma. It is the most distinguishing physical property for any comet being the first and last parameter to be observed, photographed, studied, and analyzed! The two important characteristics of any coma is the DC and Coma diameter (although it is measured in arcminutes).

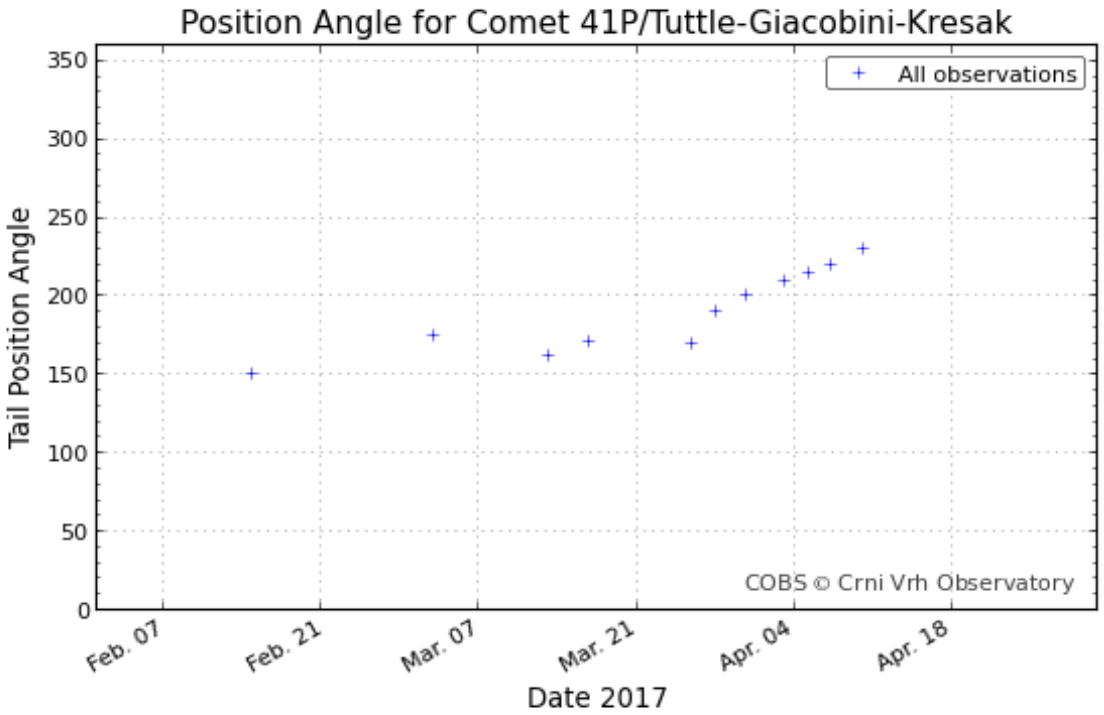
Courtesy: COBS (Comet Observations Database), http://www.cobs.si/analysis, Cache: 14 April 2017, 2010.

*DC for Comet 41P has been reported from wide range of values (1 – 6) with the most of visual reports giving the coma a DC of 3 - 4 which indicates a bright outer coma with a brighter and more distinguishable inner coma.* ***Note that comets can easily revert back to their original state as observed upon there journey towards the Sun and progressing away from the Sun****. The coma diameter field reports are in two distinct categories with larger diameter range of (41 – 90) arcminutes and a smaller diameter range of 0.5 – 39.5 arcminutes). The majority of field reports in the statistical distribution of the data places the coma diameter in the smaller range of size. Note the decreasing range of Coma diameter values on the upper limit from 70 – 56 arcminutes as the comet begins it's journey beyond the inner solar system!*

**The overall normalized average is roughly 20 arcminutes making the whole coma about 2/5 the size of an average full Moon!**

# LETS GO PICK SOME COMETS!



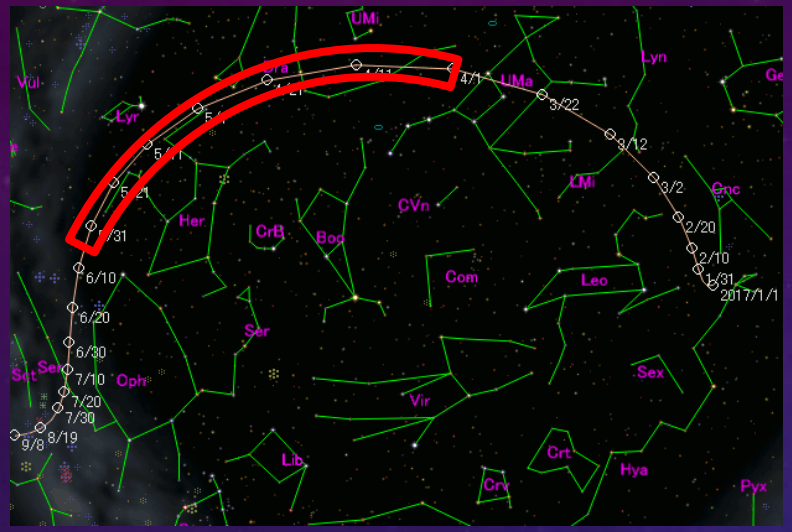

The two fundamental parameters in the analysis of a comet's tail: Tail length and Position Angle. Not all comet will show any tail of tail(s) that are visible from Earth due to the foreshadowing effect in which the orientation of a comet's tail can be positioned at a right angle to the orbital plane or the cross sectional face of the Earth or face in the opposite direction depending on the conditions of the solar wind.

*There is a limited number of field reports (both Visual and CCD images) of the comet's tail and PA which is measured in the same technique as double stars with respect to the North Celestial Pole. The Tail length from the handful of confirmed reports indicate that the tail prior to reaching either perigee or perihelion reached a presumed peak of 30 arcminutes. Most of the data has the tail confirmed to lengths of 5 – 10 arcminutes with a gradual decline from 8 – 4 arcminutes around the time of perigee and perihelion passages. The PA for the tail has been generally consistent between (150° - 230°). This shows the tail shifting from a SE to SW orientation prior to and during the times of perigee and perihelion passages.*

**Around the period of perihelion passage the foreshortening will be minimum of only 6% during and overlapping with the dates of 12 – 22 April!**

Courtesy: COBS (Comet Observations Database), http://www.cobs.si/analysis, Cache: 14 April 2017, 2010.

# LETS GO PICK A COMET!

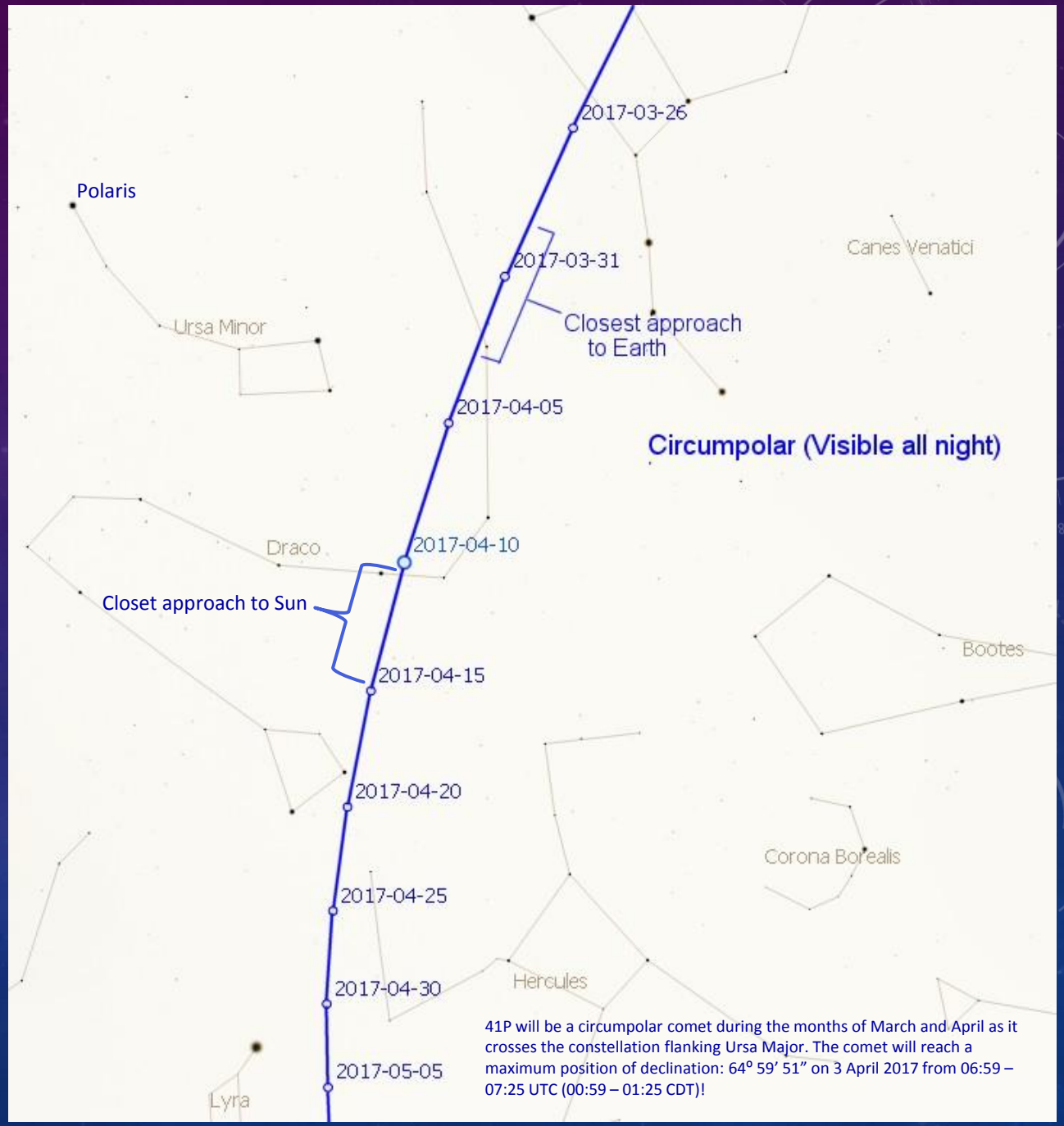



## Brightness Projections

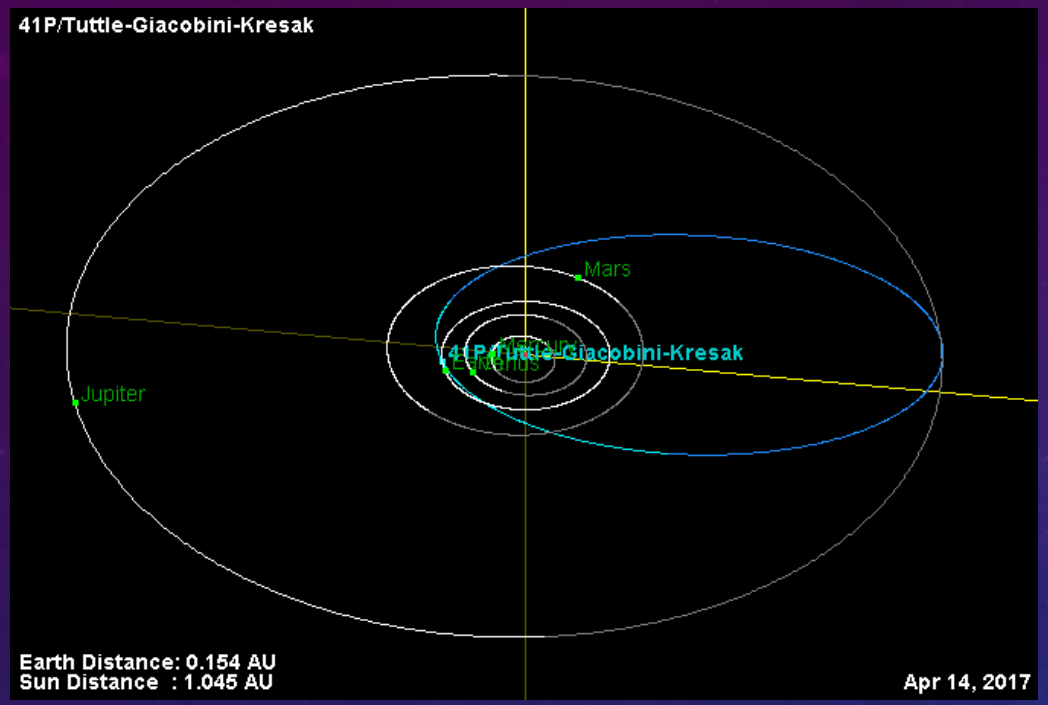
$m_1 = 13.5 + 5 \log d + 18.0 \log r$ [ ,-65] ( - 2017 Feb. 7)
$m_1 = 8.5 + 5 \log d + 55 \log r$ [-65, 0] (2017 Feb. 7 - 2017 Apr. 13)
$m_1 = 9.0 + 5 \log d + 30 \log r$ [ 0, ] (2017 Apr. 13 - )

## Progression Rate Across the Sky!

| | P.A. | "/min | | P.A. | "/min |
|---|---|---|---|---|---|
| April 10 | 117.5 | 4.35 | April 19 | 139.3 | 3.51 |
| April 11 | 120.7 | 4.26 | April 20 | 141.0 | 3.41 |
| April 12 | 123.7 | 4.17 | April 21 | 142.6 | 3.32 |
| April 13 | 126.5 | 4.08 | April 22 | 144.1 | 3.23 |
| April 14 | 129.0 | 3.99 | April 23 | 145.6 | 3.14 |
| April 15 | 131.4 | 3.89 | April 24 | 147.0 | 3.03 |
| April 16 | 133.6 | 3.80 | April 25 | 148.4 | 2.97 |
| April 17 | 135.6 | 3.70 | April 26 | 149.7 | 2.89 |
| April 18 | 137.5 | 3.60 | April 27 | 151.0 | 2.81 |



# LETS GO PICK A COMET!




JPL Small-Body Database Browser

Search: [ help ]

**41P/Tuttle-Giacobini-Kresak**

**Classification:** Jupiter-family Comet [NEO] **SPK-ID:** 1000100

[ Ephemeris | Orbit Diagram | Orbital Elements | Physical Parameters | Discovery Circumstances | Close-Approach Data ]

[ show orbit diagram ]

alternate orbits: [epoch=2017-Feb-08.0] K171/6 (default)

**Orbital Elements at Epoch 2457792.5 (2017-Feb-08.0) TDB**
**Reference: JPL K171/6 (heliocentric ecliptic J2000)**

| Element | Value | Uncertainty (1-sigma) | Units |
|---|---|---|---|
| e | .661107654554002 | 1.055e-05 | |
| a | 3.083754999212291 | 9.3176e-05 | au |
| q | 1.045060964463875 | 1.4592e-06 | au |
| i | 9.230323900505534 | 0.00011309 | deg |
| node | 141.0730263457265 | 2.1395e-05 | deg |
| peri | 62.1496649604853 | 0.00015352 | deg |
| M | 348.3967840491225 | 0.00052145 | deg |
| $t_p$ | 2457856.252042161738 (2017-Apr-12.75204216) | 4.2823e-05 | JED |
| period | 1977.963288401083 | 0.089647 | d |
| | 5.42 | 0.0002454 | yr |
| n | .1820054002574595 | 8.249e-06 | deg/d |
| Q | 5.122449033960707 | 0.00015478 | au |

**Orbit Determination Parameters**

| | |
|---|---|
| # obs. used (total) | 1305 |
| # delay obs. used | 0 |
| # Doppler obs. used | 2 |
| data-arc span | 90 days |
| first obs. used | 2016-12-08 |
| last obs. used | 2017-03-08 |
| planetary ephem. | DE431 |
| SB-pert. ephem. | SB431-BIG16 |
| condition code | 4 |
| fit RMS | .48402 |
| data source | ORB |
| producer | Davide Farnocchia |
| solution date | 2017-Mar-22 12:03:10 |

**Additional Model Parameters**

| Parameter | Value | Uncertainty (1-sigma) |
|---|---|---|
| A1 [EST] | -4.389885556332022E-9 | 5.566E-9 |
| A2 [EST] | -6.878199762043117E-10 | 8.439E-10 |

**Additional Information**

Earth MOID = .133852 au
Jupiter MOID = .488757 au
T_jup = 2.828

[ show covariance matrix ]

[ Ephemeris | Orbit Diagram | Orbital Elements | Physical Parameters | Discovery Circumstances | Close-Approach Data ]

**Physical Parameter Table**

| Parameter | Symbol | Value | Units | Sigma | Reference | Notes |
|---|---|---|---|---|---|---|
| comet total magnitude | M1 | 14.9 | mag | 1. | K171/6 | 2 parameter fit from 227 observations, autocmod 2.6i |
| comet total magnitude slope | K1 | 15. | | n/a | K171/6 | autocmod 2.6i |
| comet nuclear magnitude | M2 | 17.2 | mag | 0.8 | K171/6 | from 1027 observations, autocmod 2.6i |
| comet nuclear magnitude slope | K2 | 5. | | n/a | K171/6 | autocmod 2.6i |
| comet nuclear phase coefficient | PC | 0.03 | | n/a | K171/6 | autocmod 2.6i |
| diameter | diameter | 1.4 | km | n/a | Lamy,P.L.,Toth,I.,Fernandez,Y.R.,Weaver,H.A. (2004) Comets II, pp. 223-264 | |

Time of Perihelion Passage: 12 Apr 2017 @ 05:59:24.8 UTC
Perihelion Distance: 1.045 AU (156,332,000 km or 97,082,172 mi)

Time of Perigee Passage: 30 March – 3 April 2017
Perigee Distance: 0.142 AU (21,243,200 km or 13,192,027 mi)

Aphelion Distance: 5.123 AU – Jupiter Comet!!!

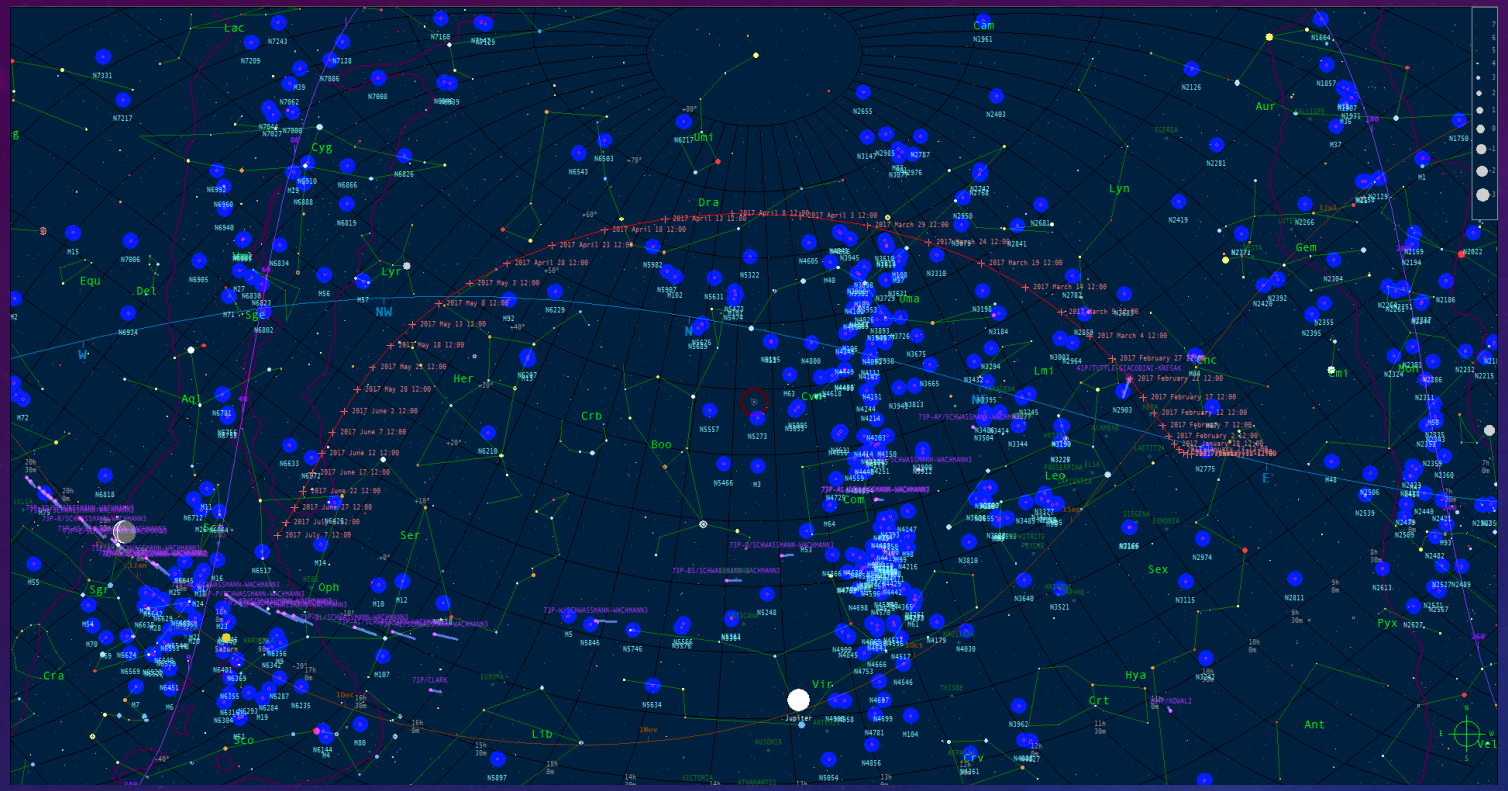
e: eccentricity – elliptical shape of an orbit!
1. e = 0 it is circular
2. 0.01 to 0.99 from slightly oval to extremely oval
3. e = 1 it is a parabolic path
4. e > 1 it is a hyperbolic path

a: semi – major axis (measured in AUs)
*Not to be confused with perihelion, aphelion, apogee, or perigee!*
q: perihelion distance (measured in AUs)
*(The tilt to the plane of the ecliptic – plane of the Earth's orbit measured in degrees!)*

i: orbital inclination
M: mean anomaly
$t_p$: time of perihelion passage
peri: the argument of perihelion
node: longitude of the ascending node
period: orbital period (measured in years)
n: mean motion (measured in degrees/day)
Q: aphelion distance (measured in AUs)

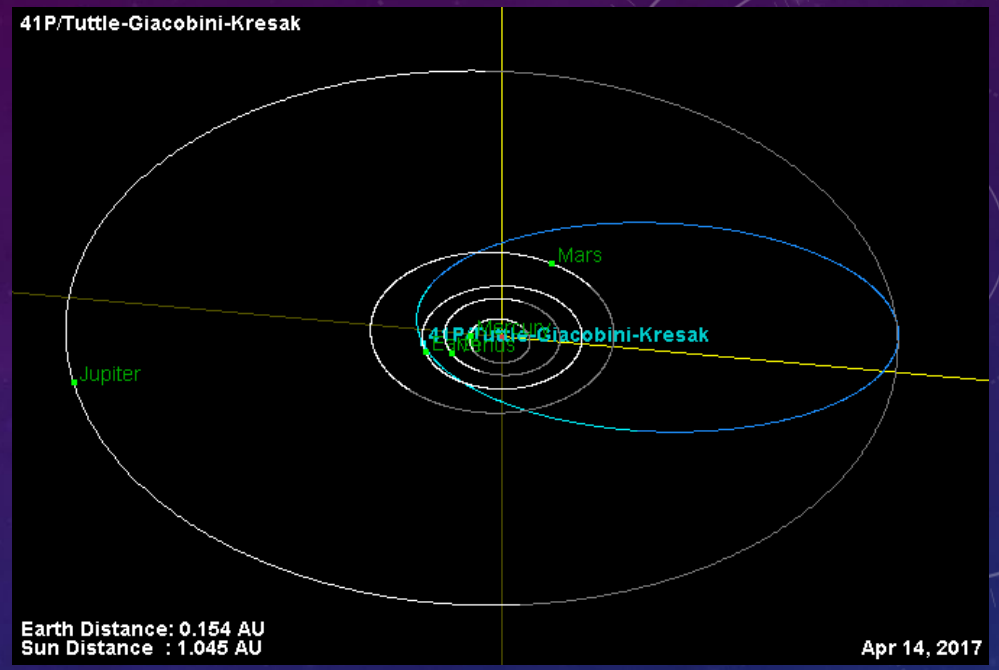
*The orbital elements of 41P/Tuttle – Giacobini – Kresak as shown in the table above indicating a very elliptical orbit for a Jovian comet with a short period of 5.42 years which falls under the range of 3 – 20 years for periodic Jovian comets! The orbital inclination is small although ~2$^o$ than the planet Mercury. Note that the orbital inclination still allows for the comet to be observable from the Earth within the region of the northern circumpolar constellations!*

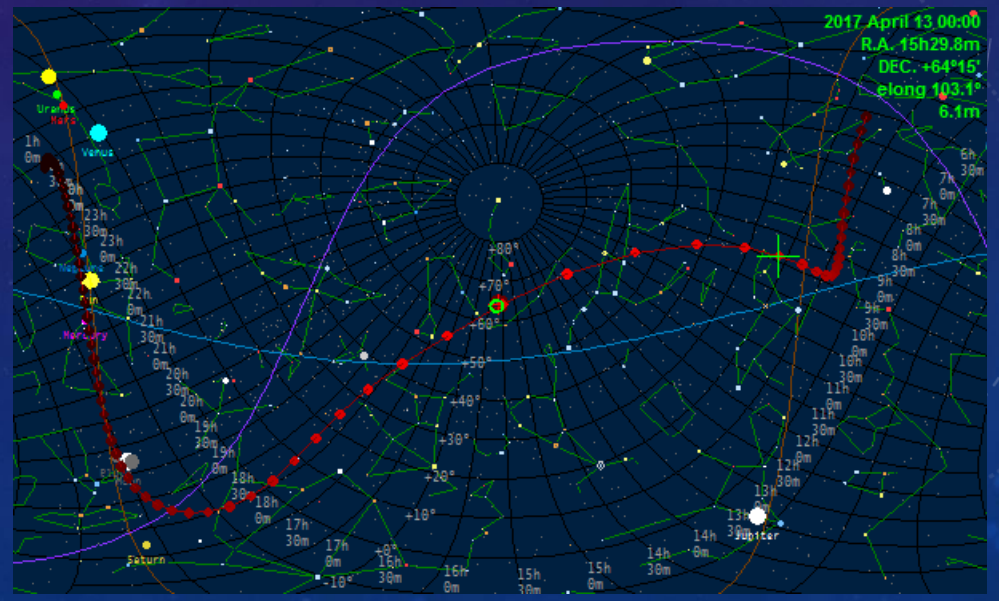
# LETS GO PICK A COMET!



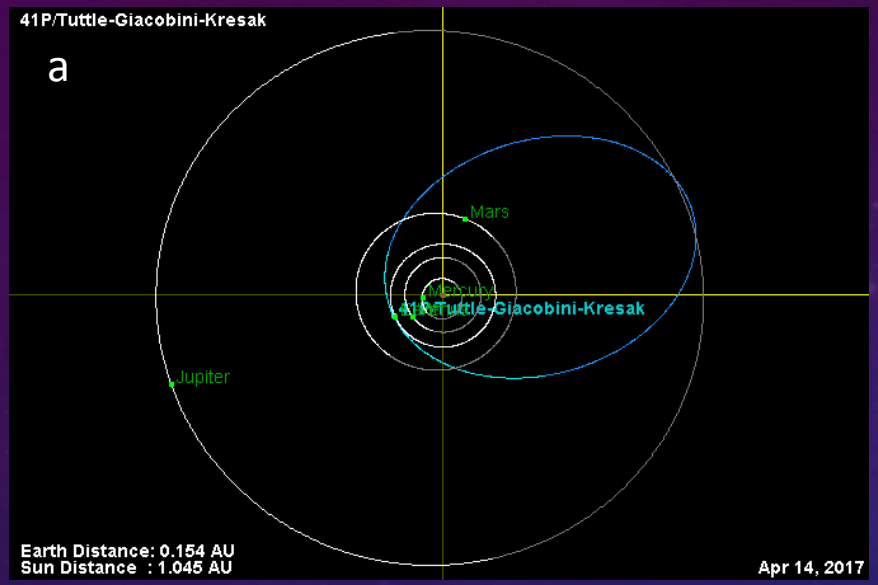
CNebulaX Project: Path of Comet 41P: (8 Jan – 7 Jul) 2017 Constellations

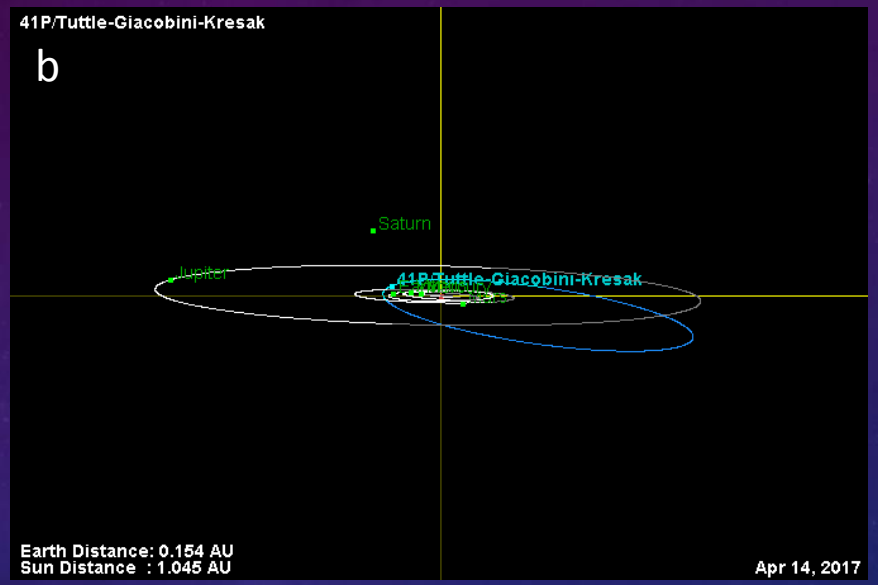
Cancer (SE Region: 8 – 17 Jan)
Leo (W Region: 18 Jan – 5 Mar)
Leo Minor (W Region: 6 – 13 Mar)
Ursa Major (Central Region: 14 Mar – 1 Apr)
Draco (E to Central Region: 2 – 26 Apr)
Hercules (E Region: 27 Apr – 3 June)

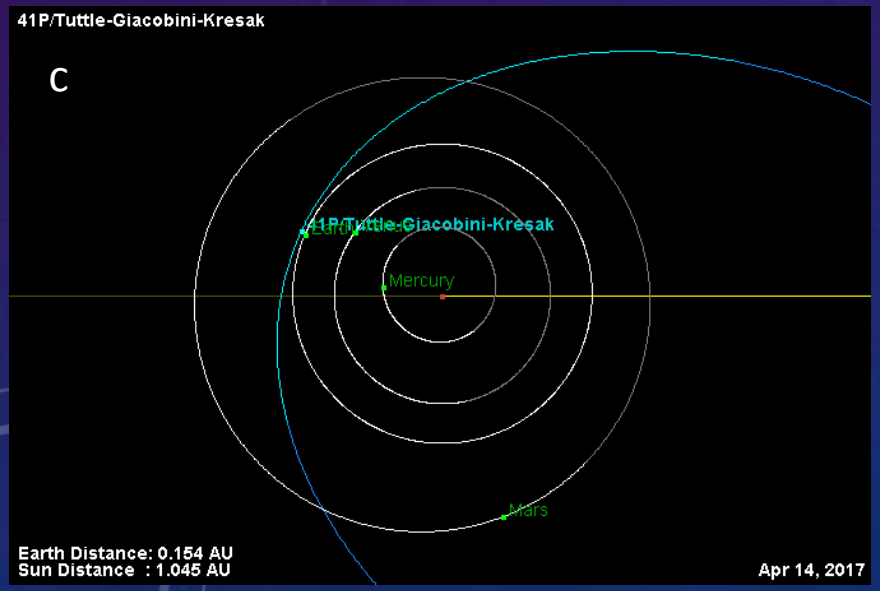


# LETS GO PICK A COMET!



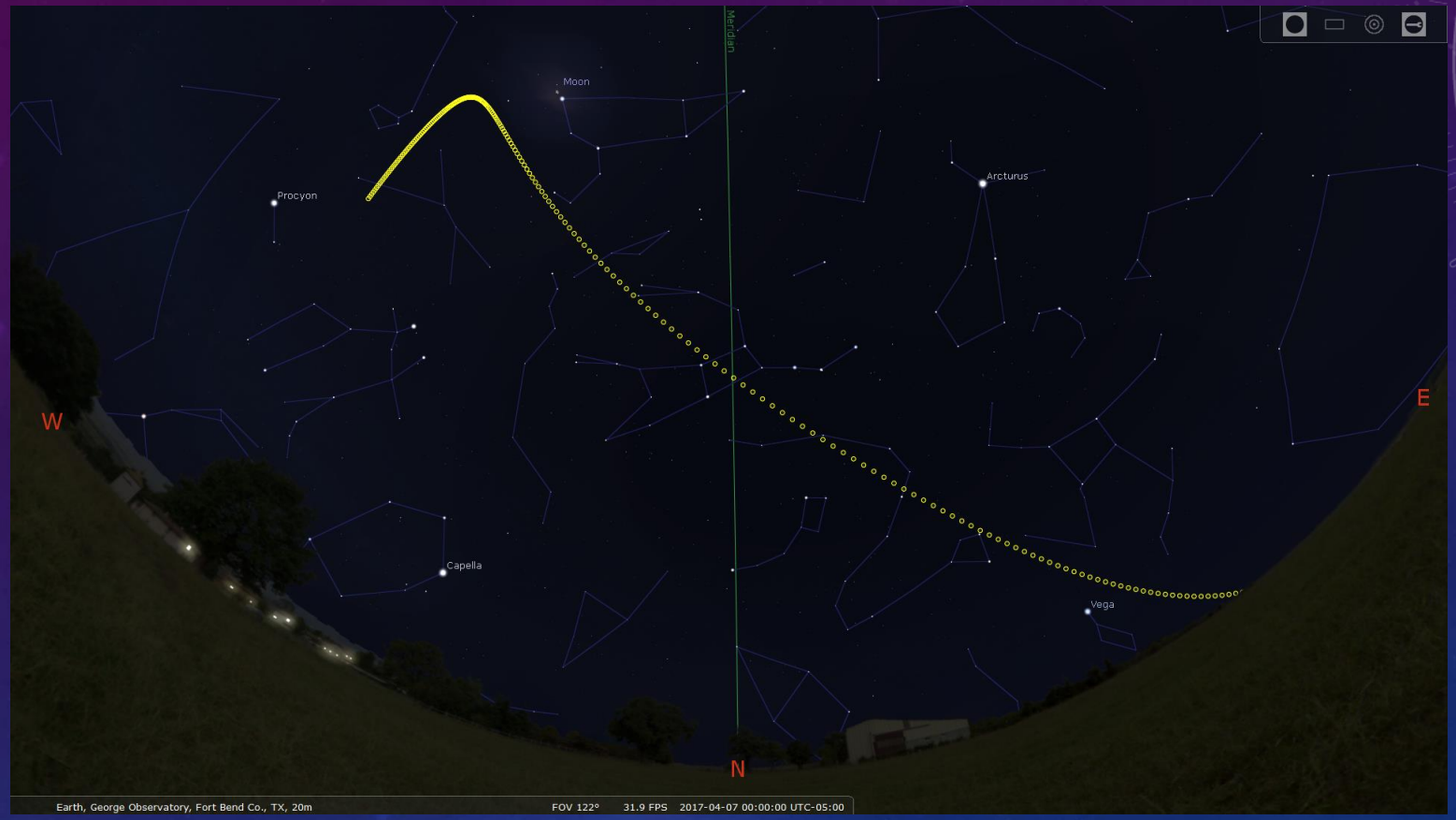




## *A 3 – Dimensional Map of the Orbit of Comet 41P*

a) Overhead View (90° with respect to the ecliptic)
b) Side View (0° with respect to the ecliptic)
c) Up – Close View (Comet at Perihelion & Perigee Passage)

This data is provided by the NASA/JPL Small Bodies database browser shows the various aspects of the orbit. The light blue and dark blue has the comet's orbit above and below the ecliptic respectfully! The light gray and dark grey has the planetary orbits above and below the ecliptic respectfully! The yellow lines are merely indication axis to give the orbits a 3-D perspective.

# LETS GO PICK A COMET!

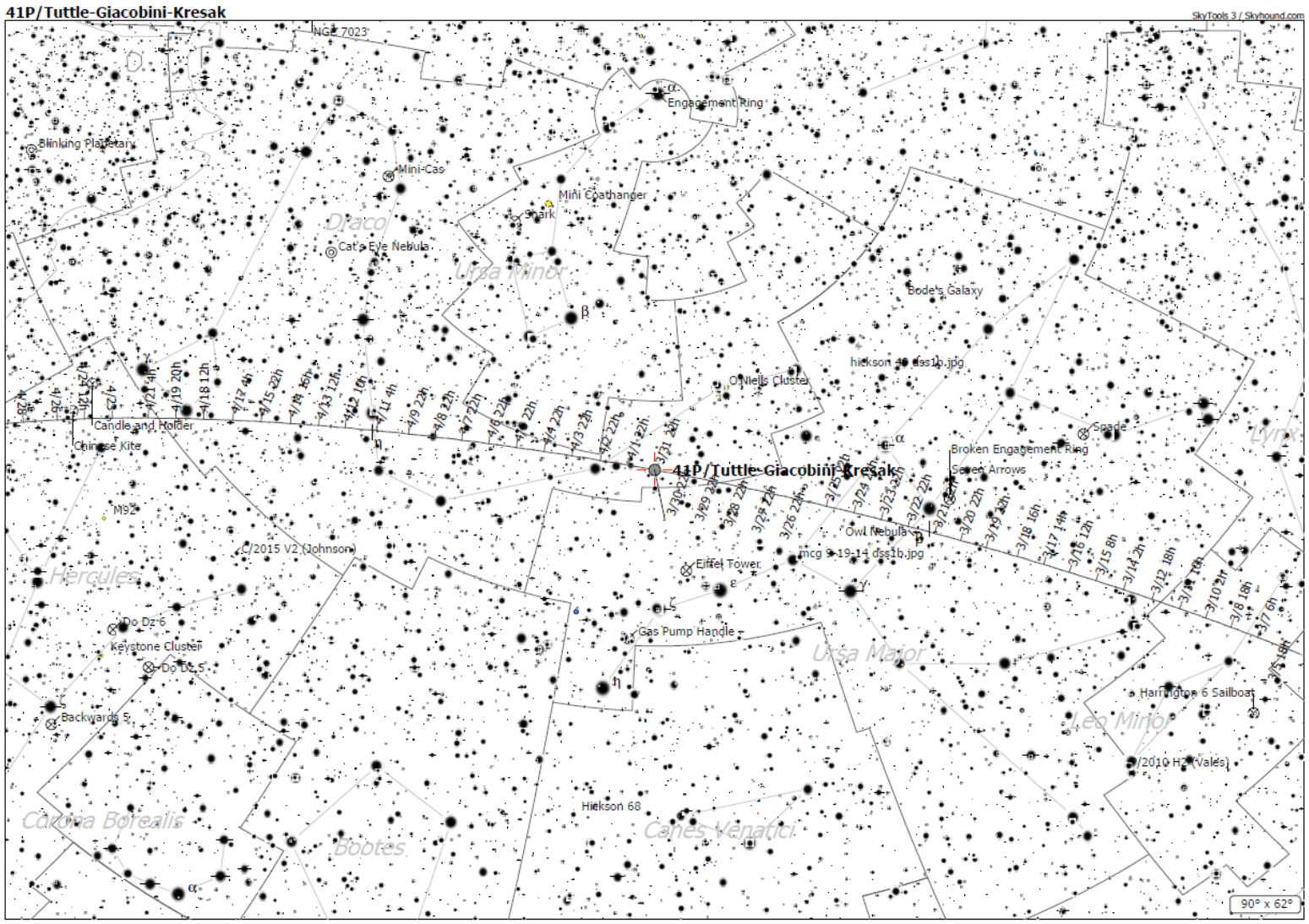



Stellarium 0.15.1: Path of Comet 41P: (1 Nov 2016 – 25 May 2017)

*2017 Foreshortening values for the Tail of 41P*

| | | | | | |
|---|---|---|---|---|---|
| *1 Jan: 62%* | *5 Feb: 93%* | *5 Mar: 56%* | ***31 Mar: 12%*** | ***8 – 11 Apr: 7%*** | *15 May: 20%* |
| *8 Jan: 66%* | ***10 Feb: 100%*** | *12 Mar: 42%* | ***1 Apr: 11%*** | ***12 – 22 Apr: 6%*** | *22 May: 27%* |
| *15 Jan: 71%* | *12 Feb: 96%* | *19 Mar: 28%* | ***4 – 5 Apr: 9%*** | *1 May: 10%* | *1 June: 41%* |
| *22 Jan: 77%* | *26 Feb: 71%* | *26 Mar: 18%* | ***6 – 7 Apr: 8%*** | *8 May: 14%* | |

# LETS GO PICK A COMET!




## Skytools Pro 3.2i version

Comet 41P during the time period from 7 March to 28 April.

The comet travels across the Spring, circumpolar constellations

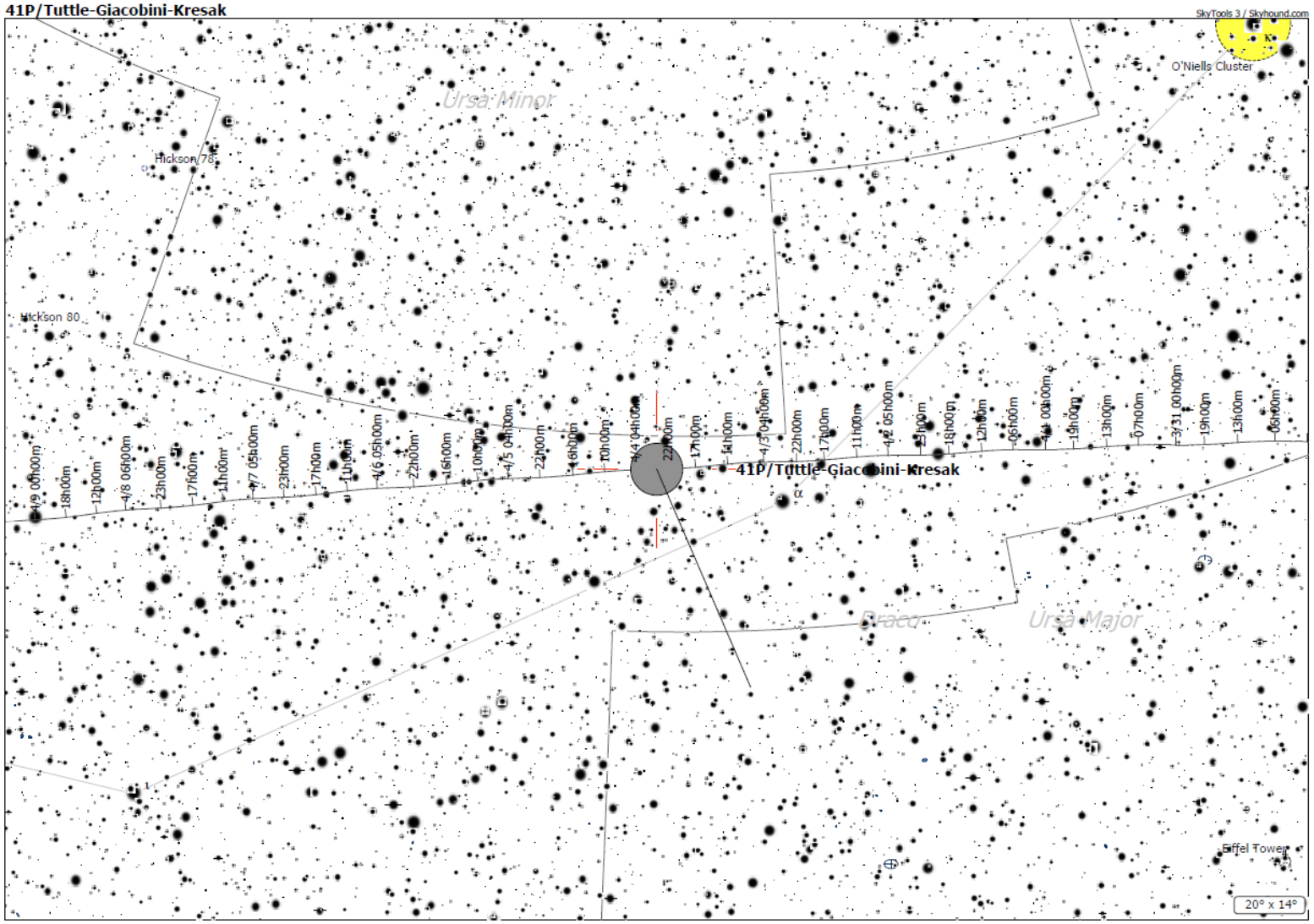
*Ursa Major*
*Draco*

North of the following degrees of Declination:

55° (22 March – 16 April)
60° (26 March – 11 April)

***+65° 00' 16.2" (J2000 Epoch)***
***3 April 2017 @ 07:00 UTC***

# LETS GO PICK A COMET!




## Skytools Pro 3.2i version

Comet 41P during the time period of perigee approach!

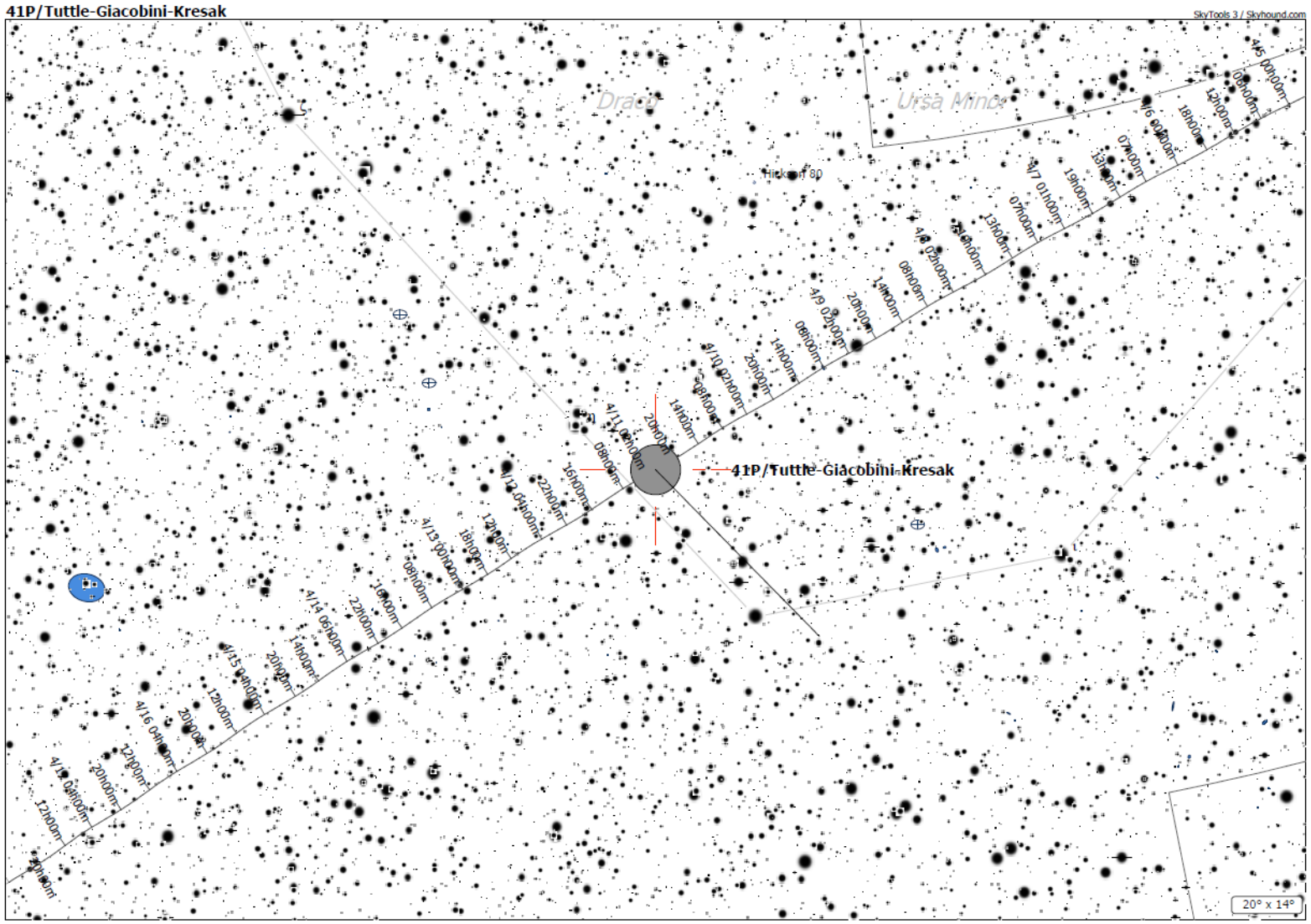
Starting Date: 30 March 2017 @ 06:00 UTC

Ending Date: 9 April 2017 @ 00:00 UTC

*Note the black line that crosses the comet's designated position (Grey – filled circle) is oriented at 160°! This fits with the PA of the comet's tail.*

*To the upper right is O'Niells Cluster which is a 4th magnitude optical, open star cluster centered around Kappa Draconis a Blue Giant beginning to enter its red giant phase!*

# LETS GO PICK A COMET!




## Skytools Pro 3.2i version

Comet 41P during the time period of perihelion approach!

Starting Date: 5 April 2017 @ 00:00 UTC

Ending Date: 17 April 2017 @ 20:00 UTC

*Note the blue oval just below of central left!*

*It is galaxy MCG 10 – 25 – 8 which is a 12th magnitude, Dwarf Elliptical in the constellation of Draco!*

*The batch of stellar targets to the upper left of 41P is Eta Draconis; a multiple star system. A possible variable of mag range 2.7 – 2.74!*

# LETS GO PICK A COMET!

**41P/Tuttle-Giacobini-Kresak**

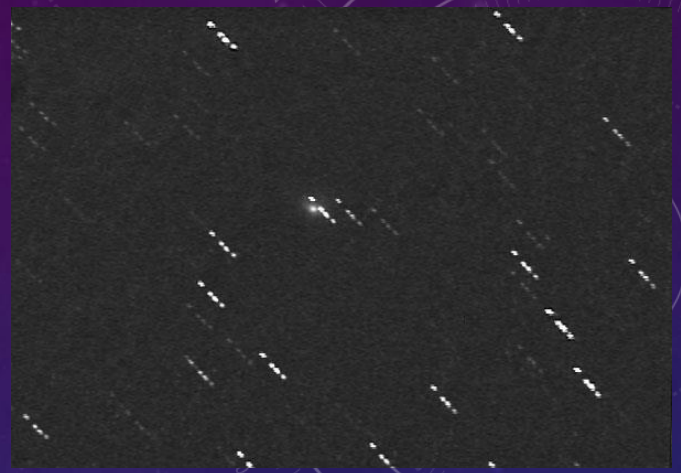
Perturbed ephemeris below is based on elements from *MPEC* 2017-A77.

0041P

| Date | UT h m s | R.A. (J2000) | Decl. | Delta | r | El. | Ph. | m1 | Sky Motion "/min | P.A. | Object Azi. | Alt. | Sun Alt. | Moon Phase | Dist. | Alt. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 2017 03 01 | 060000 | 09 44 37.6 | +28 22 28 | 0.218 | 1.191 | 154.3 | 21.1 | 9.7 | 2.55 | 012.4 | 085 | +83 | -67 | 0.09 | 124 | -40 |
| 2017 03 02 | 060000 | 09 45 57.9 | +29 23 29 | 0.213 | 1.185 | 152.9 | 22.4 | 9.6 | 2.64 | 013.3 | 093 | +83 | -67 | 0.16 | 110 | -27 |
| 2017 03 03 | 060000 | 09 47 26.3 | +30 26 25 | 0.208 | 1.179 | 151.4 | 23.7 | 9.4 | 2.74 | 014.3 | 101 | +82 | -66 | 0.25 | 097 | -15 |
| 2017 03 04 | 060000 | 09 49 03.7 | +31 31 18 | 0.204 | 1.173 | 150.0 | 25.0 | 9.3 | 2.83 | 015.3 | 108 | +82 | -66 | 0.36 | 083 | -02 |
| 2017 03 05 | 060000 | 09 50 50.9 | +32 38 07 | 0.200 | 1.167 | 148.5 | 26.4 | 9.2 | 2.93 | 016.3 | 115 | +81 | -66 | 0.47 | 070 | +11 |
| 2017 03 06 | 060000 | 09 52 48.7 | +33 46 52 | 0.195 | 1.161 | 147.0 | 27.7 | 9.0 | 3.02 | 017.3 | 120 | +80 | -65 | 0.59 | 057 | +23 |
| 2017 03 07 | 060000 | 09 54 58.2 | +34 57 30 | 0.191 | 1.155 | 145.5 | 29.1 | 8.9 | 3.12 | 018.4 | 125 | +79 | -65 | 0.70 | 046 | +35 |
| 2017 03 08 | 060000 | 09 57 20.5 | +36 10 01 | 0.188 | 1.150 | 144.1 | 30.4 | 8.8 | 3.23 | 019.5 | 129 | +78 | -65 | 0.79 | 035 | +47 |
| 2017 03 09 | 060000 | 09 59 56.7 | +37 24 20 | 0.184 | 1.144 | 142.6 | 31.8 | 8.7 | 3.33 | 020.7 | 133 | +77 | -64 | 0.88 | 028 | +57 |
| 2017 03 10 | 060000 | 10 02 48.2 | +38 40 26 | 0.180 | 1.139 | 141.0 | 33.2 | 8.5 | 3.43 | 021.9 | 137 | +76 | -64 | 0.94 | 026 | +66 |
| 2017 03 11 | 060000 | 10 05 56.5 | +39 58 12 | 0.177 | 1.134 | 139.5 | 34.7 | 8.4 | 3.53 | 023.1 | 141 | +75 | -63 | 0.98 | 030 | +69 |
| 2017 03 12 | 060000 | 10 09 23.1 | +41 17 33 | 0.174 | 1.129 | 138.0 | 36.1 | 8.3 | 3.64 | 024.4 | 144 | +74 | -63 | 1.00 | 038 | +67 |
| 2017 03 13 | 060000 | 10 13 09.9 | +42 38 20 | 0.171 | 1.124 | 136.5 | 37.5 | 8.2 | 3.74 | 025.8 | 147 | +73 | -63 | 1.00 | 047 | +59 |
| 2017 03 14 | 060000 | 10 17 18.9 | +44 00 25 | 0.168 | 1.119 | 135.0 | 38.9 | 8.1 | 3.84 | 027.2 | 150 | +72 | -62 | 0.97 | 057 | +50 |
| 2017 03 15 | 060000 | 10 21 52.4 | +45 23 35 | 0.165 | 1.114 | 133.5 | 40.4 | 8.0 | 3.94 | 028.8 | 153 | +71 | -62 | 0.93 | 067 | +40 |
| 2017 03 16 | 060000 | 10 26 52.7 | +46 47 37 | 0.162 | 1.110 | 131.9 | 41.8 | 7.9 | 4.04 | 030.4 | 156 | +70 | -62 | 0.87 | 077 | +30 |
| 2017 03 17 | 060000 | 10 32 22.8 | +48 12 16 | 0.160 | 1.105 | 130.4 | 43.3 | 7.8 | 4.14 | 032.1 | 158 | +69 | -61 | 0.80 | 087 | +20 |
| 2017 03 18 | 060000 | 10 38 25.5 | +49 37 11 | 0.157 | 1.101 | 128.9 | 44.7 | 7.7 | 4.23 | 033.9 | 161 | +68 | -61 | 0.72 | 096 | +10 |
| 2017 03 19 | 060000 | 10 45 04.4 | +51 02 01 | 0.155 | 1.097 | 127.4 | 46.1 | 7.6 | 4.32 | 035.8 | 164 | +67 | -61 | 0.64 | 104 | -01 |
| 2017 03 20 | 060000 | 10 52 22.9 | +52 26 21 | 0.153 | 1.093 | 125.9 | 47.6 | 7.5 | 4.40 | 037.9 | 166 | +66 | -60 | 0.54 | 112 | -11 |
| 2017 03 21 | 060000 | 11 00 24.9 | +53 49 42 | 0.151 | 1.089 | 124.5 | 49.0 | 7.4 | 4.48 | 040.2 | 169 | +65 | -60 | 0.45 | 118 | -21 |
| 2017 03 22 | 060000 | 11 09 14.7 | +55 11 30 | 0.150 | 1.085 | 123.0 | 50.4 | 7.3 | 4.55 | 042.6 | 171 | +64 | -59 | 0.35 | 124 | -31 |
| 2017 03 23 | 060000 | 11 18 56.2 | +56 31 09 | 0.148 | 1.082 | 121.6 | 51.7 | 7.2 | 4.61 | 045.2 | 173 | +62 | -59 | 0.26 | 127 | -41 |
| 2017 03 24 | 060000 | 11 29 33.5 | +57 47 57 | 0.147 | 1.078 | 120.2 | 53.1 | 7.1 | 4.67 | 048.1 | 176 | +61 | -59 | 0.17 | 129 | -50 |
| 2017 03 25 | 060000 | 11 41 10.4 | +59 01 08 | 0.146 | 1.075 | 118.8 | 54.4 | 7.1 | 4.72 | 051.2 | 178 | +60 | -58 | 0.10 | 129 | -59 |
| 2017 03 26 | 060000 | 11 53 49.9 | +60 09 53 | 0.145 | 1.072 | 117.4 | 55.7 | 7.0 | 4.75 | 054.5 | 180 | +59 | -58 | 0.04 | 127 | -64 |
| 2017 03 27 | 060000 | 12 07 33.8 | +61 13 20 | 0.144 | 1.069 | 116.1 | 57.0 | 6.9 | 4.79 | 058.1 | 182 | +58 | -58 | 0.01 | 122 | -64 |
| 2017 03 28 | 060000 | 12 22 22.3 | +62 10 35 | 0.143 | 1.066 | 114.8 | 58.2 | 6.9 | 4.81 | 061.9 | 185 | +57 | -57 | 0.00 | 117 | -59 |
| 2017 03 29 | 060000 | 12 38 13.2 | +63 00 44 | 0.143 | 1.064 | 113.6 | 59.3 | 6.8 | 4.82 | 066.0 | 187 | +56 | -57 | 0.02 | 111 | -49 |
| 2017 03 30 | 060000 | 12 55 01.5 | +63 42 56 | 0.142 | 1.061 | 112.4 | 60.5 | 6.8 | 4.82 | 070.3 | 189 | +55 | -56 | 0.06 | 104 | -38 |
| 2017 03 31 | 060000 | 13 12 39.1 | +64 16 26 | 0.142 | 1.059 | 111.3 | 61.5 | 6.8 | 4.82 | 074.8 | 191 | +54 | -56 | 0.13 | 098 | -26 |
| 2017 04 01 | 060000 | 13 30 54.7 | +64 40 38 | 0.142 | 1.057 | 110.2 | 62.6 | 6.7 | 4.80 | 079.5 | 193 | +53 | -56 | 0.22 | 092 | -14 |
| 2017 04 02 | 060000 | 13 49 34.2 | +64 55 08 | 0.142 | 1.055 | 109.2 | 63.5 | 6.7 | 4.78 | 084.2 | 195 | +52 | -55 | 0.33 | 087 | -02 |
| 2017 04 03 | 060000 | 14 08 21.6 | +64 59 48 | 0.142 | 1.053 | 108.2 | 64.4 | 6.7 | 4.75 | 089.0 | 197 | +51 | -55 | 0.44 | 083 | +10 |
| 2017 04 04 | 060000 | 14 27 00.5 | +64 54 42 | 0.143 | 1.051 | 107.3 | 65.3 | 6.6 | 4.71 | 093.7 | 199 | +50 | -55 | 0.55 | 080 | +21 |
| 2017 04 05 | 060000 | 14 45 15.2 | +64 40 14 | 0.143 | 1.050 | 106.4 | 66.0 | 6.6 | 4.66 | 098.3 | 201 | +49 | -54 | 0.66 | 077 | +32 |
| 2017 04 06 | 060000 | 15 02 51.9 | +64 16 57 | 0.144 | 1.049 | 105.7 | 66.7 | 6.6 | 4.60 | 102.8 | 203 | +48 | -54 | 0.76 | 075 | +42 |
| 2017 04 07 | 060000 | 15 19 39.7 | +63 45 36 | 0.145 | 1.048 | 104.9 | 67.4 | 6.6 | 4.54 | 107.0 | 205 | +47 | -54 | 0.84 | 074 | +50 |
| 2017 04 08 | 060000 | 15 35 30.9 | +63 07 04 | 0.146 | 1.047 | 104.3 | 68.0 | 6.6 | 4.47 | 111.0 | 206 | +46 | -53 | 0.91 | 074 | +57 |
| 2017 04 09 | 060000 | 15 50 20.9 | +62 22 14 | 0.147 | 1.046 | 103.7 | 68.5 | 6.6 | 4.39 | 114.8 | 208 | +46 | -53 | 0.96 | 074 | +60 |
| 2017 04 10 | 060000 | 16 04 07.9 | +61 32 02 | 0.148 | 1.046 | 103.2 | 68.9 | 6.6 | 4.31 | 118.3 | 210 | +45 | -52 | 0.99 | 073 | +60 |
| 2017 04 11 | 060000 | 16 16 52.1 | +60 37 20 | 0.149 | 1.045 | 102.7 | 69.3 | 6.6 | 4.23 | 121.5 | 212 | +44 | -52 | 1.00 | 073 | +55 |
| 2017 04 12 | 060000 | 16 28 35.6 | +59 38 58 | 0.151 | 1.045 | 102.3 | 69.6 | 6.7 | 4.14 | 124.5 | 214 | +44 | -52 | 0.99 | 073 | +49 |
| 2017 04 13 | 060000 | 16 39 21.4 | +58 37 41 | 0.152 | 1.045 | 102.0 | 69.8 | 6.7 | 4.05 | 127.3 | 215 | +43 | -51 | 0.96 | 073 | +41 |
| 2017 04 14 | 060000 | 16 49 13.1 | +57 34 08 | 0.154 | 1.045 | 101.7 | 70.0 | 6.7 | 3.96 | 129.8 | 217 | +43 | -51 | 0.92 | 073 | +32 |
| 2017 04 15 | 060000 | 16 58 14.8 | +56 28 55 | 0.156 | 1.046 | 101.5 | 70.1 | 6.7 | 3.86 | 132.2 | 219 | +42 | -51 | 0.86 | 074 | +23 |
| 2017 04 16 | 060000 | 17 06 30.4 | +55 22 32 | 0.158 | 1.046 | 101.4 | 70.1 | 6.8 | 3.77 | 134.4 | 220 | +42 | -50 | 0.79 | 074 | +14 |
| 2017 04 17 | 060000 | 17 14 03.9 | +54 15 23 | 0.159 | 1.047 | 101.3 | 70.1 | 6.8 | 3.67 | 136.4 | 222 | +41 | -50 | 0.71 | 074 | +05 |
| 2017 04 18 | 060000 | 17 20 59.1 | +53 07 52 | 0.161 | 1.048 | 101.3 | 70.0 | 6.9 | 3.58 | 138.4 | 223 | +41 | -50 | 0.62 | 075 | -05 |
| 2017 04 19 | 060000 | 17 27 19.3 | +52 00 16 | 0.164 | 1.049 | 101.3 | 69.9 | 6.9 | 3.48 | 140.2 | 225 | +41 | -49 | 0.52 | 077 | -14 |
| 2017 04 20 | 060000 | 17 33 07.8 | +50 52 50 | 0.166 | 1.050 | 101.4 | 69.7 | 6.9 | 3.39 | 141.9 | 226 | +41 | -49 | 0.42 | 079 | -23 |
| 2017 04 21 | 060000 | 17 38 27.5 | +49 45 47 | 0.168 | 1.051 | 101.5 | 69.5 | 7.0 | 3.30 | 143.5 | 228 | +40 | -49 | 0.32 | 082 | -33 |
| 2017 04 22 | 060000 | 17 43 20.9 | +48 39 15 | 0.170 | 1.053 | 101.7 | 69.2 | 7.1 | 3.21 | 145.0 | 229 | +40 | -48 | 0.23 | 086 | -41 |
| 2017 04 23 | 060000 | 17 47 50.5 | +47 33 24 | 0.172 | 1.055 | 102.0 | 68.8 | 7.1 | 3.12 | 146.5 | 231 | +40 | -48 | 0.14 | 090 | -49 |
| 2017 04 24 | 060000 | 17 51 58.2 | +46 28 18 | 0.175 | 1.057 | 102.2 | 68.5 | 7.2 | 3.04 | 147.9 | 232 | +40 | -48 | 0.07 | 095 | -54 |
| 2017 04 25 | 060000 | 17 55 46.0 | +45 24 02 | 0.177 | 1.059 | 102.6 | 68.0 | 7.2 | 2.95 | 149.3 | 233 | +40 | -47 | 0.02 | 100 | -56 |
| 2017 04 26 | 060000 | 17 59 15.6 | +44 20 39 | 0.180 | 1.061 | 102.9 | 67.6 | 7.3 | 2.88 | 150.7 | 235 | +40 | -47 | 0.00 | 106 | -53 |
| 2017 04 27 | 060000 | 18 02 28.5 | +43 18 11 | 0.182 | 1.064 | 103.4 | 67.0 | 7.4 | 2.80 | 152.0 | 236 | +40 | -47 | 0.01 | 111 | -46 |
| 2017 04 28 | 060000 | 18 05 26.1 | +42 16 40 | 0.185 | 1.066 | 103.8 | 66.5 | 7.4 | 2.73 | 153.3 | 238 | +40 | -46 | 0.05 | 116 | -36 |
| 2017 04 29 | 060000 | 18 08 09.6 | +41 16 06 | 0.187 | 1.069 | 104.3 | 65.9 | 7.5 | 2.66 | 154.6 | 239 | +40 | -46 | 0.11 | 119 | -26 |
| 2017 04 30 | 060000 | 18 10 40.1 | +40 16 29 | 0.190 | 1.072 | 104.8 | 65.3 | 7.6 | 2.59 | 155.9 | 240 | +41 | -46 | 0.20 | 121 | -15 |
| 2017 05 01 | 060000 | 18 12 58.6 | +39 17 50 | 0.193 | 1.075 | 105.4 | 64.6 | 7.7 | 2.53 | 157.1 | 242 | +41 | -45 | 0.30 | 120 | -04 |

Location: HMNS George Observatory, Brazos Bend State Park, Texas, USA

**Courtesy: Akimasa Nakamura**
**(Kuma Kogen Astronomical Observatory, Japan)**
**2000 November 28.86 UT**
**60-cm, f/6 reflector and CCD**



**Courtesy: Gary W. Kronk**
**(St. Jacob, Illinois, USA) on 2006 June 4.**
**Composed of nine 30-second exposures**
**20-cm Meade LX200 GPS and a MallinCam.**
**The image was processed using Registax and PhotoShop.**

The table on the left shows the ephemeris for 41P/Tuttle – Giacobini – Kresák.

The range of dates: 1 March through 1 May

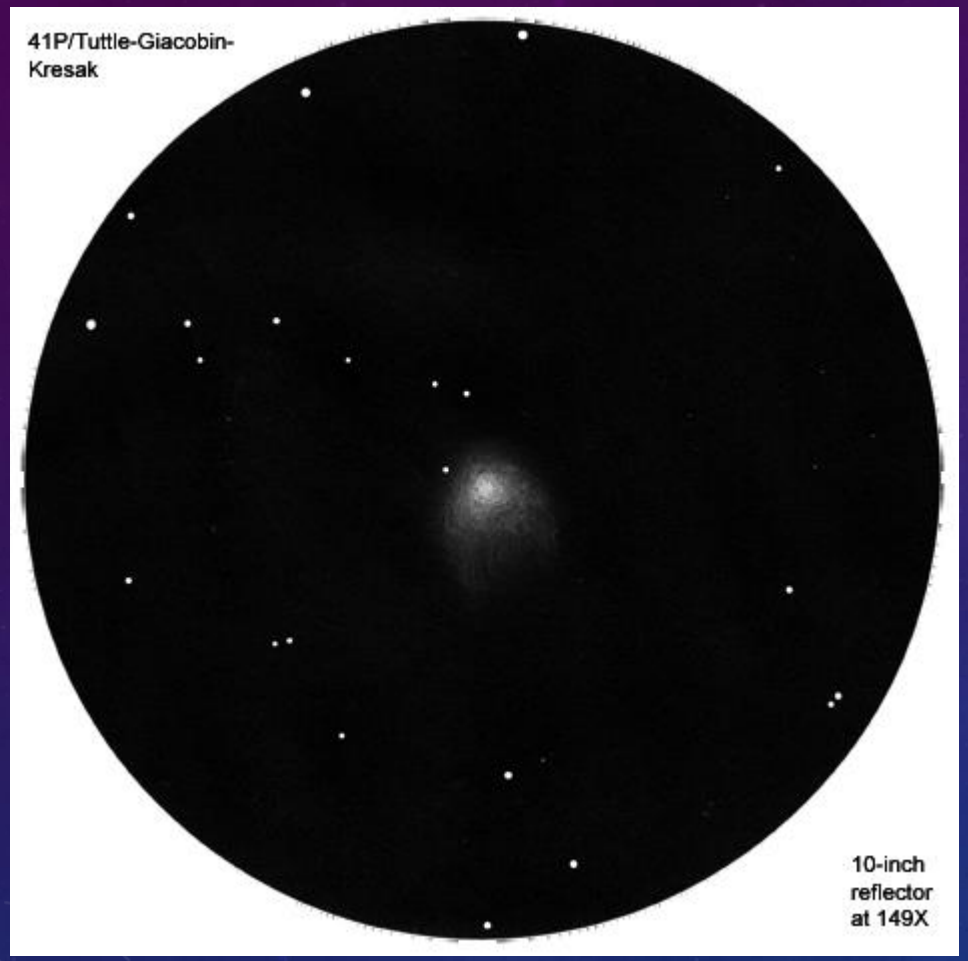
Note that the comet is best observed when there is minimal moon and best on the table of Moon Phases.

March 1: 0.09 (Near New Moon)
March 5: 0.47 (1st Qtr. Moon)
March 12 – 13: 1.00 (Full Moon)
March 20: 0.54 (Last Qtr. Moon)
March 28: 0.00 (New Moon)
*April 4: 0.55 (1st Qtr. Moon)
*April 10: 1.00 (Full Moon)

*April 19: 0.52 (Last Qtr. Moon)
April 26: 0.00 (New Moon)
May 3: 0.52 (1st Qtr. Moon)
May 10 – 11: 1.00 (Full Moon)
May 19: 0.48 (Last Qtr. Moon)
May 26: 0.00 (New Moon)
June 1: 0.47 (1st Qtr. Moon)

***Note that the conditions for observing 41P are not very favorable since the time from April 4 – 19 during the two weeks after perigee when the comet is expected to be at its brightest between perigee and perihelion and the time of perihelion passage. This is in spite of the fact that comet 41P will be a circumpolar comet!***

# LETS GO PICK A COMET!




**Courtesy: Cloudynights member Achernar**
**(Mobile, Alabama, USA)**
**Posted: 25 March 2017 – 07:11 CDT**
**10" reflector telescope**

**<u>Observations by Cloudynights Member: Archernar</u>**

Sky conditions – Not very good, but transparency was satisfactory for attempting comet observations.

Not visible through 11x56 binoculars

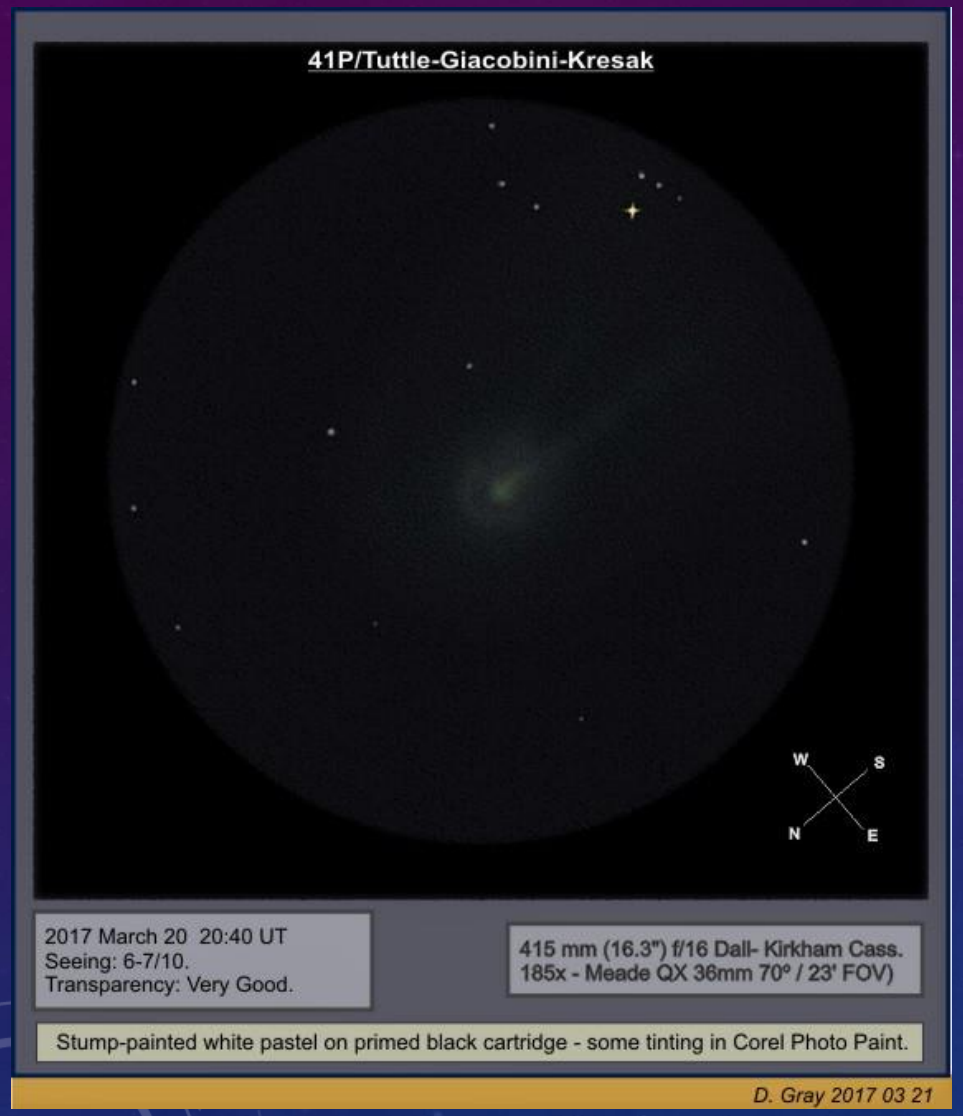
Observations done at 93x and 149x

Coma is large, faint, and diffuse! A lot fainter than the reported 7 – 7.5.

The comet is so close to Earth that the comet did move noticeably within a time period of one half – hour!

A Lumicon comet filter was applied.
Results: 'Modest improvement to the view'.

# LETS GO PICK A COMET!




**Courtesy: David Gray**
**(Near Newcastle upon Tyne, Northumberland, England, UK)**
**21 March 2017**

**Observations by Cloudynights Member: David Gray**

Sky conditions – Sky were clear temporarily, but in the vicinity of the comet!

Instruments used where 20x100 binoculars &
80mm Skywatcher refractor

The tail looked clear, but somewhat clumpy with a secondary tail that looked more fleeting towards a brighter star!

There appeared an outer coma – off alignment with the inner coma.

Inner coma was brighter and more yellowish than the fainter greens of the comet.

A possible false – nucleus observed; maybe a 13$^{th}$ mag star in the area of the coma, but it disappeared afterwards!

# LETS GO PICK SOME COMETS!

C/2015 V2 (Johnson)

*27 March 2017*

*Roland Fichtl*

*Discoverer: A. Jess Johnson*

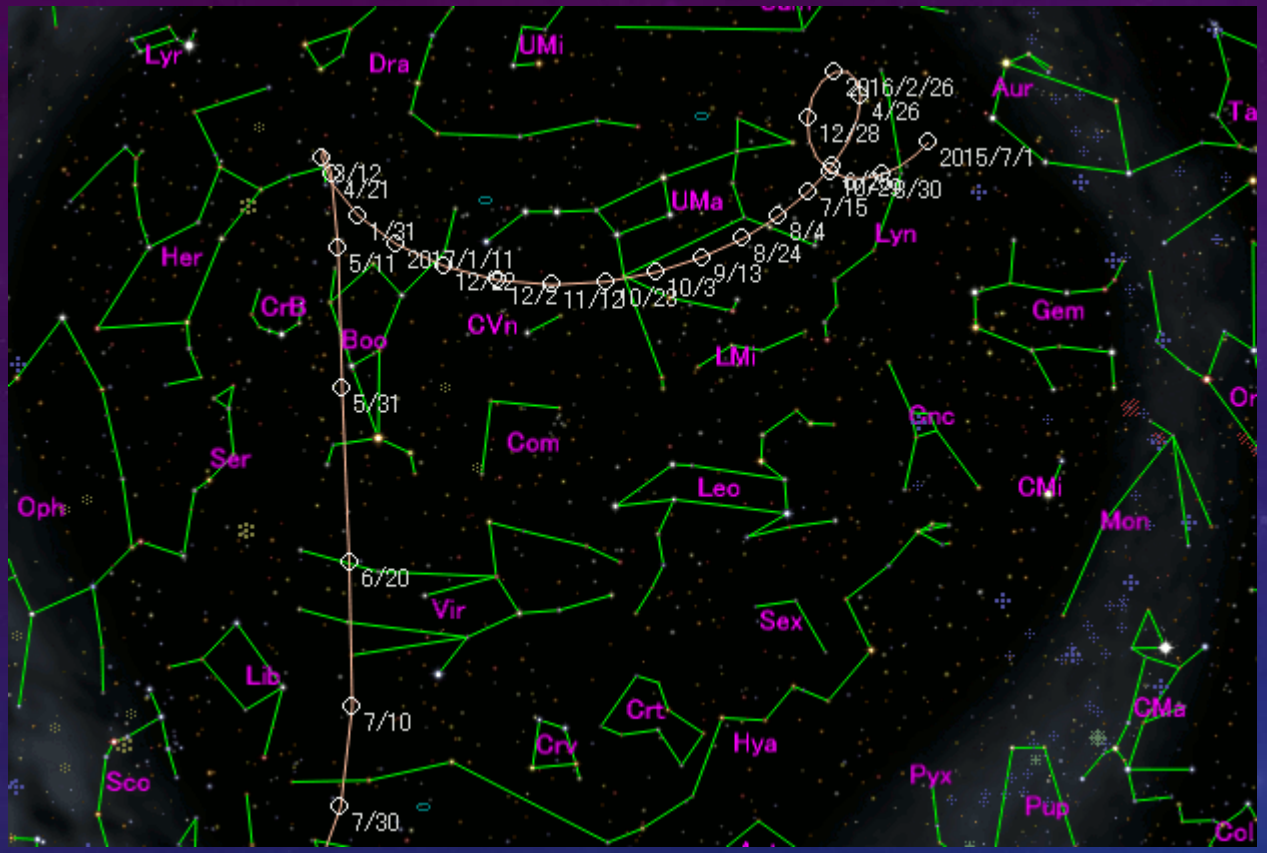
Discovery Date (Original) : 3 November 2015

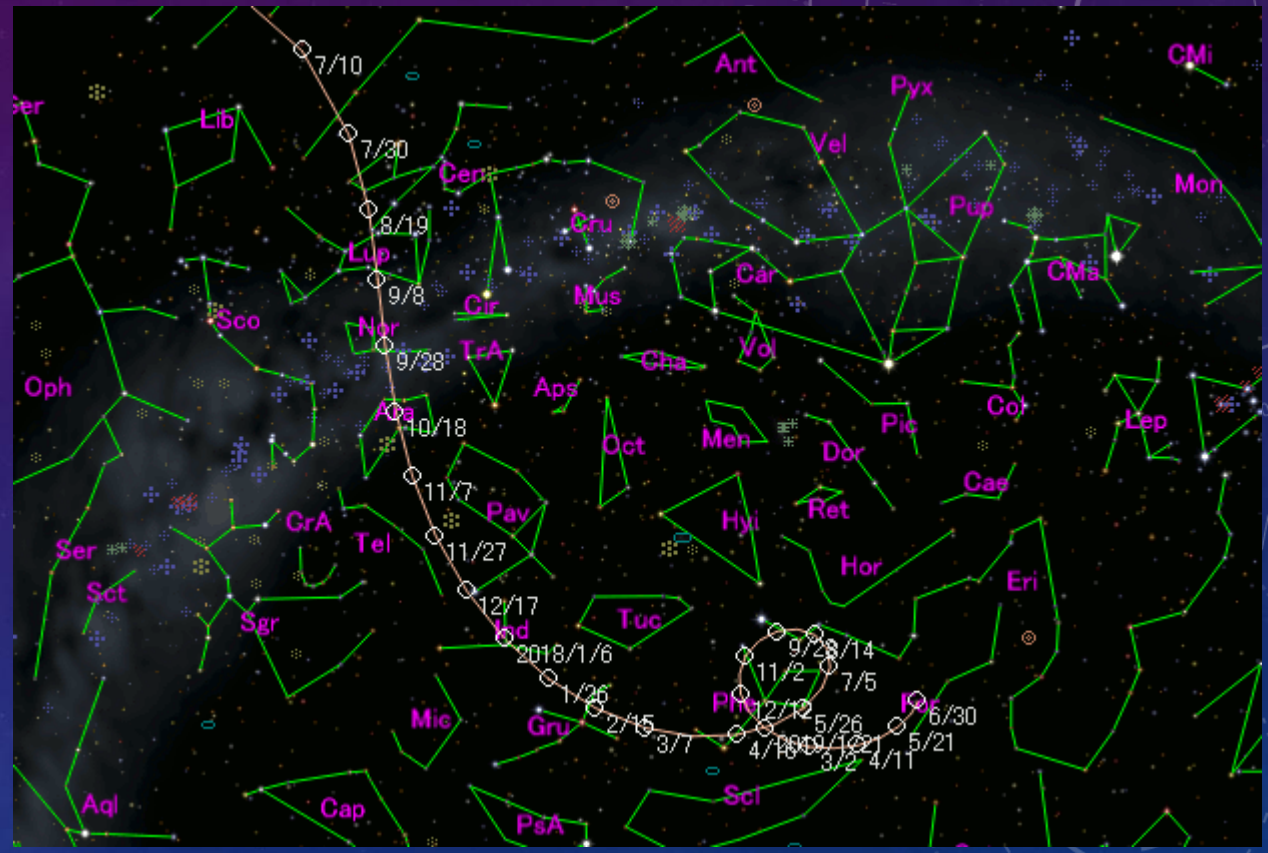
**Instruments: 0.68 m (27 in) Schmidt – Cassegrain Reflector**
*(Catalina Sky Survey, Mt. Lemmon IR Observatory, Stewart Observatory, Univ. of Az., NASA, Arizona, USA)*

Epoch (Time – based reference point): 10 February 2016
Aphelion: Not Applicable
Perihelion: 1.63714 AU
Visual Magnitude (On Date of Discovery): 17.1
Semi – Major Axis: (Incoming Orbit – 59,200 AU or ~8.856 trillion km)
Eccentricity: 1.0009 (Hyperbolic path)
Orbital Inclination: $48.87499^0$ or ($48^0$ 52' 30")
Orbital Period: (Incoming pathway – 14.4 million years)
*Next Perihelion Date: 12 June 2017*

*Comet C/2012 V2 has the 'C' designation assigned to comets that do not have long term stable orbits and in many cases can be predominantly 'non – periodic' comets. Some of these comets can either have a parabolic path (return to the outer regions) or hyperbolic (reach escape velocity from the Solar System entirely)! It is not unknown for 'C' designation comets to eventually return to the inner solar system in a new semi – orbital or non – orbital trajectory, but for periods lasting upwards of tens of millions of years. These comets likely reside from the Oort Cloud at the very primeval edges of the solar system at the edge of the Sun's gravitational influence.*

# LETS GO PICK SOME COMETS!

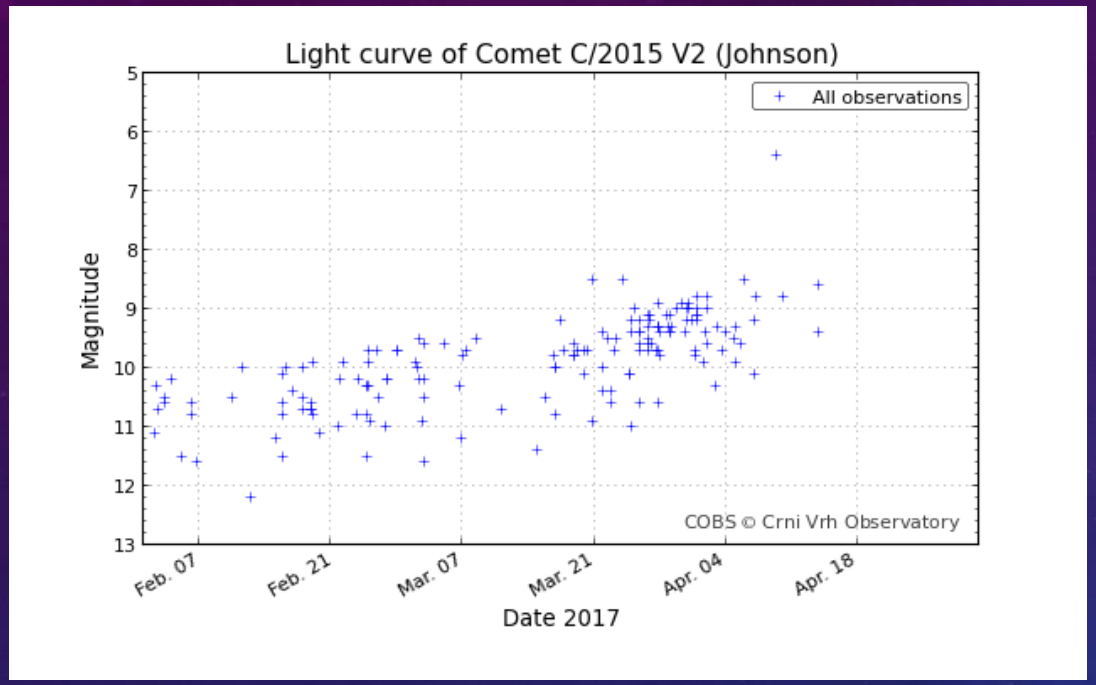


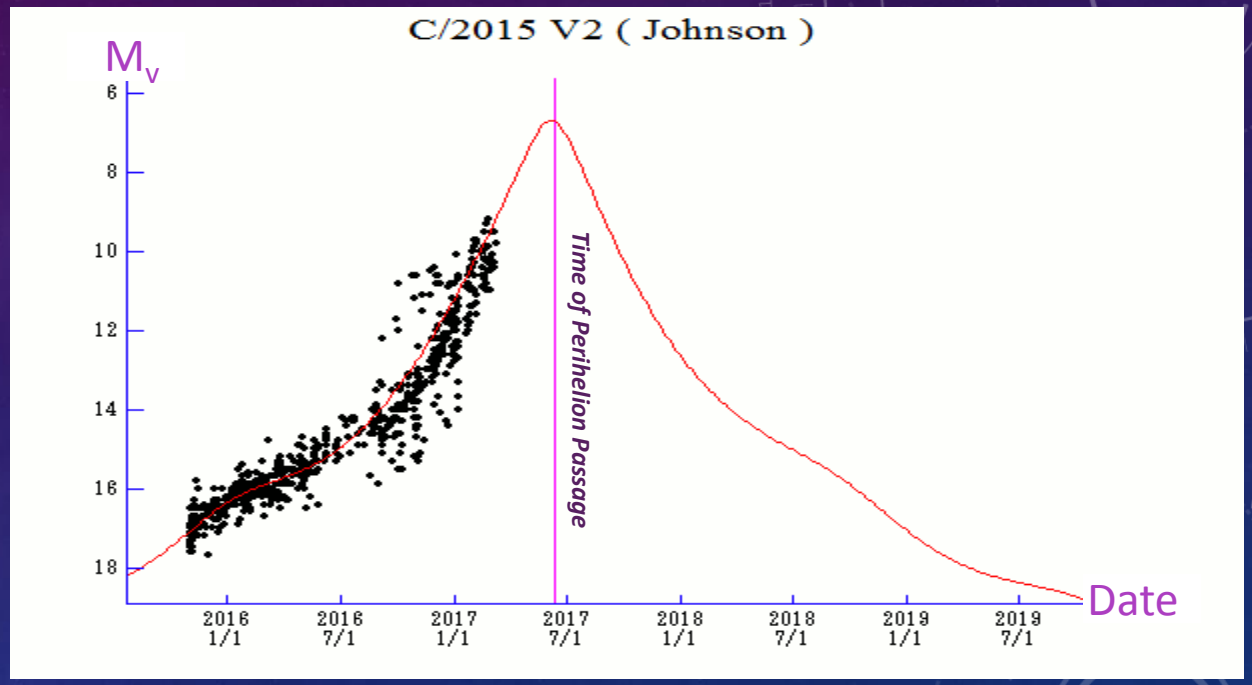

Courtesy: Seiichi Yoshida's Home Page – C/2015 V2 (Johnson) webpage, http://www.aerith.net/comet/catalog/2015V2/2015V2.html, Updated: 27 February 2017.

The left image shows the path of C/2015 V2 from 1 July 2015 in the constellation of Lynx undergoing retrograde motion from 29 October 2015 to 28 June 2016 in the region between Lynx & Ursa Major. The comet then progressed eastwards across Ursa Major during the period: (8 July – 28 October) 2016. Then the comet moves through Canes Venatici, then Boötes (both northern regions) from 29 October 2016 to 20 February 2017. Currently Comet Johnson is undergoing a tighter retrograde loop in the NW region of Hercules near the star 'Rukbalgethi Shemali' or 'the northern knee' (Tau Herculi) during the period of (20 February – 24 April) 2017. C/2015 V2 will then head SE to southwards from (25 April crossing into Boötes on 3 May) as crosses into the north boundary of Virgo on midnight, 14 June. The comet will pass into the constellation of Lupus by late August and will be lost to observers in the northern hemisphere by the civil and nautical twilight after sunset before 1 September. The right image shows the comet moving deeper into the southern celestial skies with a maximum southern declination of 57$^{o}$ 04' 2.1" S (J2000 Epoch) on 19 November 2017 during the period of (14:50 – 16:44) UTC.

# LETS GO PICK SOME COMETS!



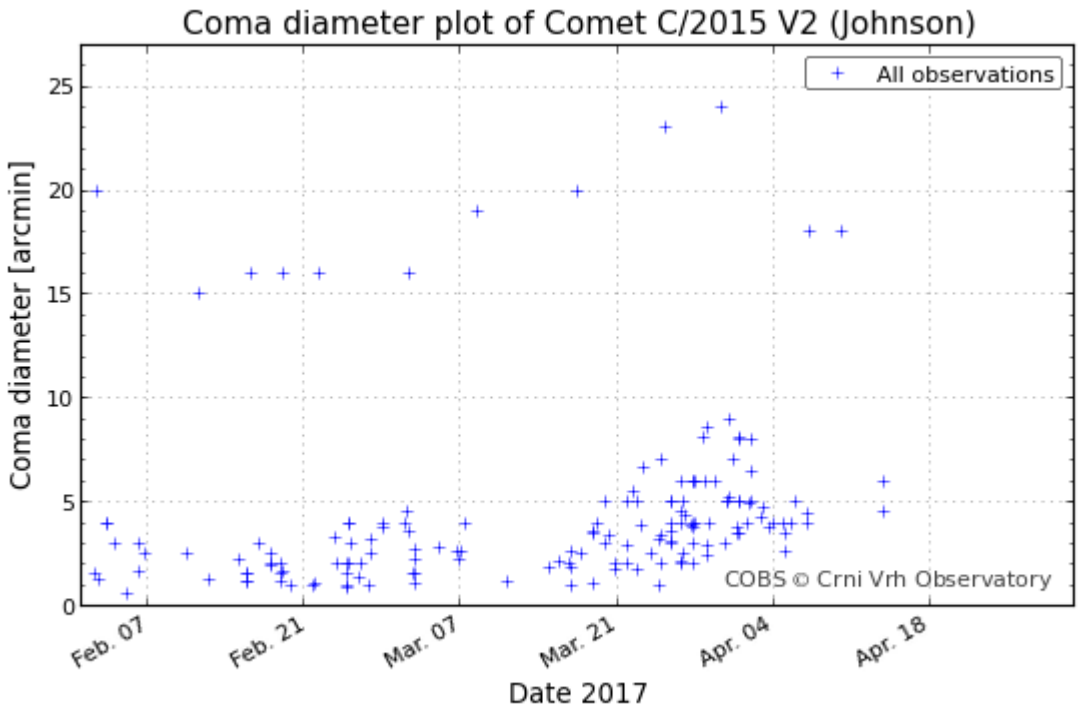

Courtesy: COBS (Comet Observations Database), http://www.cobs.si/analysis, Cache: 14 April 2017, 2010.

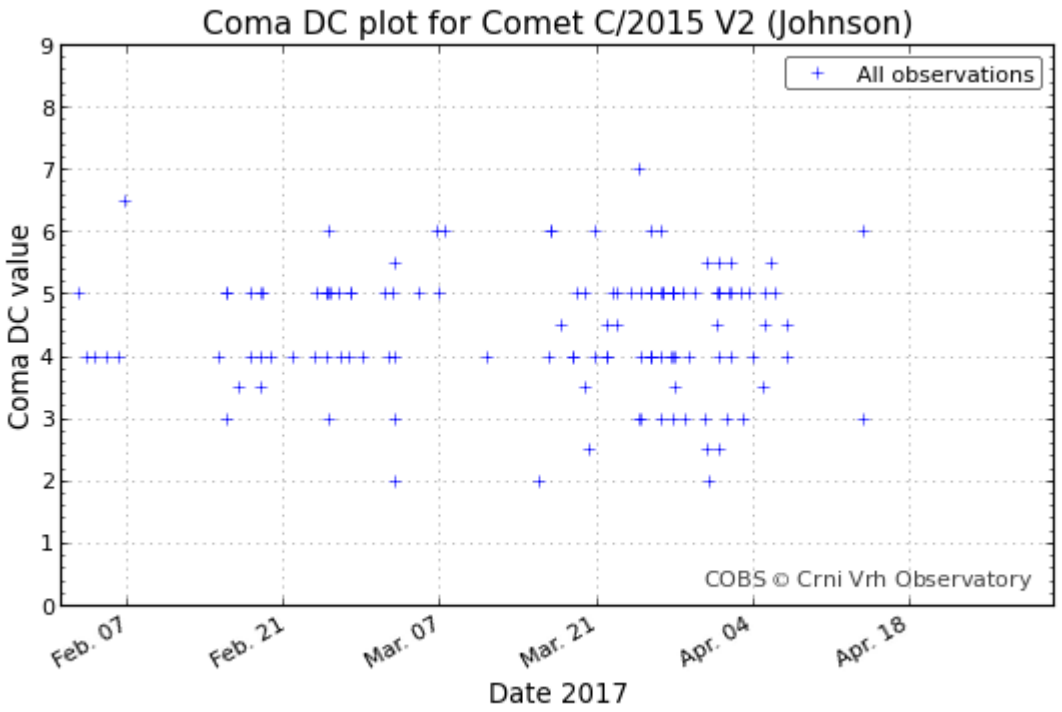



Courtesy: Seiichi Yoshida's Home Page – C/2015 V2 (Johnson) webpage, http://www.aerith.net/comet/catalog/2015V2/2015V2.html, Updated: 1 April 2017.

*Progression of the visual and measured brightness of C/2015 V2 showing a gradual brightening of the comet from reports indicating magnitude values as faint as 12.2 to a peak brightness between visual magnitudes of 6.5 – 7 by the time of perihelion passage on 12 June 2017! However, there is already on visual observation at 6.3, but it is non – confirmed not does it correlate with the majority of the field reports indicate a gradual increase in the range of visual magnitudes:* ***10 – 11 between 1 Feb – 7 Mar and 9 – 10 between 21 Mar – 4 April . The latest observation reports have the visual magnitude range between 8.9 – 8.5 for all of the early half of April.*** *The right graph shows a photometry or light curve projection with the comet passing 12th magnitude brightness by 1 January 2018. Note the slight oscillating or wave pattern predicted for the brightness and from the measured values on either side of the perihelion passage. This is characteristic of the comet's slight fluctuation in it's ever increasing Solar and Earth distances and this is mostly due to the 365.26 day period for the sidereal year as the orbital period of the Earth about the Sun!*

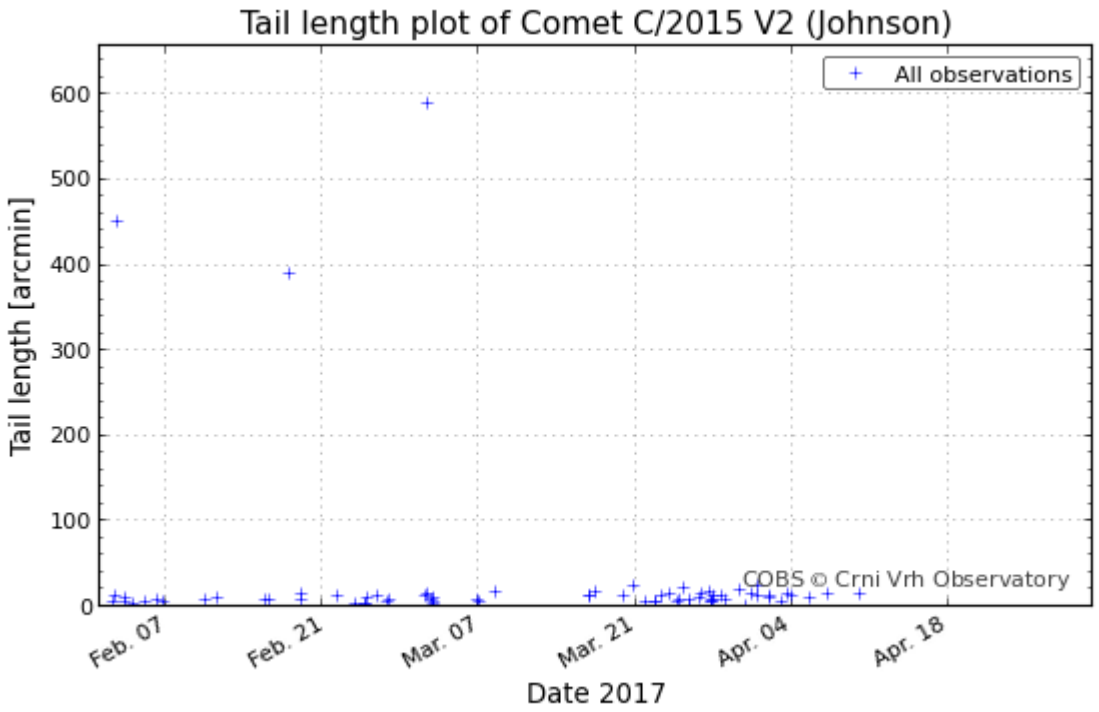
# LETS GO PICK SOME COMETS!

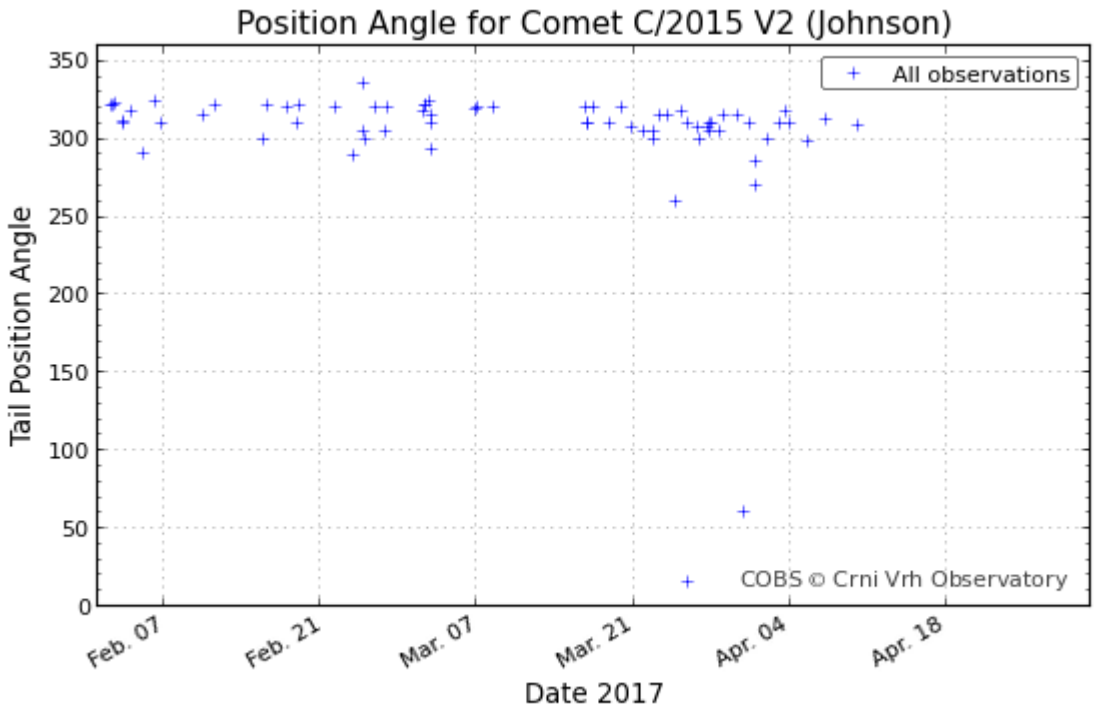



The DC for Comet Johnson for the period of (1 February to 1 May) 2017 shows a value range of 2 – 7 with the majority of the field reports indicating a tighter pattern between 4 – 5 which indicates an inner coma developing, becoming brighter, and developing more distinctly from the outer coma. The coma diameter is much smaller than for 41P with most of the reports indicating a size range of 1 – 5 arcminutes with peak values ranging from 15 – 24 arcminutes with one field report at 24 arcminutes in the 3 days before and after 31 March which is far from the time of perigee or perihelion passage. Maybe due to some undocumented outburst that was gradual during the time around 31 March, but shows no distinguishing changes based on the DC plot!

# LETS GO PICK SOME COMETS!

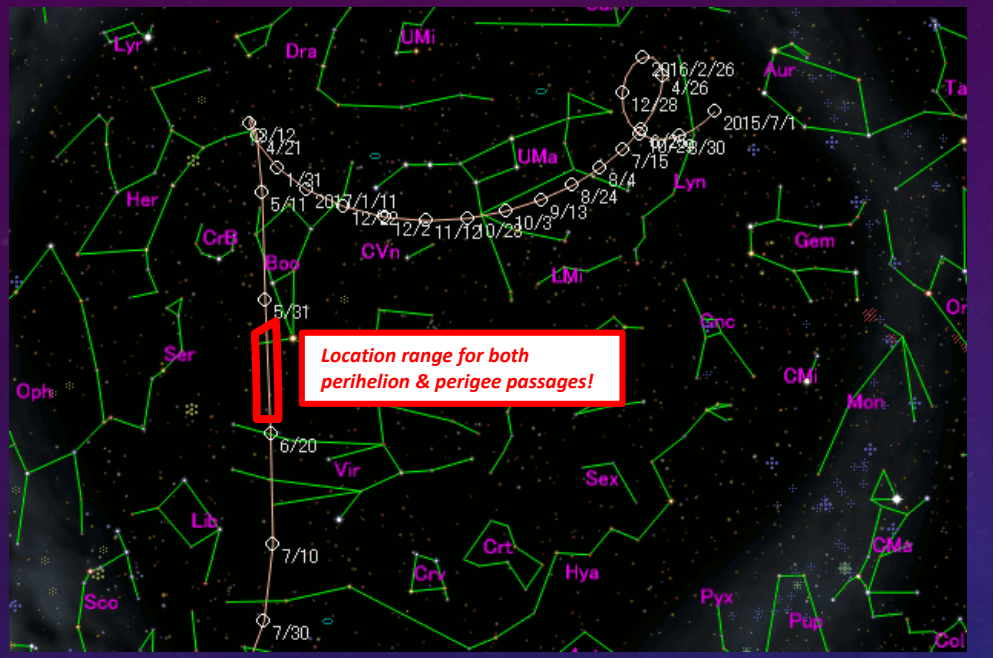



The tail length for Comet Johnson based on all previous field reports (visual and CCD imaging) shows a very narrow tail <20 arcminutes in length and (be aware that the angular diameter of the average full moon is 31 arcminutes). However, the PA angle has the tail oriented between 300 – 330 degrees and this indicates that the tail is positioned to the NW to NNW from the coma upon the comet approaching perihelion passage.

There are some anomalous field reports showing the comet's tail at lengths of 450, 390, & 595 arcminutes between the dates of 2 Feb – 2 Mar. This has caused a disproportionate eschewing of the data in the graph to a tighter pattern at the low end where upon focus the true range is likely 10 – 15 arcminutes.

# LETS GO PICK A COMET!




## Brightness Projections

m1 = 13.5 + 5 log d + 18.0 log r [ ,-65] ( - 2017 Feb. 7)
m1 = 8.5 + 5 log d + 55 log r [-65, 0] (2017 Feb. 7 - 2017 Apr. 13)
m1 = 9.0 + 5 log d + 30 log r [ 0, ] (2017 Apr. 13 - )

Time of Perihelion Passage: 10 – 16 June 2017
Date of Minimum Perihelion: 12 June 2017 @ 09:08:42.6 UTC
Perihelion Distance: 1.637 AU (244,891,714.3 km or 152,168,197.5 mi)

Time of Perigee Passage: 4 – 6 June 2017
Date of Minimum Perigee: 5 June 2017 from (00:56 – 04:31) UTC
Perigee Distance: 0.811 AU (121,331,000 km or 75,391,360.7 mi)

**JPL Small-Body Database Browser**

Search: [ help ]

### C/2015 V2 (Johnson)

**Classification:** Hyperbolic Comet **SPK-ID:** 1003415

[ Ephemeris | Orbit Diagram | Orbital Elements | Physical Parameters ]

[ show orbit diagram ]

**Orbital Elements at Epoch 2457531.5 (2016-May-23.0) TDB**
**Reference: JPL 25 (heliocentric ecliptic J2000)**

| Element | Value | Uncertainty (1-sigma) | Units |
|---|---|---|---|
| e | 1.001516612402057 | 2.9677e-06 | |
| a | -1079.390254722715 | 2.1109 | au |
| q | 1.637016646971843 | 4.5081e-06 | au |
| i | 49.87543875361992 | 1.4691e-05 | deg |
| node | 69.85605603877086 | 3.0317e-05 | deg |
| peri | 164.899783724658 | 0.00016245 | deg |
| M | -.01071091785106322 | 3.1413e-05 | deg |
| $t_p$ | 2457916.881048181923 (2017-Jun-12.38104818) | 0.00033805 | JED |
| period | n/a | n/a | d |
| | n/a | n/a | yr |
| n | 2.779305806965116E-5 | 8.1531e-08 | deg/d |
| Q | n/a | n/a | au |

**Orbit Determination Parameters**

| | |
|---|---|
| # obs. used (total) | 1752 |
| data-arc span | 435 days (1.19 yr) |
| first obs. used | 2015-11-03 |
| last obs. used | 2017-01-11 |
| planetary ephem. | DE431 |
| SB-pert. ephem. | SB431-BIG16 |
| fit RMS | .45029 |
| data source | ORB |
| producer | Otto Matic |
| solution date | 2017-Jan-11 19:59:50 |

**Additional Information**

Earth MOID = .642236 au
Jupiter MOID = 3.34838 au

[ hide covariance matrix ]

**Orbit Covariance (6×6)**

| | e | q | tp | node | peri | i |
|---|---|---|---|---|---|---|
| e | 8.807233222364454E-12 | 5.478356335980256E-12 | -8.232175421817032E-10 | -1.850885496353208E-11 | -3.761473303242824E-10 | 5.79236648024342E-13 |
| q | 5.478356335980256E-12 | 2.032278078650565E-11 | 2.374778248188722E-10 | 2.260693281035782E-11 | -6.429242565950261E-10 | 1.978794621307947E-11 |
| tp | -8.232175421817032E-10 | 2.374778248188722E-10 | 1.142806785126811E-7 | 3.271959173181247E-9 | 1.751909877490689E-8 | 8.431476803022161E-10 |
| node | -1.850885496353208E-11 | 2.260693281035782E-11 | 3.271959173181247E-9 | 9.190972090113112E-10 | -5.509853099646166E-10 | 3.616312322037173E-10 |
| peri | -3.761473303242824E-10 | -6.429242565950261E-10 | 1.751909877490689E-8 | -5.509853099646166E-10 | 2.638860708089413E-8 | -6.973262862892317E-10 |
| i | 5.79236648024342E-13 | 1.978794621307947E-11 | 8.431476803022161E-10 | 3.616312322037173E-10 | -6.973262862892317E-10 | 2.158254524647174E-10 |

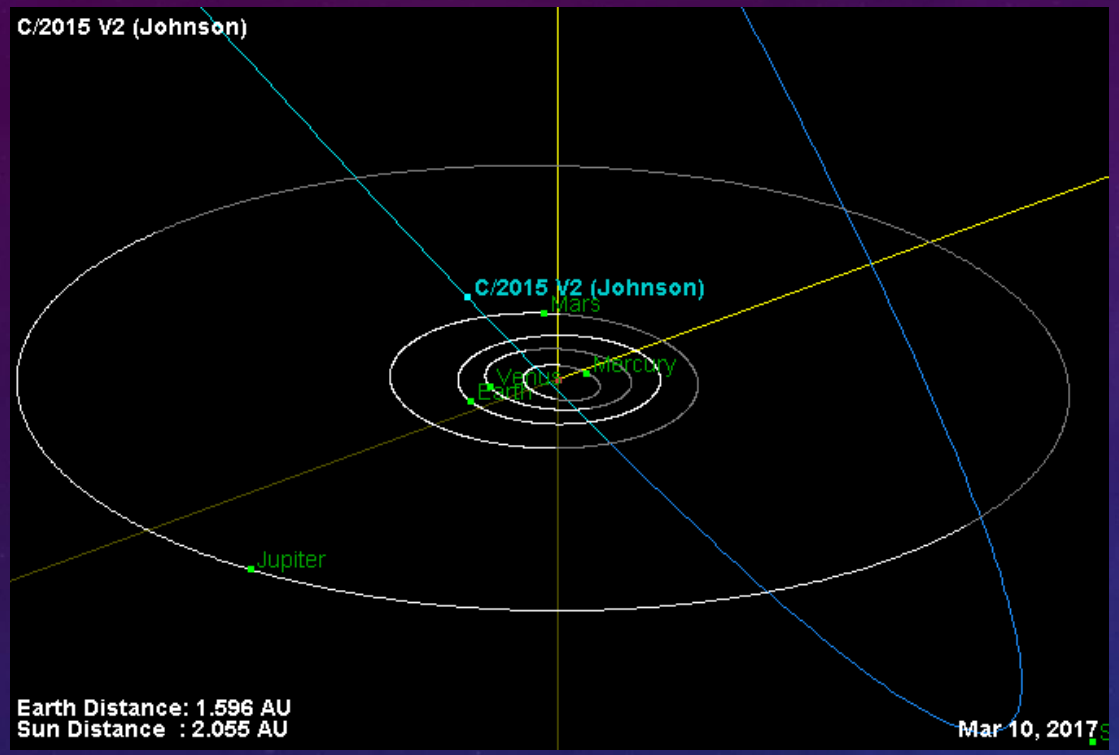
[ Ephemeris | Orbit Diagram | Orbital Elements | Physical Parameters ]

**Physical Parameter Table**

| Parameter | Symbol | Value | Units | Sigma | Reference | Notes |
|---|---|---|---|---|---|---|
| comet total magnitude | M1 | 6.8 | mag | 0.6 | 25 | from 373 observations, assumed slope, autocmod 2.6g |
| comet total magnitude slope | K1 | 8. | | n/a | 25 | autocmod 2.6g |
| comet nuclear magnitude | M2 | 9.6 | mag | 0.8 | 25 | from 1192 observations, autocmod 2.6g |
| comet nuclear magnitude slope | K2 | 5. | | n/a | 25 | autocmod 2.6g |
| comet nuclear phase coefficient | PC | 0.03 | | n/a | 25 | autocmod 2.6g |

[ Ephemeris | Orbit Diagram | Orbital Elements | Physical Parameters ]

# LETS GO PICK SOME COMETS!




*The 'light blue' segment of the comet's path places it currently above the plane of the ecliptic where the rest of the hyperbolic path is in the 'dark blue' tone which places the comet on future dates below the ecliptic plane. The ecliptic plane corresponds to the plane of the Solar system being the plane of the Earth's solar orbit! The comet will be crossing the ecliptic plane on 30 June 2017 long after it has reach it's predicted brightest, visual magnitude, time of perigee and perihelion passages.*

*The ephemeris table to the right shows the essential coordinates for determining the path of characteristics of the comet for the period: (1 May to 1 July) 2017!*

**C/2015 V2 (Johnson)**

Location: HMNS George Observatory
Brazos Bend State Park, Texas, USA

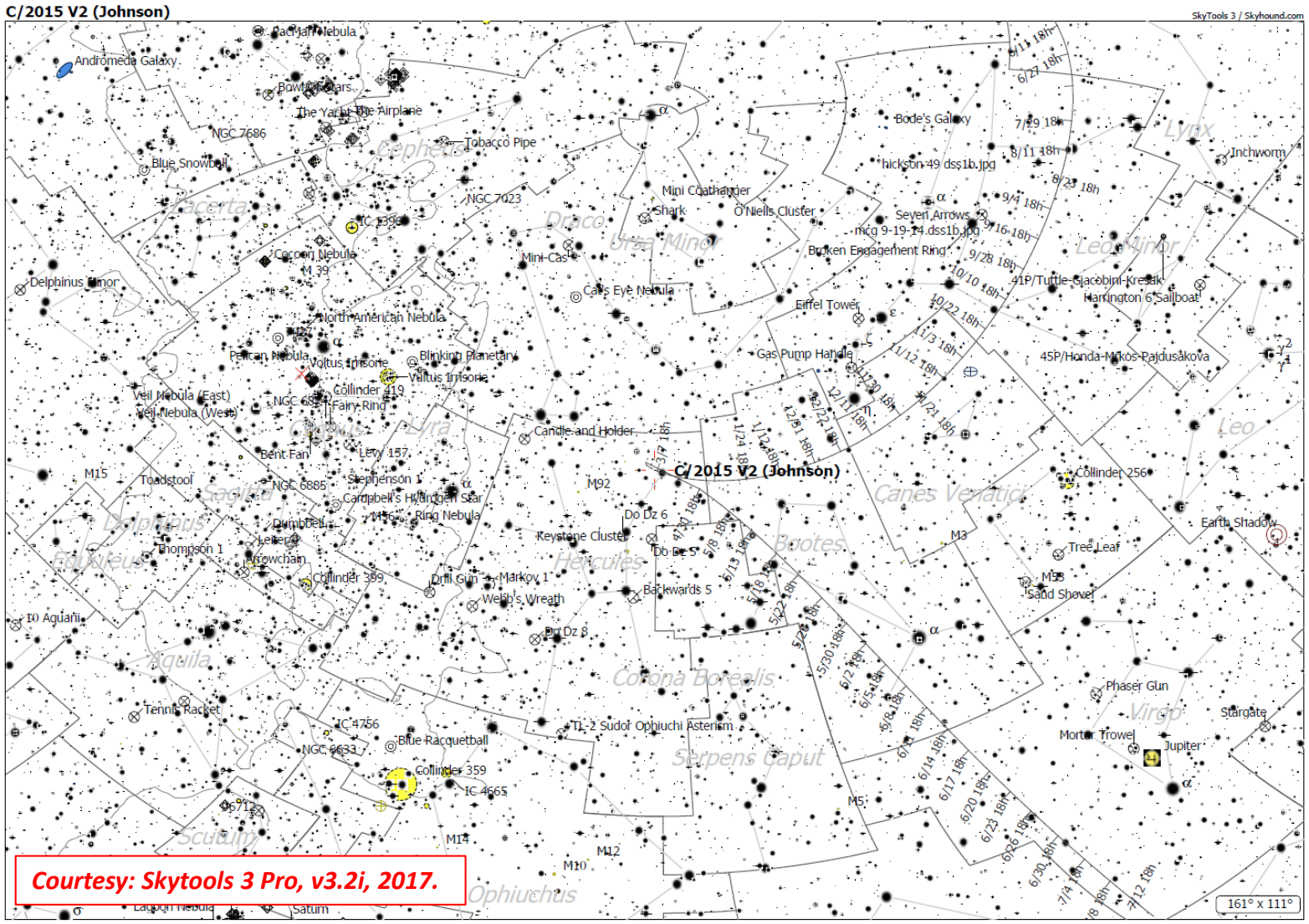
Perturbed ephemeris below is based on elements from *MPC* 102953.

CK15V020

| Date | UT h m s | R.A. (J2000) | Decl. | Delta | r | El. | Ph. | m1 | Sky Motion "/min | P.A. | Object Azi. | Alt. | Sun Alt. | Moon Phase | Dist. | Alt. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 2017 05 01 | 060000 | 15 53 11.3 | +43 51 23 | 1.009 | 1.731 | 118.3 | 30.8 | 7.4 | 1.28 | 230.1 | 226 | +66 | -45 | 0.30 | 103 | -04 |
| 2017 05 02 | 060000 | 15 51 02.8 | +43 30 47 | 0.999 | 1.727 | 118.8 | 30.8 | 7.4 | 1.34 | 229.1 | 226 | +67 | -45 | 0.40 | 095 | +06 |
| 2017 05 03 | 060000 | 15 48 52.1 | +43 08 58 | 0.990 | 1.723 | 119.2 | 30.7 | 7.3 | 1.39 | 228.1 | 225 | +68 | -45 | 0.52 | 087 | +16 |
| 2017 05 04 | 060000 | 15 46 39.3 | +42 45 54 | 0.980 | 1.719 | 119.6 | 30.7 | 7.3 | 1.44 | 227.1 | 224 | +69 | -45 | 0.62 | 080 | +26 |
| 2017 05 05 | 060000 | 15 44 24.6 | +42 21 33 | 0.971 | 1.715 | 120.0 | 30.6 | 7.3 | 1.49 | 226.1 | 223 | +70 | -44 | 0.72 | 072 | +34 |
| 2017 05 06 | 060000 | 15 42 08.2 | +41 55 52 | 0.962 | 1.711 | 120.4 | 30.6 | 7.2 | 1.55 | 225.2 | 222 | +71 | -44 | 0.81 | 066 | +41 |
| 2017 05 07 | 060000 | 15 39 50.2 | +41 28 51 | 0.953 | 1.707 | 120.9 | 30.5 | 7.2 | 1.60 | 224.2 | 221 | +73 | -44 | 0.88 | 060 | +47 |
| 2017 05 08 | 060000 | 15 37 30.9 | +41 00 27 | 0.945 | 1.703 | 121.3 | 30.4 | 7.2 | 1.66 | 223.2 | 220 | +74 | -44 | 0.94 | 056 | +50 |
| 2017 05 09 | 060000 | 15 35 10.4 | +40 30 38 | 0.936 | 1.700 | 121.7 | 30.4 | 7.2 | 1.71 | 222.3 | 218 | +75 | -43 | 0.97 | 053 | +51 |
| 2017 05 10 | 060000 | 15 32 49.0 | +39 59 24 | 0.928 | 1.696 | 122.1 | 30.3 | 7.1 | 1.77 | 221.3 | 216 | +76 | -43 | 1.00 | 052 | +50 |
| 2017 05 11 | 060000 | 15 30 26.9 | +39 26 43 | 0.920 | 1.693 | 122.5 | 30.2 | 7.1 | 1.82 | 220.4 | 213 | +77 | -43 | 1.00 | 053 | +46 |
| 2017 05 12 | 060000 | 15 28 04.3 | +38 52 33 | 0.912 | 1.689 | 122.9 | 30.1 | 7.1 | 1.88 | 219.5 | 210 | +79 | -42 | 0.98 | 057 | +40 |
| 2017 05 13 | 060000 | 15 25 41.3 | +38 16 54 | 0.904 | 1.686 | 123.3 | 30.0 | 7.1 | 1.94 | 218.5 | 207 | +80 | -42 | 0.95 | 062 | +34 |
| 2017 05 14 | 060000 | 15 23 18.2 | +37 39 45 | 0.897 | 1.683 | 123.7 | 30.0 | 7.0 | 1.99 | 217.6 | 202 | +81 | -42 | 0.90 | 068 | +26 |
| 2017 05 15 | 060000 | 15 20 55.3 | +37 01 05 | 0.890 | 1.680 | 124.1 | 29.9 | 7.0 | 2.05 | 216.7 | 195 | +82 | -42 | 0.84 | 075 | +18 |
| 2017 05 16 | 060000 | 15 18 32.6 | +36 20 53 | 0.883 | 1.677 | 124.5 | 29.8 | 7.0 | 2.10 | 215.9 | 187 | +83 | -42 | 0.76 | 083 | +10 |
| 2017 05 17 | 060000 | 15 16 10.5 | +35 39 10 | 0.876 | 1.674 | 124.8 | 29.7 | 7.0 | 2.16 | 215.0 | 176 | +84 | -41 | 0.68 | 091 | +02 |
| 2017 05 18 | 060000 | 15 13 49.1 | +34 55 55 | 0.870 | 1.671 | 125.2 | 29.7 | 6.9 | 2.22 | 214.1 | 163 | +84 | -41 | 0.58 | 100 | -07 |
| 2017 05 19 | 060000 | 15 11 28.6 | +34 11 09 | 0.864 | 1.669 | 125.5 | 29.6 | 6.9 | 2.27 | 213.3 | 149 | +84 | -41 | 0.48 | 109 | -15 |
| 2017 05 20 | 060000 | 15 09 09.2 | +33 24 52 | 0.858 | 1.666 | 125.8 | 29.5 | 6.9 | 2.32 | 212.4 | 135 | +84 | -41 | 0.37 | 118 | -24 |
| 2017 05 21 | 060000 | 15 06 51.2 | +32 37 05 | 0.852 | 1.664 | 126.1 | 29.4 | 6.9 | 2.38 | 211.6 | 122 | +83 | -40 | 0.27 | 126 | -32 |
| 2017 05 22 | 060000 | 15 04 34.7 | +31 47 49 | 0.847 | 1.661 | 126.4 | 29.4 | 6.8 | 2.43 | 210.7 | 112 | +82 | -40 | 0.18 | 134 | -39 |
| 2017 05 23 | 060000 | 15 02 19.8 | +30 57 06 | 0.842 | 1.659 | 126.7 | 29.3 | 6.8 | 2.48 | 209.9 | 104 | +81 | -40 | 0.10 | 138 | -44 |
| 2017 05 24 | 060000 | 15 00 06.9 | +30 04 58 | 0.838 | 1.657 | 126.9 | 29.3 | 6.8 | 2.52 | 209.1 | 098 | +80 | -40 | 0.04 | 139 | -47 |
| 2017 05 25 | 060000 | 14 57 56.0 | +29 11 26 | 0.833 | 1.655 | 127.1 | 29.2 | 6.8 | 2.57 | 208.3 | 093 | +79 | -40 | 0.01 | 135 | -46 |
| 2017 05 26 | 060000 | 14 55 47.2 | +28 16 33 | 0.829 | 1.653 | 127.3 | 29.2 | 6.8 | 2.62 | 207.5 | 089 | +77 | -39 | 0.00 | 128 | -42 |
| 2017 05 27 | 060000 | 14 53 40.9 | +27 20 22 | 0.826 | 1.651 | 127.4 | 29.2 | 6.8 | 2.66 | 206.8 | 086 | +76 | -39 | 0.03 | 118 | -35 |
| 2017 05 28 | 060000 | 14 51 37.0 | +26 22 56 | 0.823 | 1.650 | 127.6 | 29.1 | 6.7 | 2.70 | 206.0 | 084 | +74 | -39 | 0.09 | 107 | -27 |
| 2017 05 29 | 060000 | 14 49 35.8 | +25 24 18 | 0.820 | 1.648 | 127.7 | 29.1 | 6.7 | 2.73 | 205.3 | 082 | +73 | -39 | 0.17 | 095 | -18 |
| 2017 05 30 | 060000 | 14 47 37.4 | +24 24 33 | 0.817 | 1.646 | 127.7 | 29.1 | 6.7 | 2.77 | 204.5 | 080 | +71 | -39 | 0.26 | 083 | -09 |
| 2017 05 31 | 060000 | 14 45 41.8 | +23 23 44 | 0.815 | 1.645 | 127.8 | 29.2 | 6.7 | 2.80 | 203.8 | 079 | +70 | -39 | 0.37 | 071 | +00 |
| 2017 06 01 | 060000 | 14 43 49.1 | +22 21 55 | 0.814 | 1.644 | 127.8 | 29.2 | 6.7 | 2.83 | 203.1 | 077 | +68 | -39 | 0.47 | 060 | +09 |
| 2017 06 02 | 060000 | 14 41 59.5 | +21 19 12 | 0.812 | 1.643 | 127.8 | 29.2 | 6.7 | 2.85 | 202.4 | 076 | +66 | -38 | 0.58 | 050 | +17 |
| 2017 06 03 | 060000 | 14 40 13.0 | +20 15 38 | 0.812 | 1.642 | 127.7 | 29.3 | 6.7 | 2.87 | 201.7 | 075 | +65 | -38 | 0.67 | 040 | +24 |
| 2017 06 04 | 060000 | 14 38 29.7 | +19 11 19 | 0.811 | 1.641 | 127.6 | 29.3 | 6.7 | 2.89 | 201.0 | 075 | +63 | -38 | 0.76 | 032 | +31 |
| 2017 06 05 | 060000 | 14 36 49.6 | +18 06 19 | 0.811 | 1.640 | 127.5 | 29.4 | 6.7 | 2.91 | 200.3 | 074 | +61 | -38 | 0.84 | 027 | +36 |
| 2017 06 06 | 060000 | 14 35 12.9 | +17 00 44 | 0.811 | 1.639 | 127.3 | 29.5 | 6.7 | 2.92 | 199.7 | 073 | +60 | -38 | 0.90 | 027 | +41 |
| 2017 06 07 | 060000 | 14 33 39.4 | +15 54 40 | 0.812 | 1.638 | 127.1 | 29.6 | 6.7 | 2.93 | 199.0 | 073 | +58 | -38 | 0.95 | 031 | +43 |
| 2017 06 08 | 060000 | 14 32 09.3 | +14 48 10 | 0.813 | 1.638 | 126.9 | 29.7 | 6.7 | 2.93 | 198.4 | 072 | +56 | -38 | 0.98 | 039 | +44 |
| 2017 06 09 | 060000 | 14 30 42.5 | +13 41 20 | 0.815 | 1.638 | 126.6 | 29.8 | 6.7 | 2.93 | 197.7 | 072 | +55 | -38 | 1.00 | 048 | +43 |
| 2017 06 10 | 060000 | 14 29 19.2 | +12 34 17 | 0.817 | 1.637 | 126.3 | 30.0 | 6.7 | 2.93 | 197.1 | 071 | +53 | -38 | 1.00 | 058 | +40 |
| 2017 06 11 | 060000 | 14 27 59.2 | +11 27 04 | 0.819 | 1.637 | 126.0 | 30.1 | 6.7 | 2.93 | 196.5 | 071 | +51 | -37 | 0.97 | 069 | +36 |
| 2017 06 12 | 060000 | 14 26 42.7 | +10 19 47 | 0.822 | 1.637 | 125.6 | 30.3 | 6.7 | 2.92 | 195.9 | 070 | +49 | -37 | 0.94 | 080 | +30 |
| 2017 06 13 | 060000 | 14 25 29.6 | +09 12 31 | 0.825 | 1.637 | 125.2 | 30.4 | 6.7 | 2.91 | 195.3 | 070 | +48 | -37 | 0.88 | 091 | +24 |
| 2017 06 14 | 060000 | 14 24 19.9 | +08 05 20 | 0.829 | 1.637 | 124.8 | 30.6 | 6.7 | 2.89 | 194.6 | 070 | +46 | -37 | 0.81 | 103 | +17 |
| 2017 06 15 | 060000 | 14 23 13.7 | +06 58 21 | 0.833 | 1.637 | 124.4 | 30.8 | 6.7 | 2.88 | 194.0 | 069 | +44 | -37 | 0.73 | 115 | +10 |
| 2017 06 16 | 060000 | 14 22 10.8 | +05 51 36 | 0.837 | 1.638 | 123.9 | 31.0 | 6.8 | 2.86 | 193.4 | 069 | +43 | -37 | 0.63 | 127 | +02 |
| 2017 06 17 | 060000 | 14 21 11.4 | +04 45 10 | 0.842 | 1.638 | 123.4 | 31.2 | 6.8 | 2.83 | 192.8 | 069 | +41 | -37 | 0.53 | 140 | -06 |
| 2017 06 18 | 060000 | 14 20 15.3 | +03 39 08 | 0.847 | 1.639 | 122.9 | 31.4 | 6.8 | 2.81 | 192.2 | 069 | +39 | -37 | 0.42 | 152 | -14 |
| 2017 06 19 | 060000 | 14 19 22.6 | +02 33 33 | 0.853 | 1.640 | 122.4 | 31.6 | 6.8 | 2.78 | 191.6 | 068 | +38 | -37 | 0.31 | 164 | -22 |
| 2017 06 20 | 060000 | 14 18 33.2 | +01 28 29 | 0.859 | 1.640 | 121.8 | 31.8 | 6.8 | 2.75 | 191.0 | 068 | +36 | -37 | 0.21 | 170 | -29 |
| 2017 06 21 | 060000 | 14 17 47.2 | +00 24 00 | 0.865 | 1.641 | 121.2 | 32.0 | 6.8 | 2.72 | 190.3 | 068 | +35 | -37 | 0.12 | 161 | -36 |
| 2017 06 22 | 060000 | 14 17 04.5 | -00 39 53 | 0.872 | 1.642 | 120.7 | 32.2 | 6.9 | 2.69 | 189.7 | 068 | +33 | -37 | 0.05 | 147 | -40 |
| 2017 06 23 | 060000 | 14 16 25.1 | -01 43 05 | 0.879 | 1.644 | 120.1 | 32.4 | 6.9 | 2.65 | 189.1 | 067 | +32 | -37 | 0.01 | 133 | -42 |
| 2017 06 24 | 060000 | 14 15 48.9 | -02 45 35 | 0.887 | 1.645 | 119.4 | 32.6 | 6.9 | 2.62 | 188.4 | 067 | +30 | -37 | 0.00 | 118 | -41 |
| 2017 06 25 | 060000 | 14 15 16.0 | -03 47 20 | 0.894 | 1.646 | 118.8 | 32.8 | 6.9 | 2.58 | 187.7 | 067 | +29 | -37 | 0.02 | 103 | -37 |
| 2017 06 26 | 060000 | 14 14 46.3 | -04 48 18 | 0.903 | 1.648 | 118.2 | 32.9 | 6.9 | 2.54 | 187.1 | 067 | +27 | -37 | 0.07 | 089 | -31 |
| 2017 06 27 | 060000 | 14 14 19.7 | -05 48 27 | 0.911 | 1.649 | 117.5 | 33.1 | 7.0 | 2.50 | 186.4 | 067 | +26 | -37 | 0.14 | 075 | -24 |
| 2017 06 28 | 060000 | 14 13 56.2 | -06 47 46 | 0.920 | 1.651 | 116.9 | 33.3 | 7.0 | 2.46 | 185.7 | 066 | +24 | -37 | 0.22 | 061 | -16 |
| 2017 06 29 | 060000 | 14 13 35.8 | -07 46 13 | 0.929 | 1.653 | 116.2 | 33.5 | 7.0 | 2.42 | 185.1 | 066 | +23 | -37 | 0.32 | 048 | -09 |
| 2017 06 30 | 060000 | 14 13 18.5 | -08 43 48 | 0.938 | 1.655 | 115.6 | 33.7 | 7.0 | 2.38 | 184.4 | 066 | +21 | -37 | 0.42 | 035 | -01 |
| 2017 07 01 | 060000 | 14 13 04.1 | -09 40 29 | 0.948 | 1.657 | 114.9 | 33.8 | 7.1 | 2.34 | 183.7 | 066 | +20 | -37 | 0.52 | 022 | +07 |

# LETS GO PICK SOME COMETS!

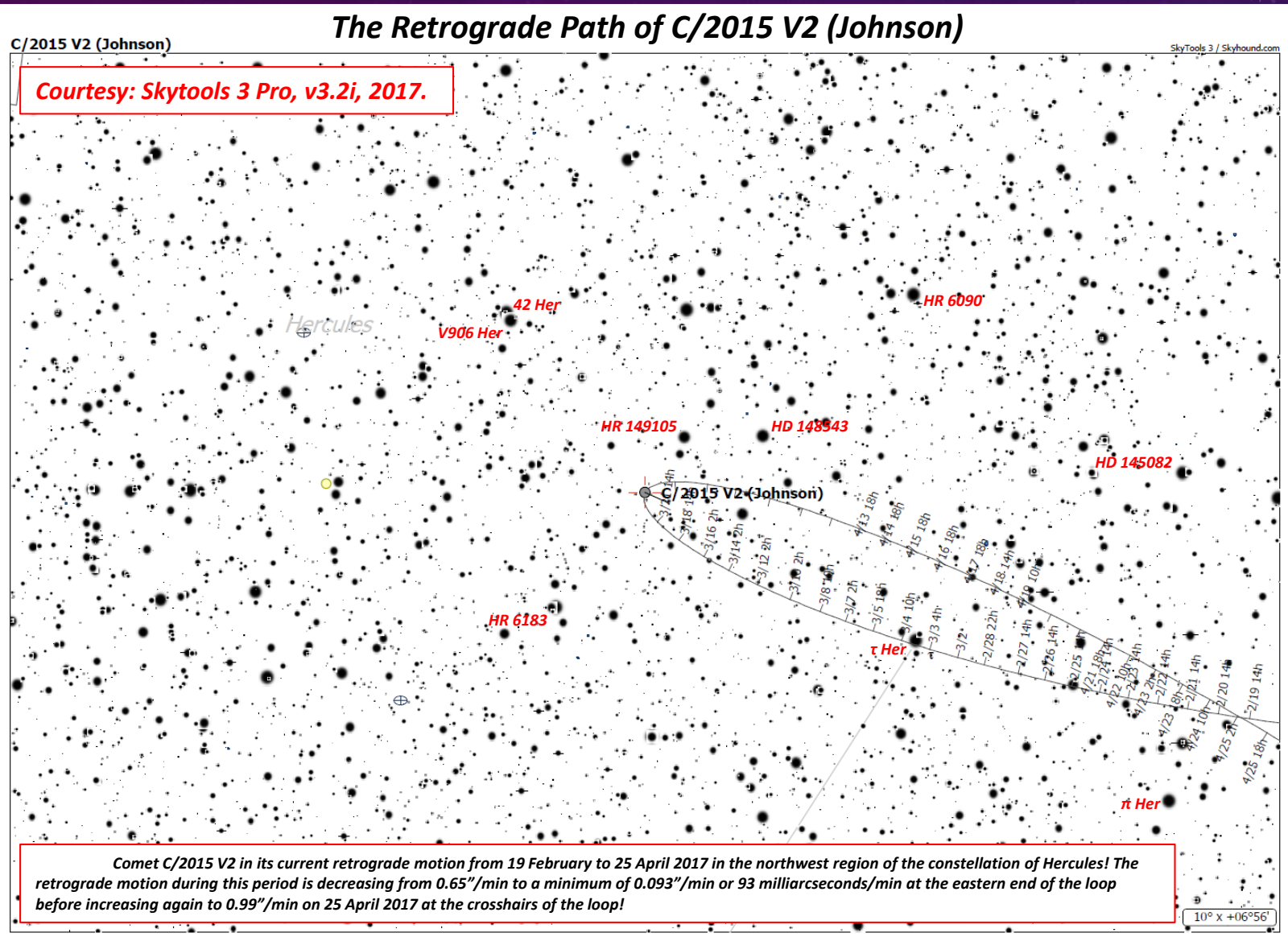
***The Current & Projected Path of C/2015 V2 (Johnson)***




***Courtesy: Skytools 3 Pro, v3.2i, 2017.***

Comet C/2015 V2 has for most of 2016 remained the general region of the northern circumpolar constellations. Since early July 2016 the comet was progressed in pure eastward direction through the central region of Ursa Major south of the 'Big Dipper' asterism up until late October 2016. Then Comet Johnson continued through the northern region of Canes Venatici from Late October 2016 through Late December 2016. Then it continued to progress eastward across the narrow northern region of Boötes from 20 December 2016 to 9 February 2017. Currently the comet is in a narrow retrograde motion as shown in the loop at the center of the image in the northwestern region of Hercules from 19 February to 25 April 2017. The comet will afterwards return to the constellation of Boötes travelling SE to southward along its eastern to south central regions from 3 May to 14 June. Then continues it's southward path through the eastern regions of Virgo thru mid July!

# LETS GO PICK SOME COMETS!




Comet C/2015 V2 in its current retrograde motion from 19 February to 25 April 2017 in the northwest region of the constellation of Hercules! The retrograde motion during this period is decreasing from 0.65”/min to a minimum of 0.093”/min or 93 milliarcseconds/min at the eastern end of the loop before increasing again to 0.99”/min on 25 April 2017 at the crosshairs of the loop!

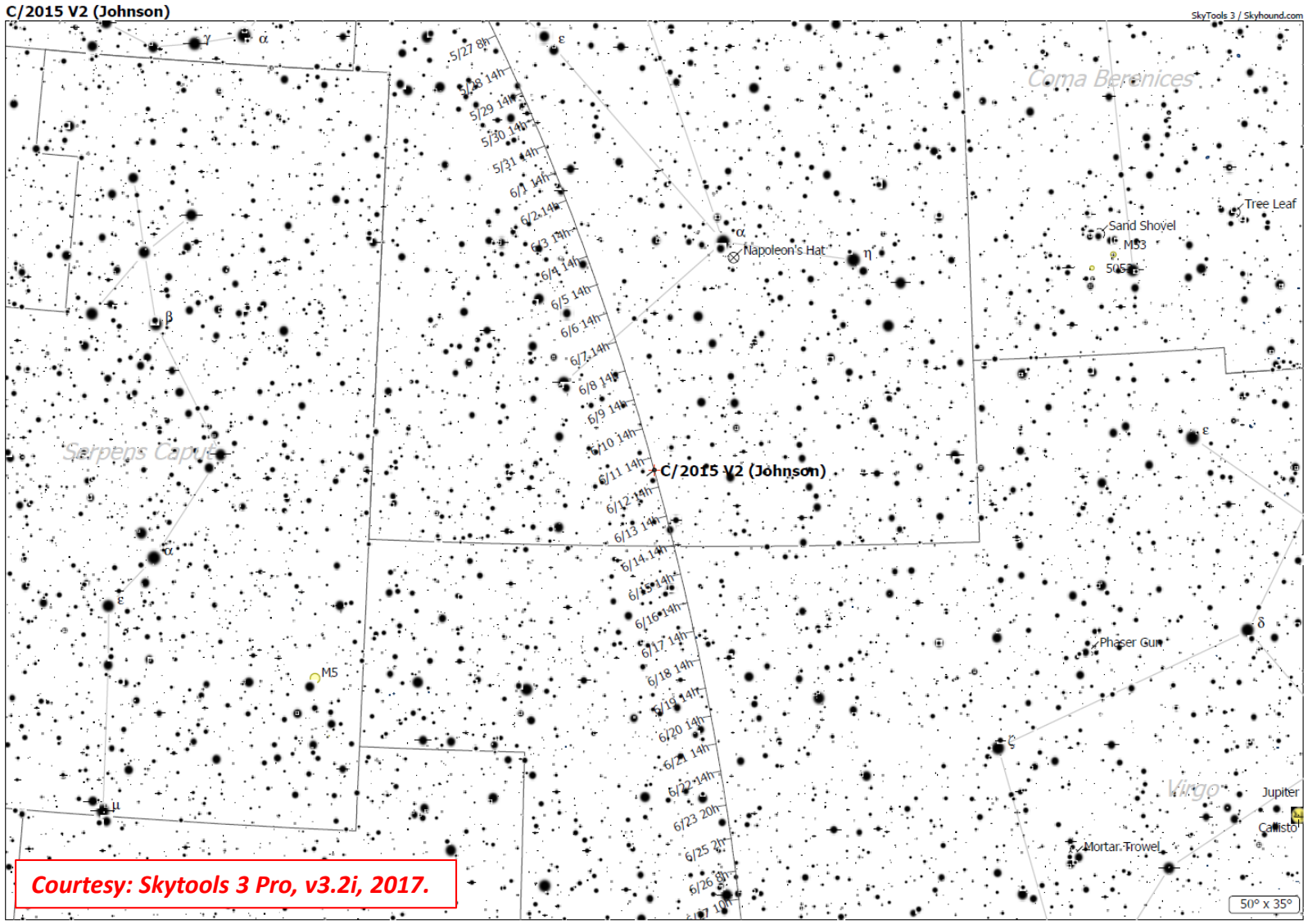
# LETS GO PICK SOME COMETS!

## *The Projected Path of C/2015 V2 (Johnson)*

***During the time of both perihelion and perigee passage!***

*2017 Foreshortening values for the Tail of C/2015 V2*

| | |
|---|---|
| *1 – 3 Jan: 63%* | *15 – 20 Feb: 56%* |
| *4 – 10 Jan: 62%* | *21 – 27 Feb: 55%* |
| *11 – 17 Jan: 61%* | *28 Feb – 5 Mar: 54%* |
| *18 – 24 Jan: 60%* | *6 – 12 Mar: 53%* |
| *25 – 31 Jan: 59%* | *13 – 19 Mar: 52%* |
| *1 – 7 Feb: 58%* | *20 – 26 Mar: 51%* |
| *8 – 14 Feb: 57%* | *27 Mar – 4 Apr: 50%* |
| *5 Apr – 9 May: 49%* | *8 – 12 Jun: 50%* |
| *10 – 18 May: 50%* | *13 – 16 Jun: 49%* |
| *19 May – 7 Jun: 51%* | *17 – 19 Jun: 48%* |




***Courtesy: Skytools 3 Pro, v3.2i, 2017.***

Moon Phases for Comet C/2015 V2 (1 March – 1 July) 2017:

| | |
|---|---|
| March 1: 0.09 (Near New Moon) | May 3: 0.52 (1st Qtr. Moon) |
| March 5: 0.47 (1st Qtr. Moon) | May 10 – 11: 1.00 (Full Moon) |
| March 12 – 13: 1.00 (Full Moon) | May 19: 0.48 (Last Qtr. Moon) |
| March 20: 0.54 (Last Qtr. Moon) | May 26: 0.00(New Moon) |
| March 28: 0.00 (New Moon) | Jun 1: 0.47 (1st Qtr. Moon) |
| *April 4: 0.55 (1st Qtr. Moon) | Jun 9 – 10: 1.00 (New Moon) |
| *April 10: 1.00 (Full Moon) | Jun 17: 0.53 (Last Qtr. Moon) |
| *April 19: 0.52 (Last Qtr. Moon) | Jun 24: 0.00 (New Moon) |
| April 26: 0.00 (New Moon) | July 1: 0.52 (1st Qtr. Moon) |

***Note that the conditions for observing C/2015 V2 are not very favorable since the time from April 4 – 19 during the two weeks after perigee when the comet is expected to be at its brightest between perigee and perihelion and the time of perihelion passage. This is in spite of the fact that comet 41P will be a circumpolar comet!***

# LETS GO PICK A COMET!

**Comet C/2015 V2 (Johnson)**

**<u>Observations by Cloudynights Member: Heidescoper</u>**

Location: Niedersachsen, Germany

Date: 2 March 2017 @ 22:30 UTC

Telescope Instrument: 16” Dobsonian Reflector @ 139x

Coma Diameter: 1.1 arcminutes w/ DC of 5 – 5.5

Tail Length: 5.5 arcminutes @ P.A. of 315° (NW)

The star to the slight upper right is Tau Herculis at 10.5’ distance from the comet.

*A eclipsing binary system*
*Visual Magnitude: 3.90*
*Type B5 (Bluish) Main Sequence Subgiant at 4.9 solar masses*
*Luminosity: 700 Suns*
*Distance: 307.40 light years*

# LETS GO PICK SOME COMETS!

C/2017 E4 (Lovejoy)

*28 March 2017*

*Roland Fichtl*

*Discoverers: Terry James Lovejoy*
*(Birkdale, Queensland, Australia)*

Discovery Date: 9 March 2017
Visual Magnitude on Discovery Date: 15.0

**Instruments: Celestron C8 (Schmidt – Cassegrain Telescope)**
**f/2.1 QHY9 CCD Camera**

Epoch (Time – based reference point): 16 March 2017

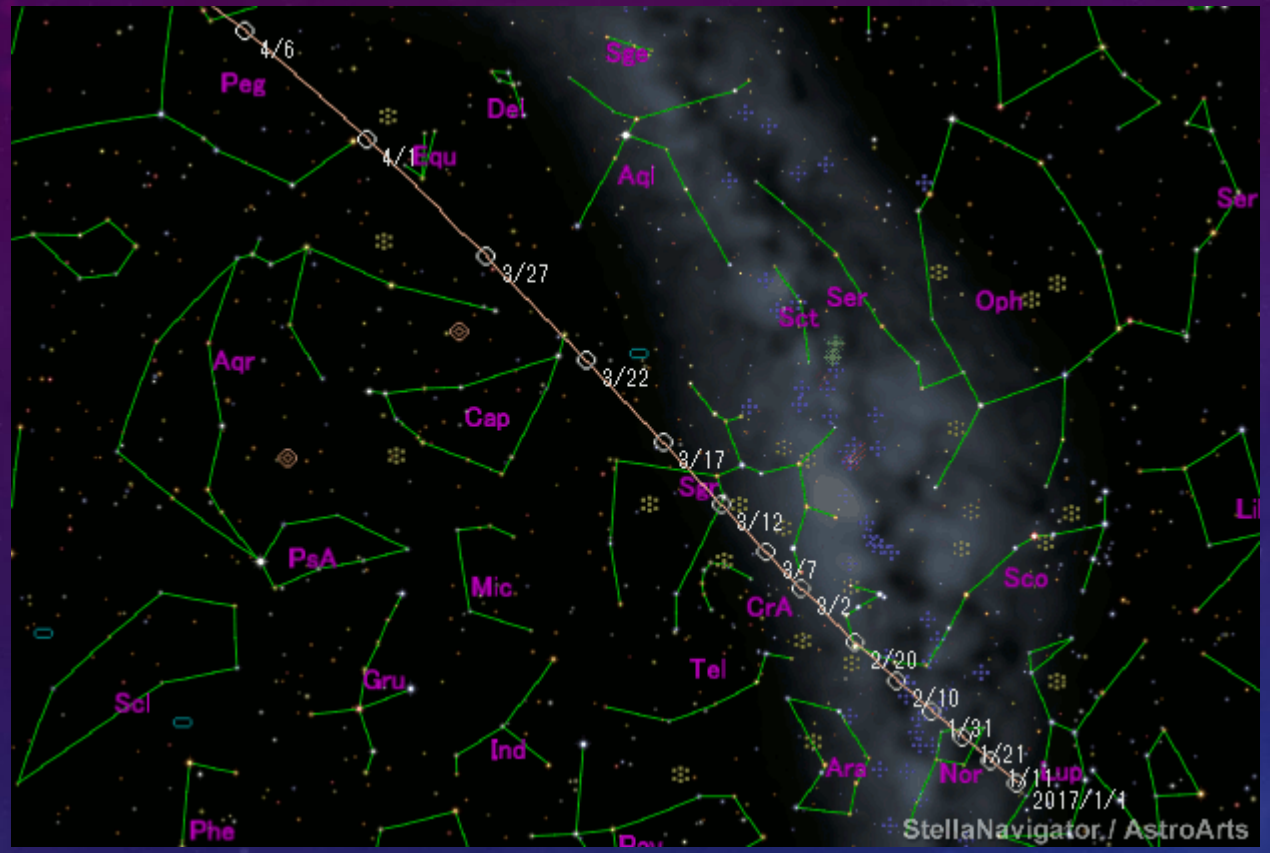
Perihelion: 0.4937 AU (73,856,468.8 km or 45,864,867.1 mi)
Aphelion: 14,112.53 AU (~2.111 trillion km)
Perigee: 0.606 AU (90,656,309.6 km)
Semi – Major Axis: 7056.51 AU (~1.056 trillion km)
Eccentricity: 0.99993 (A Parabolic Path)
Orbital Inclination: $88.1783^0$ or ($88^0$ 10' 41.88")

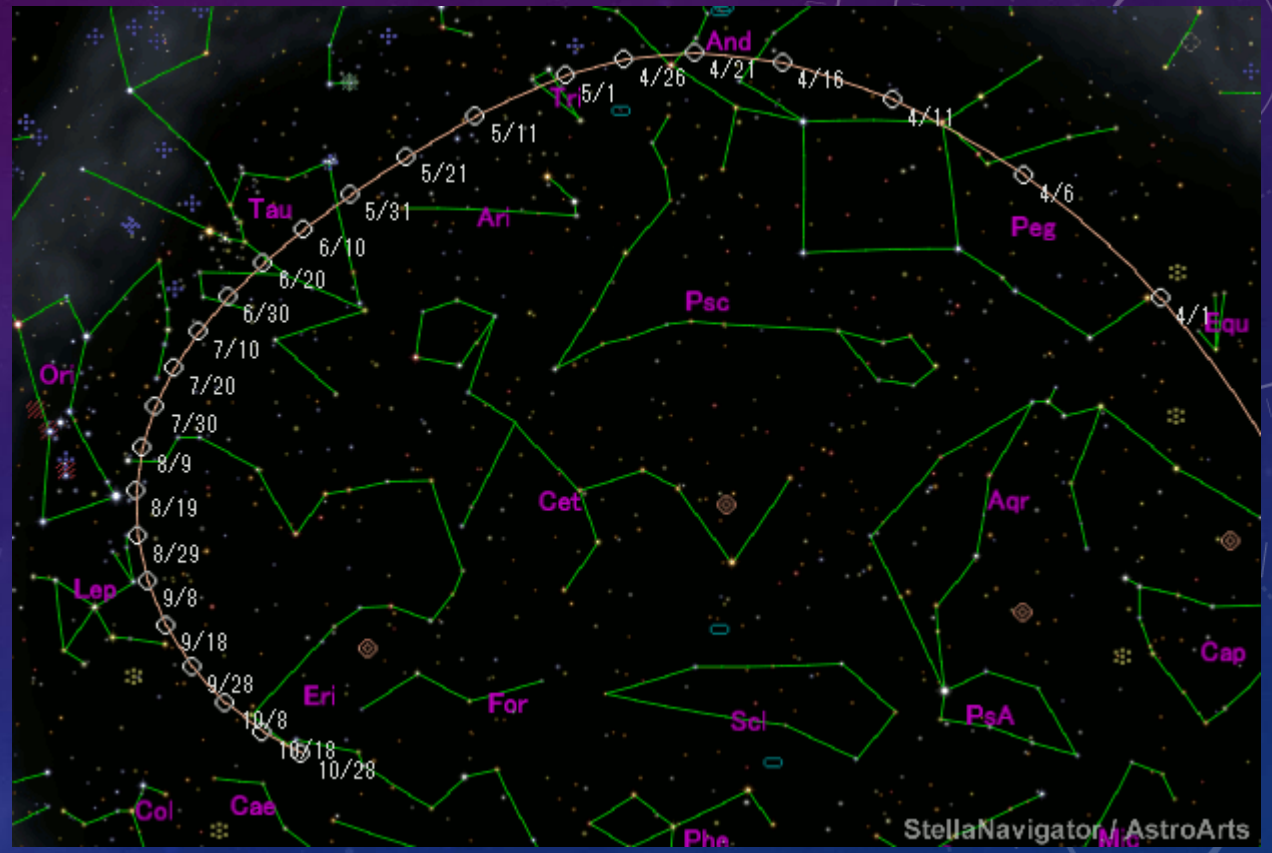
Orbital Period: ~592,779.78 years

*Time of Perihelion Passage: 23 April 2017 @ 07:09:58.8 UTC*

Note of interest: Due to the Comet's aphelion distance it is likely an Oort Cloud object!

# LETS GO PICK SOME COMETS!

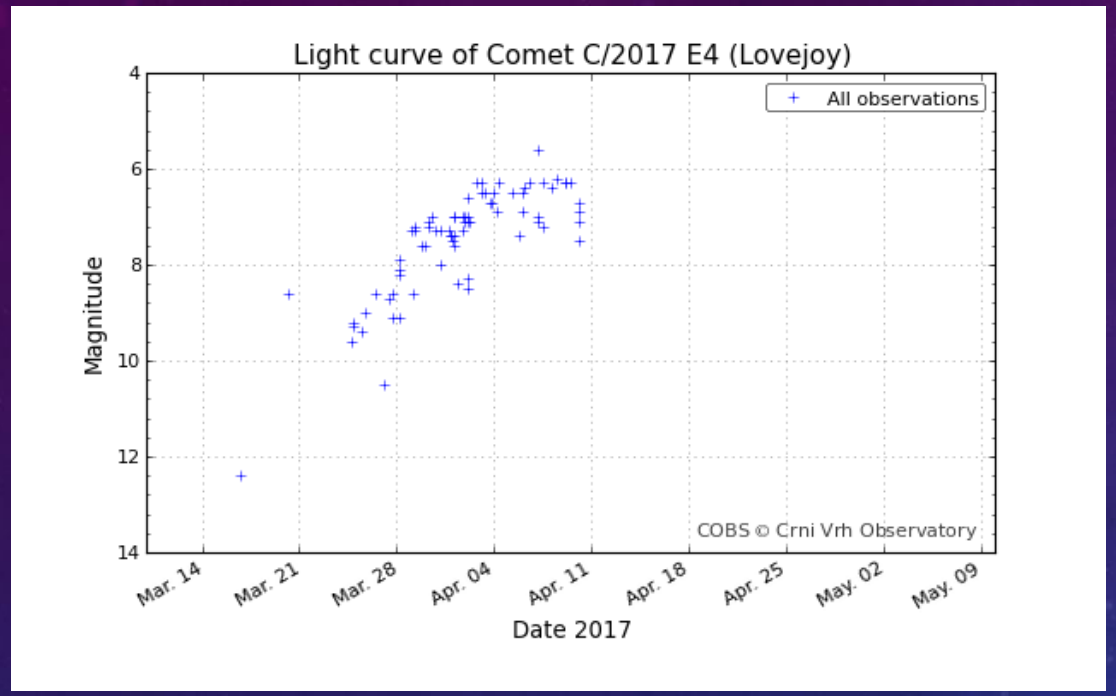


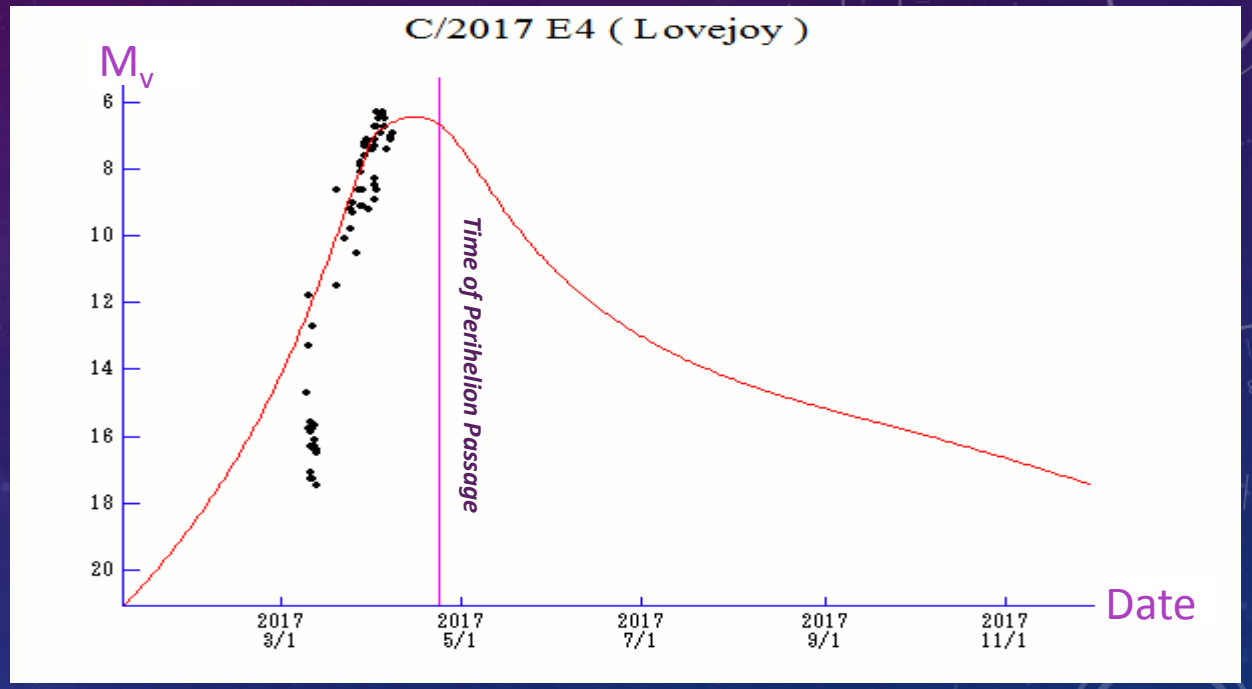

Courtesy: Seiichi Yoshida's Home Page – C/2017 E4 (Lovejoy) webpage, http://aerith.net/comet/catalog/2017E4/2017E4.html, Updated: 14 April 2017.

The left image shows the path of comet C/2017 E4 as it moves along the constellations of the southern celestial skies from Lupus through Norma & Ara to Corona Australis during the time period of (1 Janaury – 1 March) 2017 and continuing to progress further northward and east towards the late summer/early autumn constellations of Capricornus, Aquarius, Equulus, and Pegasus from Late March into Early May. The right image shows the comet continuing its path eastward into the region of Andromeda south of M31 (Andromeda Galaxy) where it most northerly position in declination (J2000) Epoch is 36° 53' 11" on 21 April where it is expected to be within ~6° of M31 of six widths of an average full Moon. The comet will then take a southeasterly approach starting on 26 April upon approaching the Triangulum constellation and will be within ~5.5° to the north of M33 (Triangulum Galaxy) to the SE region of Taurus by 1 July. The comet will then take a southerly approach by late July as it moves into the Western edge of Orion into the region of Eridanus close to the Witch Head's Nebula!

# LETS GO PICK SOME COMETS!



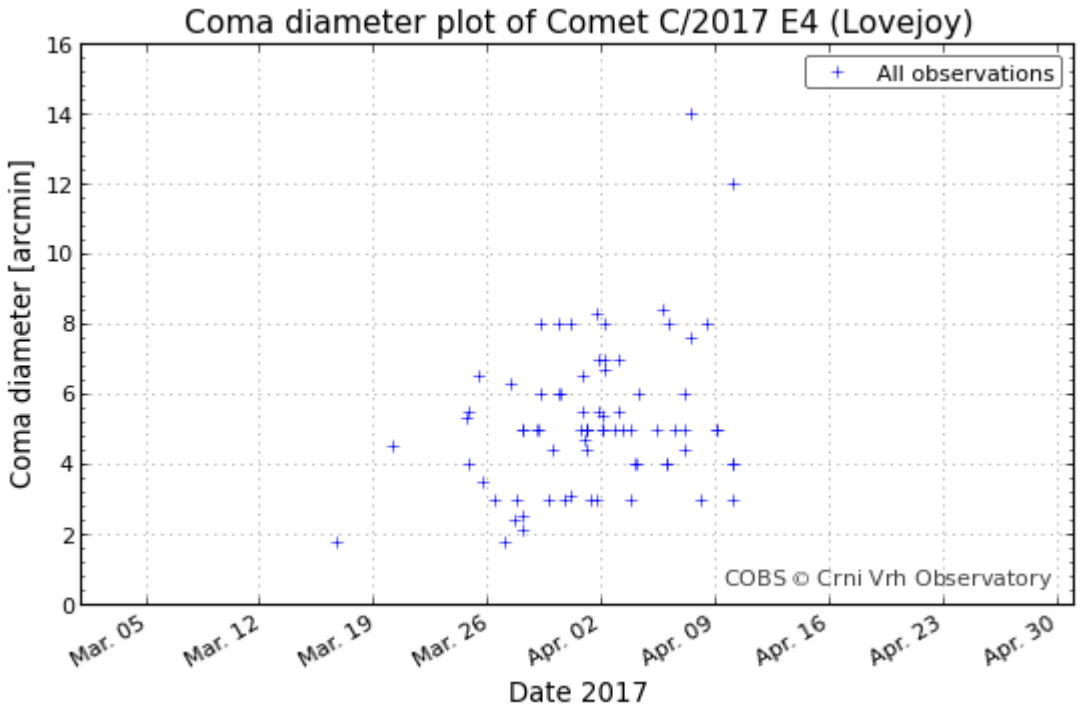

Courtesy: COBS (Comet Observations Database), http://www.cobs.si/analysis, Cache: 14 April 2017, 2010.

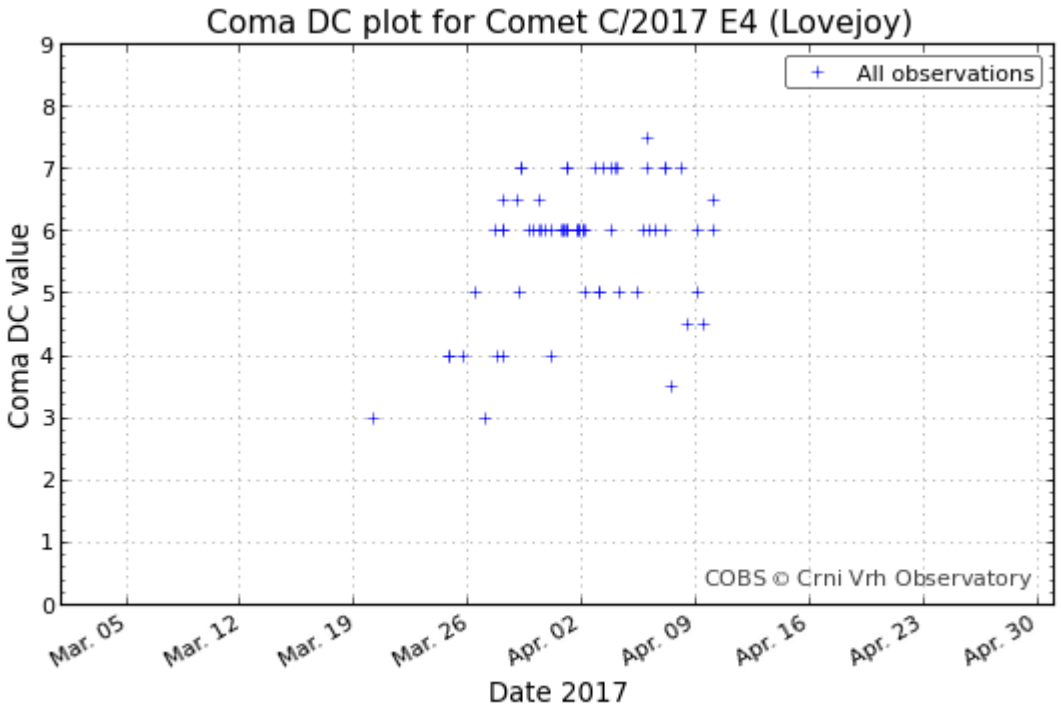



Courtesy: Seiichi Yoshida's Home Page – C/2015 V2 (Johnson) webpage, http://aerith.net/comet/catalog/2017E4/2017E4.html , Updated: 14 April 2017.

*Comet Lovejoy 2017 as indicated in the light curve profile on the left has had a rapid rate of brightness in a 2.5 week period from 24 March to 10 April. The field reports (Visual and CCD imaging) indicate a visual magnitude change from 9.6 to 6.2 with a single 5.9 value reported on 7 April. The brightness range is starting to plateau around mid to late April prior to the time of perihelion passage, but past the time of perigee passage (30 – 31 March). The right graph has the comet at perihelion past the peak of predicted and projected brightness on 23 April 2017 with a progressive to a slightly progressive decline in brightness for the rest of the year post perigee with the comet dimming past 12$^{th}$ magnitude before the Summer solstice.*

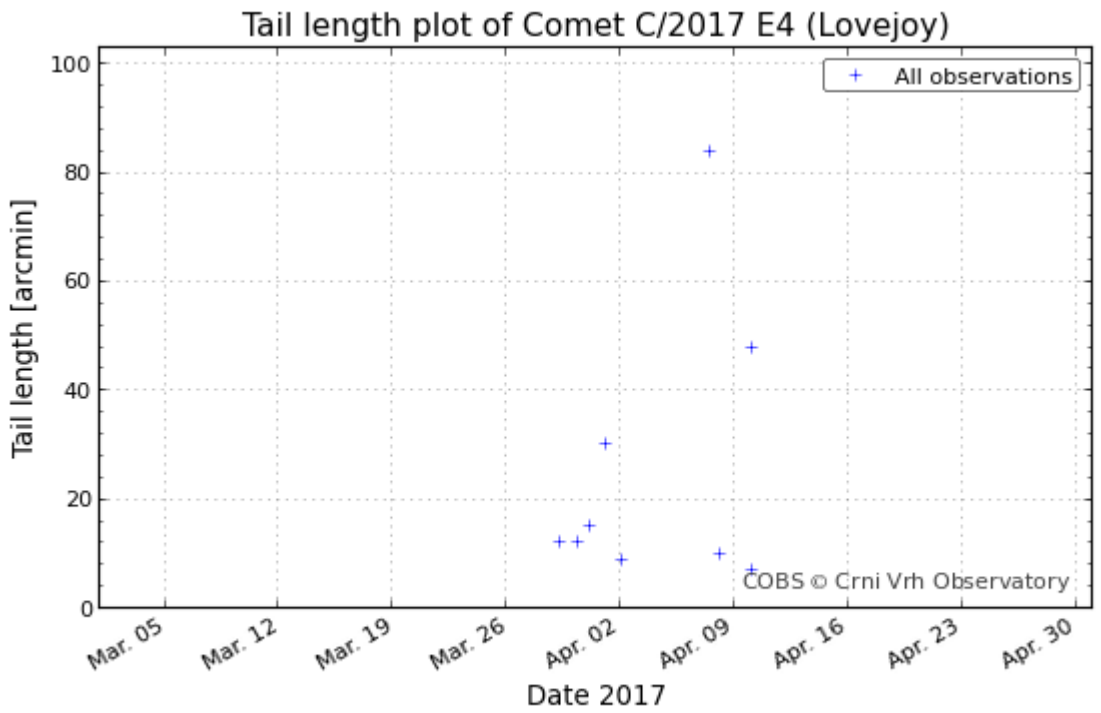
# LETS GO PICK SOME COMETS!

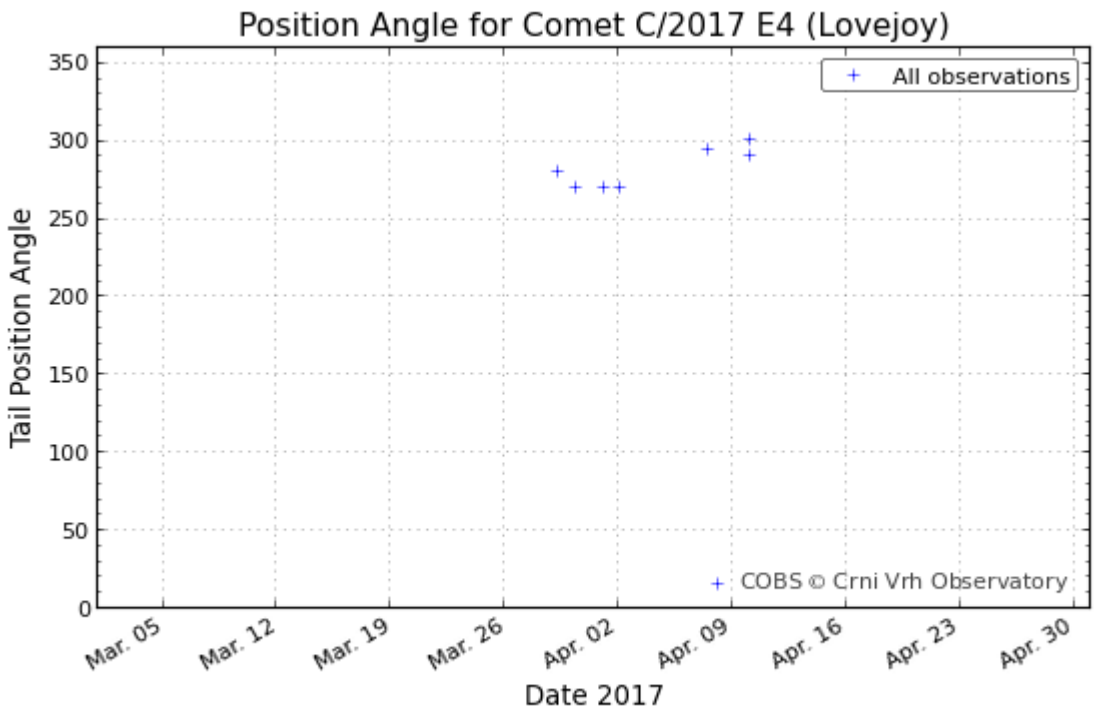



The DC for Comet Lovejoy 2017 ranges from 3 – 7 where the majority of the values based on all known field reports is 6 -7. This indicatess a bright, distinguishing inner coma of smaller size in a larger more dispersed and slightly fainter outer coma. The comet has a more compact coma size with a tight range of 3.5 – 8 arcminutes. A moderate coma size to a high DC value indicates that the coma has a bright, distinguishing inner coma of very small size in order for the outer coma to fit within the Coma diameter size range values as reported on the left graph.

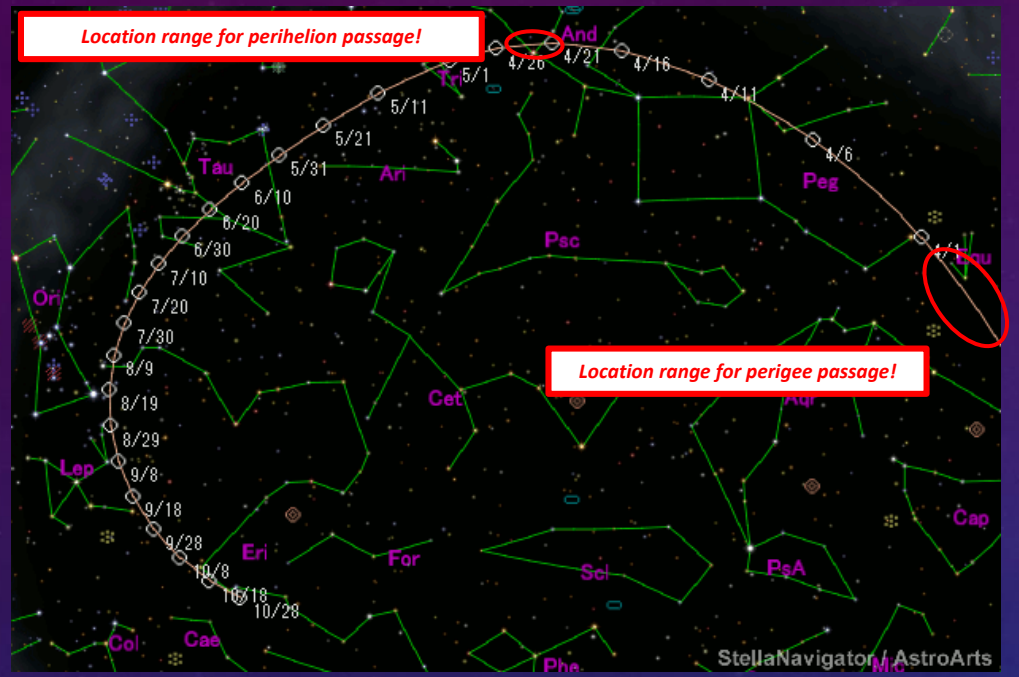
# LETS GO PICK SOME COMETS!




The tail length for Comet Lovejoy based on the small number of field reports available (visual and CCD imaging) have the tail length that varies wildly between 10 – 85 arcminutes. One must be cautious about determining the true tail size from this small number of reports as the wide range over such a small number of reports can not be determined with any degree of accuracy or confidence at this time. The PA for the comet's tail shows a tighter range of 260° - 300° with the tail oriented from just WSW to WNW which is more reliable in terms f confidence than the tail length at this period of time for early Spring 2017.

# LETS GO PICK A COMET!




## Brightness Projections

$m_1 = 11.5 + 5 \log d + 23.5 \log r$ [ ,-22] (Prior - 2017 April 1)
$m_1 = 9.5 + 5 \log d + 10.0 \log r$ [-22, ] (2017 April 1 - onward)

Time of Perihelion Passage: 22 – 24 April 2017
Date of Minimum Perihelion: 23 Apri 2017 @ 07:08:58.8 UTC
Perihelion Distance: 0.4937 AU (73,856,468.8 km or 45,864,867.1 mi)

Date/Time of Perigee Passage: 30 - 31 March 2017
Perigee Distance: 0.606 AU (90,656,309.6 km or 56,297,568.3 mi)

**JPL Small-Body Database Browser**

Search: [ help ]

**C/2017 E4 (Lovejoy)**

Classification: Comet SPK-ID: 1003508

[ Ephemeris | Orbit Diagram | Orbital Elements | Physical Parameters ]

[ show orbit diagram ]

Orbital Elements at Epoch 2457828.5 (2017-Mar-16.0) TDB
Reference: JPL 4 (heliocentric ecliptic J2000)

| Element | Value | Uncertainty (1-sigma) | Units |
|---|---|---|---|
| e | .9999300355165199 | 0.00058538 | |
| a | 7056.512584095493 | 59042 | au |
| q | .4937052581168357 | 8.9003e-05 | au |
| i | 88.17830657920311 | 0.0015794 | deg |
| node | 223.1822231710353 | 0.0081082 | deg |
| peri | 87.20627436782549 | 0.023986 | deg |
| M | 359.9999363201899 | 0.00079923 | deg |
| $t_p$ | 2457866.798597139176 (2017-Apr-23.29859714) | 0.0098841 | JED |
| period | 216512815.4285168 | 2.7173e+09 | d |
| | 592779.78 | 7.44e+06 | yr |
| n | 1.662719129523566E-6 | 2.0868e-05 | deg/d |
| Q | 14112.53146293287 | 1.1808e+05 | au |

Orbit Determination Parameters

| | |
|---|---|
| # obs. used (total) | 183 |
| data-arc span | 17 days |
| first obs. used | 2017-03-09 |
| last obs. used | 2017-03-26 |
| planetary ephem. | DE431 |
| SB-pert. ephem. | SB431-BIG16 |
| fit RMS | .80322 |
| data source | ORB |
| producer | Otto Matic |
| solution date | 2017-Mar-30 09:56:23 |

Additional Information

Earth MOID = .0486359 au
Jupiter MOID = 3.19698 au
T_jup = 0.028

[ show covariance matrix ]

[ Ephemeris | Orbit Diagram | Orbital Elements | Physical Parameters ]

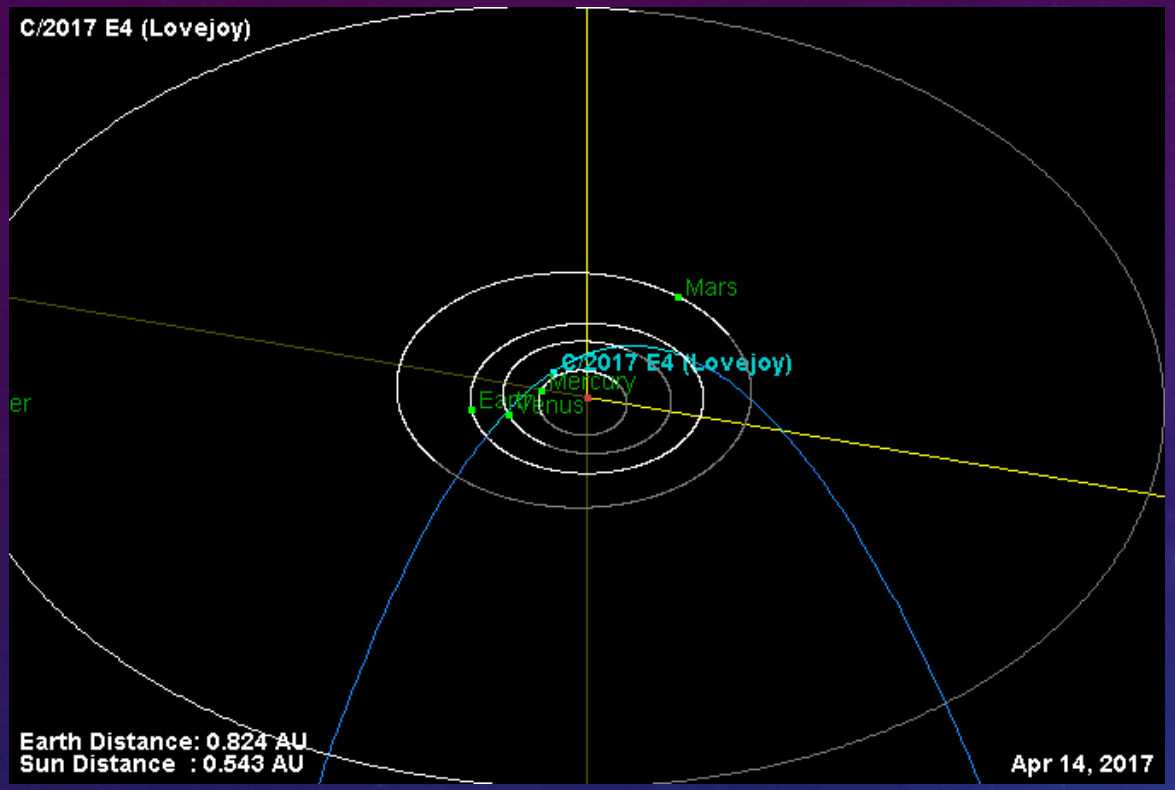
Physical Parameter Table

| Parameter | Symbol | Value | Units | Sigma | Reference | Notes |
|---|---|---|---|---|---|---|
| comet total magnitude | M1 | 16.1 | mag | 0.8 | 4 | 2 parameter fit from 117 observations, autocmod 2.6g |
| comet total magnitude slope | K1 | 16. | | n/a | 4 | autocmod 2.6g |
| comet nuclear magnitude | M2 | 18.3 | mag | 0.5 | 4 | from 47 observations, autocmod 2.6g |
| comet nuclear magnitude slope | K2 | 5. | | n/a | 4 | autocmod 2.6g |
| comet nuclear phase coefficient | PC | 0.03 | | n/a | 4 | autocmod 2.6g |

Alternate Designations

| Perihelion Year (est.) | New-Style Desig | Roman Numeral | Year/ Letter |
|---|---|---|---|
| 2017.3 | C/2017 E4 | | |

# LETS GO PICK SOME COMETS!




*The 'light blue' segment of the comet's path places it currently above the plane of the ecliptic during the time period of 19 March until 3 June. Note that the comet's trajectory appears in a downward pattern indicating that the comet is coming that possible region of the inner Oort Cloud towards the southern ecliptic hemisphere!*

*The ephemeris table to the right shows the essential coordinates for determining the path of characteristics of the comet for the period: (1 April – 1 June) 2017!*

**C/2015 V2 (Johnson)**

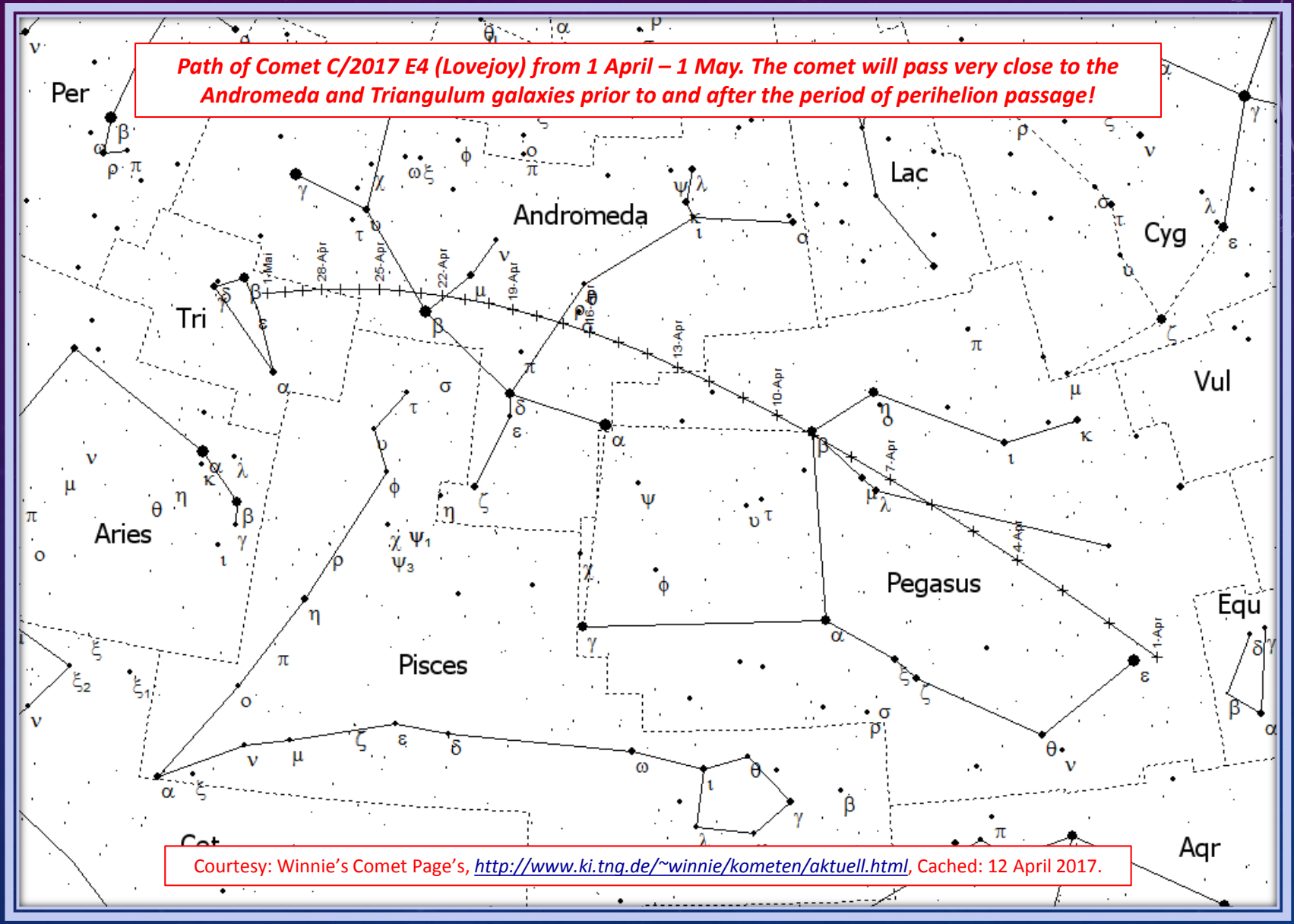
Perturbed ephemeris below is based on elements from *MPC* 102953.

Location: HMNS George Observatory
Brazos Bend State Park, Texas, USA

CK15V020

| Date | UT h m s | R.A. (J2000) | Decl. | Delta | r | El. | Ph. | m1 | Sky Motion "/min | P.A. | Object Azi. | Object Alt. | Sun Alt. | Moon Phase | Moon Dist. | Moon Alt. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 2017 04 01 | 050000 | 21 40 20.6 | +10 24 00 | 0.609 | 0.717 | 45.4 | 97.5 | 14.5 | 9.21 | 043.5 | 214 | -44 | -51 | 0.22 | 098 | -03 |
| 2017 04 02 | 050000 | 21 50 39.4 | +13 02 28 | 0.614 | 0.701 | 43.9 | 98.7 | 14.4 | 9.12 | 044.4 | 210 | -42 | -50 | 0.32 | 107 | +10 |
| 2017 04 03 | 050000 | 22 01 08.0 | +15 36 05 | 0.621 | 0.686 | 42.5 | 99.8 | 14.3 | 8.97 | 045.5 | 207 | -41 | -50 | 0.44 | 117 | +22 |
| 2017 04 04 | 050000 | 22 11 44.6 | +18 03 24 | 0.630 | 0.670 | 41.2 | 100.5 | 14.3 | 8.76 | 046.8 | 204 | -39 | -50 | 0.55 | 125 | +33 |
| 2017 04 05 | 050000 | 22 22 27.2 | +20 23 10 | 0.642 | 0.655 | 40.0 | 100.9 | 14.2 | 8.50 | 048.3 | 201 | -38 | -49 | 0.66 | 132 | +44 |
| 2017 04 06 | 050000 | 22 33 13.7 | +22 34 23 | 0.656 | 0.641 | 38.9 | 101.1 | 14.1 | 8.21 | 049.9 | 198 | -36 | -49 | 0.75 | 138 | +54 |
| 2017 04 07 | 050000 | 22 44 01.9 | +24 36 17 | 0.672 | 0.626 | 37.9 | 100.9 | 14.1 | 7.88 | 051.7 | 196 | -35 | -49 | 0.84 | 143 | +62 |
| 2017 04 08 | 050000 | 22 54 49.4 | +26 28 21 | 0.689 | 0.612 | 37.0 | 100.4 | 14.1 | 7.54 | 053.7 | 193 | -33 | -48 | 0.91 | 146 | +66 |
| 2017 04 09 | 050000 | 23 05 33.9 | +28 10 18 | 0.709 | 0.599 | 36.1 | 99.6 | 14.0 | 7.19 | 055.8 | 191 | -32 | -48 | 0.96 | 147 | +64 |
| 2017 04 10 | 050000 | 23 16 13.1 | +29 42 04 | 0.730 | 0.586 | 35.3 | 98.5 | 14.0 | 6.83 | 058.1 | 189 | -30 | -48 | 0.99 | 145 | +59 |
| 2017 04 11 | 050000 | 23 26 44.7 | +31 03 44 | 0.753 | 0.574 | 34.6 | 97.2 | 14.0 | 6.48 | 060.4 | 187 | -29 | -48 | 1.00 | 142 | +50 |
| 2017 04 12 | 050000 | 23 37 06.7 | +32 15 33 | 0.777 | 0.562 | 33.9 | 95.6 | 14.0 | 6.15 | 063.0 | 185 | -28 | -47 | 0.99 | 137 | +41 |
| 2017 04 13 | 050000 | 23 47 17.0 | +33 17 53 | 0.803 | 0.551 | 33.3 | 93.7 | 13.9 | 5.82 | 065.6 | 184 | -27 | -47 | 0.96 | 132 | +32 |
| 2017 04 14 | 050000 | 23 57 14.1 | +34 11 07 | 0.829 | 0.541 | 32.6 | 91.6 | 13.9 | 5.51 | 068.3 | 182 | -27 | -47 | 0.92 | 126 | +22 |
| 2017 04 15 | 050000 | 00 06 56.3 | +34 55 47 | 0.857 | 0.532 | 32.0 | 89.4 | 13.9 | 5.22 | 071.1 | 181 | -26 | -46 | 0.86 | 119 | +12 |
| 2017 04 16 | 050000 | 00 16 22.4 | +35 32 22 | 0.885 | 0.523 | 31.4 | 86.9 | 13.9 | 4.96 | 074.0 | 180 | -25 | -46 | 0.79 | 111 | +03 |
| 2017 04 17 | 050000 | 00 25 31.3 | +36 01 25 | 0.914 | 0.516 | 30.7 | 84.3 | 13.9 | 4.71 | 077.0 | 179 | -25 | -46 | 0.71 | 104 | -07 |
| 2017 04 18 | 050000 | 00 34 22.3 | +36 23 30 | 0.944 | 0.509 | 30.1 | 81.5 | 13.9 | 4.48 | 080.0 | 178 | -24 | -45 | 0.62 | 096 | -17 |
| 2017 04 19 | 050000 | 00 42 54.9 | +36 39 07 | 0.975 | 0.504 | 29.4 | 78.6 | 14.0 | 4.27 | 083.0 | 177 | -24 | -45 | 0.52 | 087 | -27 |
| 2017 04 20 | 050000 | 00 51 08.6 | +36 48 50 | 1.005 | 0.499 | 28.8 | 75.6 | 14.0 | 4.08 | 086.0 | 176 | -24 | -45 | 0.42 | 079 | -36 |
| 2017 04 21 | 050000 | 00 59 03.3 | +36 53 11 | 1.036 | 0.496 | 28.1 | 72.5 | 14.0 | 3.91 | 088.9 | 175 | -24 | -45 | 0.32 | 069 | -45 |
| 2017 04 22 | 050000 | 01 06 39.1 | +36 52 38 | 1.067 | 0.494 | 27.4 | 69.3 | 14.1 | 3.75 | 091.8 | 174 | -24 | -44 | 0.23 | 060 | -53 |
| 2017 04 23 | 050000 | 01 13 56.2 | +36 47 43 | 1.098 | 0.494 | 26.7 | 66.1 | 14.1 | 3.61 | 094.6 | 173 | -24 | -44 | 0.14 | 050 | -59 |
| 2017 04 24 | 050000 | 01 20 55.0 | +36 38 52 | 1.129 | 0.494 | 25.9 | 63.0 | 14.2 | 3.48 | 097.4 | 173 | -24 | -44 | 0.07 | 041 | -61 |
| 2017 04 25 | 050000 | 01 27 35.8 | +36 26 34 | 1.160 | 0.496 | 25.2 | 59.8 | 14.3 | 3.36 | 100.0 | 172 | -24 | -43 | 0.02 | 033 | -57 |
| 2017 04 26 | 050000 | 01 33 59.3 | +36 11 12 | 1.190 | 0.499 | 24.4 | 56.6 | 14.4 | 3.26 | 102.4 | 171 | -24 | -43 | 0.00 | 029 | -49 |
| 2017 04 27 | 050000 | 01 40 06.2 | +35 53 10 | 1.221 | 0.503 | 23.7 | 53.5 | 14.4 | 3.16 | 104.7 | 171 | -24 | -43 | 0.01 | 030 | -39 |
| 2017 04 28 | 050000 | 01 45 57.0 | +35 32 52 | 1.251 | 0.508 | 22.9 | 50.5 | 14.5 | 3.07 | 106.9 | 170 | -24 | -43 | 0.04 | 037 | -28 |
| 2017 04 29 | 050000 | 01 51 32.5 | +35 10 36 | 1.280 | 0.514 | 22.1 | 47.5 | 14.6 | 2.98 | 108.9 | 170 | -25 | -42 | 0.11 | 046 | -16 |
| 2017 04 30 | 050000 | 01 56 53.6 | +34 46 41 | 1.309 | 0.521 | 21.3 | 44.7 | 14.8 | 2.90 | 110.8 | 170 | -25 | -42 | 0.19 | 057 | -04 |
| 2017 05 01 | 050000 | 02 02 00.9 | +34 21 25 | 1.338 | 0.530 | 20.6 | 41.9 | 14.9 | 2.83 | 112.5 | 169 | -25 | -42 | 0.29 | 069 | +08 |
| 2017 05 02 | 050000 | 02 06 55.2 | +33 55 02 | 1.365 | 0.539 | 19.8 | 39.3 | 15.0 | 2.75 | 114.1 | 169 | -26 | -42 | 0.40 | 080 | +19 |
| 2017 05 03 | 050000 | 02 11 37.3 | +33 27 46 | 1.393 | 0.549 | 19.0 | 36.8 | 15.1 | 2.69 | 115.5 | 169 | -26 | -41 | 0.51 | 092 | +29 |
| 2017 05 04 | 050000 | 02 16 08.0 | +32 59 48 | 1.420 | 0.560 | 18.3 | 34.4 | 15.2 | 2.62 | 116.8 | 168 | -27 | -41 | 0.62 | 104 | +38 |
| 2017 05 05 | 050000 | 02 20 27.9 | +32 31 18 | 1.446 | 0.571 | 17.5 | 32.1 | 15.4 | 2.56 | 117.9 | 168 | -27 | -41 | 0.72 | 115 | +46 |
| 2017 05 06 | 050000 | 02 24 37.7 | +32 02 27 | 1.471 | 0.583 | 16.8 | 29.9 | 15.5 | 2.50 | 119.0 | 168 | -28 | -41 | 0.80 | 126 | +53 |
| 2017 05 07 | 050000 | 02 28 38.0 | +31 33 20 | 1.496 | 0.596 | 16.1 | 27.9 | 15.6 | 2.44 | 120.0 | 168 | -28 | -40 | 0.88 | 136 | +56 |
| 2017 05 08 | 050000 | 02 32 29.5 | +31 04 05 | 1.521 | 0.609 | 15.4 | 26.0 | 15.8 | 2.39 | 120.8 | 168 | -29 | -40 | 0.93 | 146 | +56 |
| 2017 05 09 | 050000 | 02 36 12.7 | +30 34 48 | 1.544 | 0.623 | 14.7 | 24.3 | 15.9 | 2.33 | 121.6 | 168 | -29 | -40 | 0.97 | 155 | +53 |
| 2017 05 10 | 050000 | 02 39 48.1 | +30 05 33 | 1.568 | 0.637 | 14.1 | 22.6 | 16.0 | 2.28 | 122.3 | 168 | -30 | -40 | 1.00 | 161 | +48 |
| 2017 05 11 | 050000 | 02 43 16.3 | +29 36 24 | 1.590 | 0.652 | 13.5 | 21.1 | 16.2 | 2.23 | 122.9 | 168 | -30 | -39 | 1.00 | 161 | +41 |
| 2017 05 12 | 050000 | 02 46 37.7 | +29 07 23 | 1.613 | 0.667 | 12.9 | 19.8 | 16.3 | 2.19 | 123.5 | 168 | -31 | -39 | 0.98 | 155 | +33 |
| 2017 05 13 | 050000 | 02 49 52.6 | +28 38 35 | 1.634 | 0.682 | 12.4 | 18.5 | 16.4 | 2.14 | 124.0 | 168 | -31 | -39 | 0.95 | 147 | +25 |
| 2017 05 14 | 050000 | 02 53 01.7 | +28 10 00 | 1.655 | 0.698 | 11.9 | 17.4 | 16.5 | 2.10 | 124.5 | 168 | -32 | -39 | 0.91 | 137 | +16 |
| 2017 05 15 | 050000 | 02 56 05.0 | +27 41 40 | 1.676 | 0.714 | 11.5 | 16.3 | 16.7 | 2.06 | 124.9 | 168 | -32 | -38 | 0.84 | 127 | +08 |
| 2017 05 16 | 050000 | 02 59 03.2 | +27 13 37 | 1.696 | 0.730 | 11.1 | 15.4 | 16.8 | 2.02 | 125.3 | 168 | -33 | -38 | 0.77 | 116 | -01 |
| 2017 05 17 | 050000 | 03 01 56.3 | +26 45 51 | 1.715 | 0.746 | 10.8 | 14.7 | 16.9 | 1.98 | 125.6 | 168 | -33 | -38 | 0.68 | 105 | -10 |
| 2017 05 18 | 050000 | 03 04 44.7 | +26 18 24 | 1.735 | 0.763 | 10.5 | 14.0 | 17.0 | 1.94 | 126.0 | 168 | -34 | -38 | 0.59 | 093 | -19 |
| 2017 05 19 | 050000 | 03 07 28.8 | +25 51 15 | 1.753 | 0.779 | 10.3 | 13.5 | 17.1 | 1.91 | 126.2 | 169 | -34 | -38 | 0.48 | 081 | -28 |
| 2017 05 20 | 050000 | 03 10 08.6 | +25 24 24 | 1.771 | 0.796 | 10.2 | 13.0 | 17.3 | 1.87 | 126.5 | 169 | -35 | -37 | 0.38 | 069 | -36 |
| 2017 05 21 | 050000 | 03 12 44.5 | +24 57 53 | 1.789 | 0.813 | 10.2 | 12.7 | 17.4 | 1.84 | 126.8 | 169 | -35 | -37 | 0.28 | 056 | -44 |
| 2017 05 22 | 050000 | 03 15 16.7 | +24 31 40 | 1.806 | 0.830 | 10.2 | 12.5 | 17.5 | 1.81 | 127.0 | 169 | -36 | -37 | 0.18 | 043 | -49 |
| 2017 05 23 | 050000 | 03 17 45.3 | +24 05 46 | 1.823 | 0.847 | 10.3 | 12.4 | 17.6 | 1.78 | 127.2 | 170 | -36 | -37 | 0.10 | 030 | -52 |
| 2017 05 24 | 050000 | 03 20 10.5 | +23 40 10 | 1.840 | 0.864 | 10.5 | 12.3 | 17.7 | 1.75 | 127.4 | 170 | -36 | -37 | 0.04 | 017 | -50 |
| 2017 05 25 | 050000 | 03 22 32.5 | +23 14 52 | 1.856 | 0.881 | 10.7 | 12.4 | 17.8 | 1.72 | 127.6 | 171 | -37 | -36 | 0.01 | 010 | -45 |
| 2017 05 26 | 050000 | 03 24 51.4 | +22 49 51 | 1.872 | 0.898 | 11.0 | 12.5 | 17.9 | 1.69 | 127.8 | 171 | -37 | -36 | 0.00 | 018 | -37 |
| 2017 05 27 | 050000 | 03 27 07.4 | +22 25 08 | 1.887 | 0.916 | 11.4 | 12.6 | 18.0 | 1.67 | 128.0 | 171 | -38 | -36 | 0.03 | 032 | -28 |
| 2017 05 28 | 050000 | 03 29 20.7 | +22 00 41 | 1.902 | 0.933 | 11.8 | 12.8 | 18.1 | 1.64 | 128.2 | 172 | -38 | -36 | 0.08 | 046 | -18 |
| 2017 05 29 | 050000 | 03 31 31.2 | +21 36 30 | 1.916 | 0.950 | 12.2 | 13.0 | 18.2 | 1.62 | 128.3 | 172 | -39 | -36 | 0.16 | 060 | -07 |
| 2017 05 30 | 050000 | 03 33 39.2 | +21 12 34 | 1.931 | 0.967 | 12.7 | 13.3 | 18.3 | 1.59 | 128.5 | 173 | -39 | -36 | 0.26 | 074 | +03 |
| 2017 05 31 | 050000 | 03 35 44.7 | +20 48 53 | 1.944 | 0.985 | 13.2 | 13.6 | 18.4 | 1.57 | 128.7 | 173 | -40 | -35 | 0.36 | 087 | +13 |
| 2017 06 01 | 050000 | 03 37 47.8 | +20 25 27 | 1.958 | 1.002 | 13.7 | 13.9 | 18.5 | 1.55 | 128.8 | 174 | -40 | -35 | 0.47 | 100 | +22 |

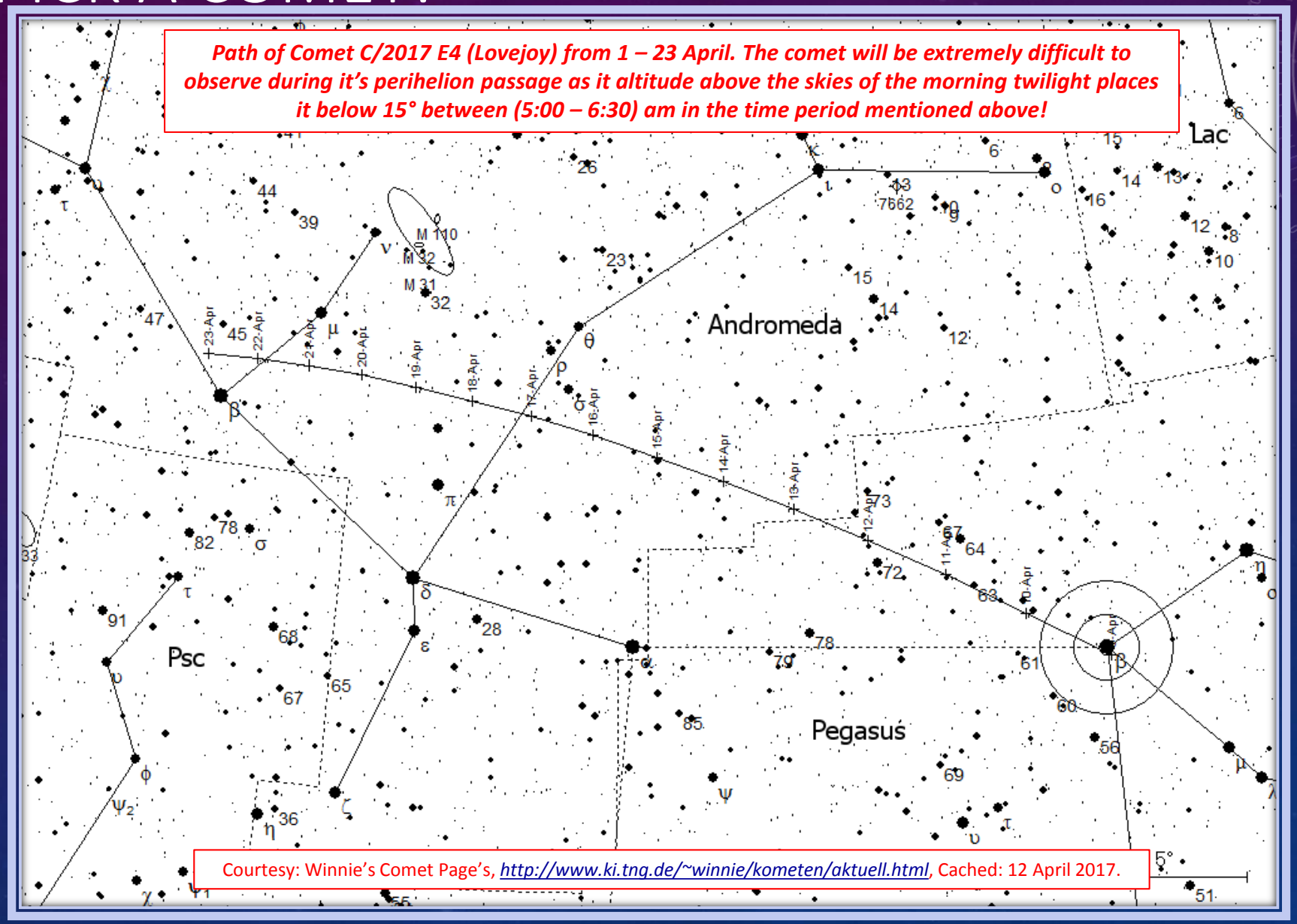
# LETS GO PICK A COMET!



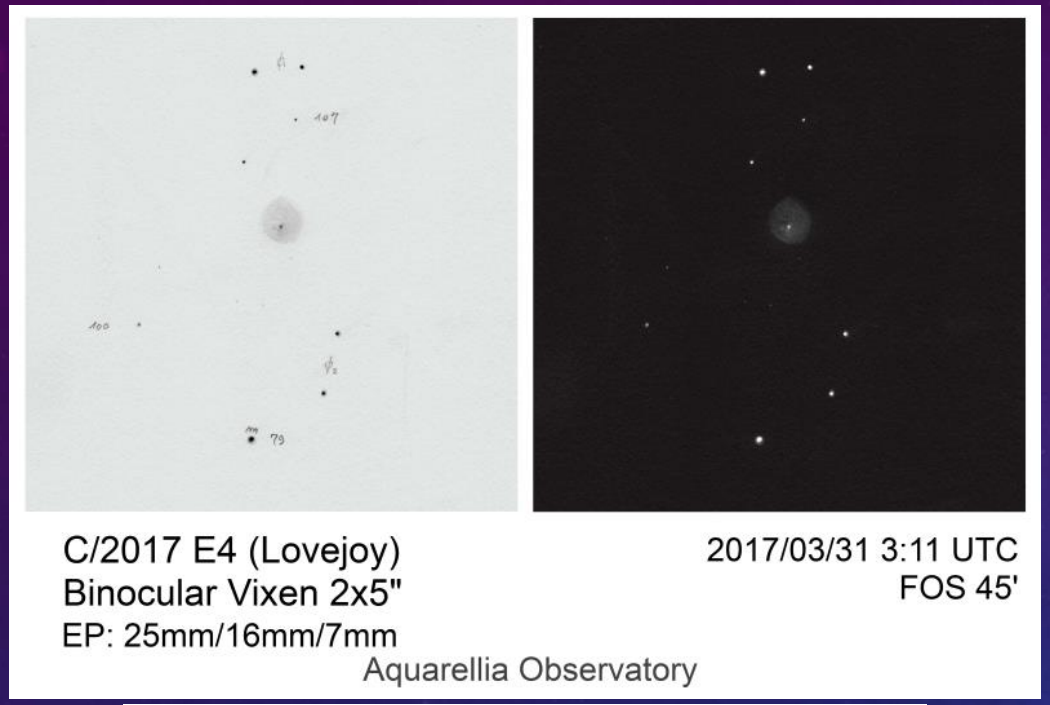

*Path of Comet C/2017 E4 (Lovejoy) from 1 April – 1 May. The comet will pass very close to the Andromeda and Triangulum galaxies prior to and after the period of perihelion passage!*

Courtesy: Winnie's Comet Page's, *http://www.ki.tng.de/~winnie/kometen/aktuell.html*, Cached: 12 April 2017.

# LETS GO PICK A COMET!



# LETS GO PICK A COMET!



**<u>Observations by Cloudynights Member: Aquarellia</u>**

Location: Artignosc, Provence, France

Date: 3 March 2017 @ 03:11 UTC

Telescope Instrument: 5” Vixen Binoculars

Field of View: 45 arcminues

Visual Magnitude (Est.): 6.9 – 7.4

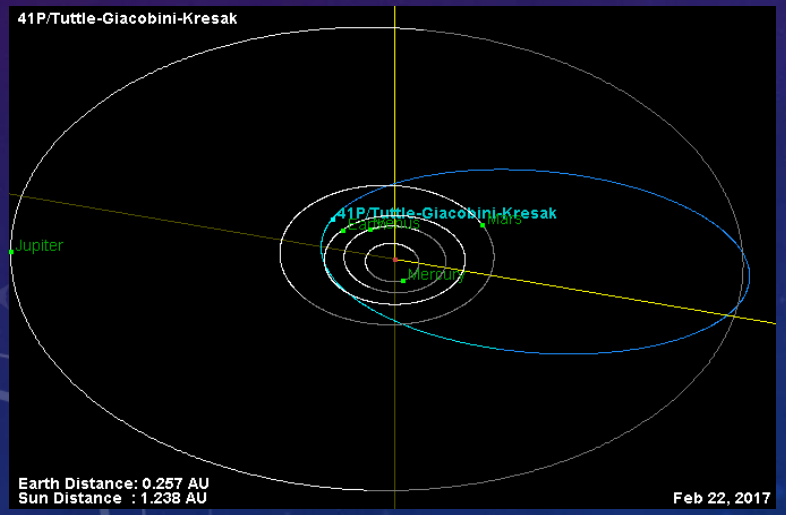
Coma Diameter: 6 arcminutes with DC at 5

No Color & No Tail!

Minimum stellar magnitude was 10.7

The bright dot at the bottom of both sketches is star SAO126850 at visual magnitude 7.9!

# PERIODIC VERSUS NON - PERIODIC!




Designations

**"P/" for periodic comets!**

Multiple – apparition comet or single – apparition with an orbital period of <30 yrs!

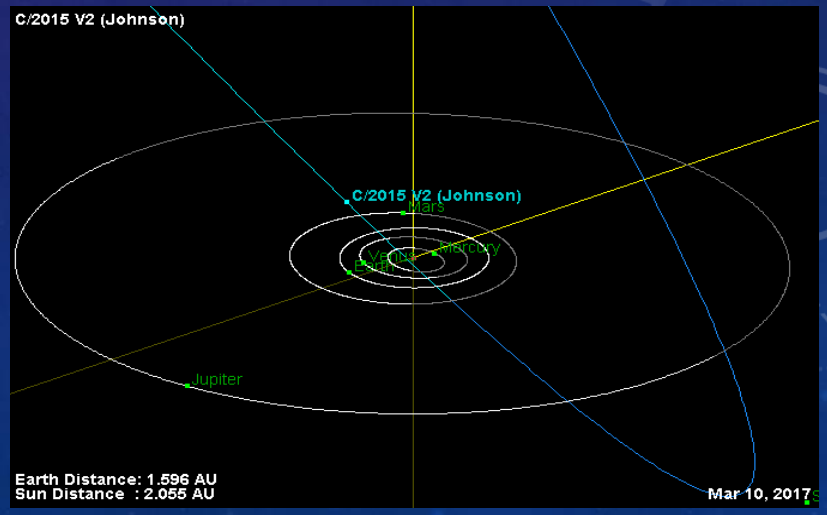
**"C/" for non – periodic comets!**

Single – apparition comets

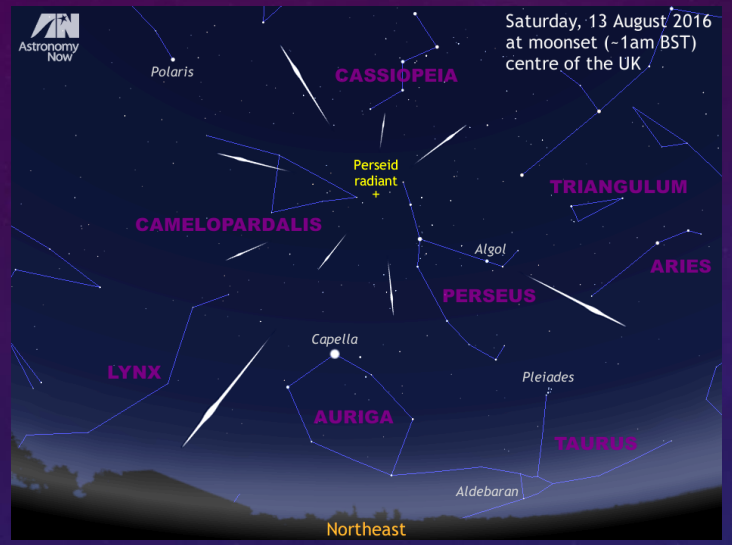
(Parabolic or Hyperbolic path)

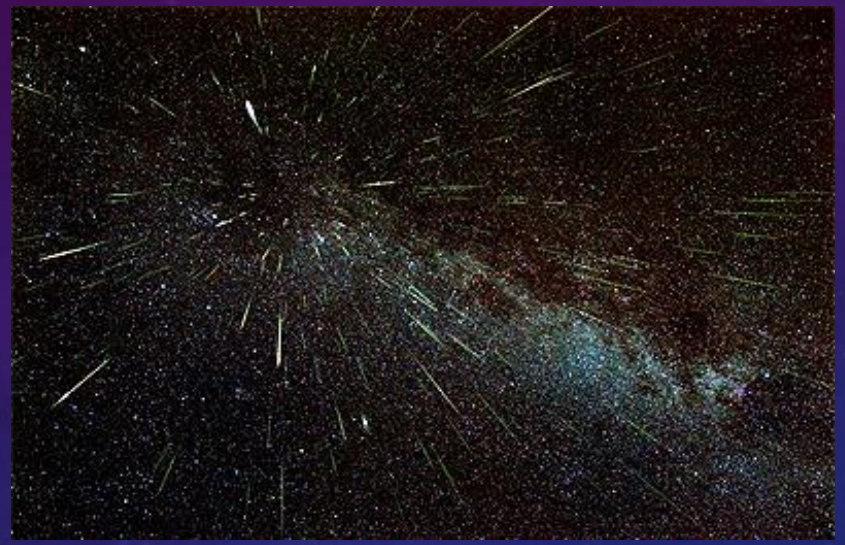
**"D/" for short period comets!**

Cannot be predicted accurately and considered essentially lost! *(Limited observations)*



# METEOR SHOWERS? WHERE DO THEY ORIGINATE?

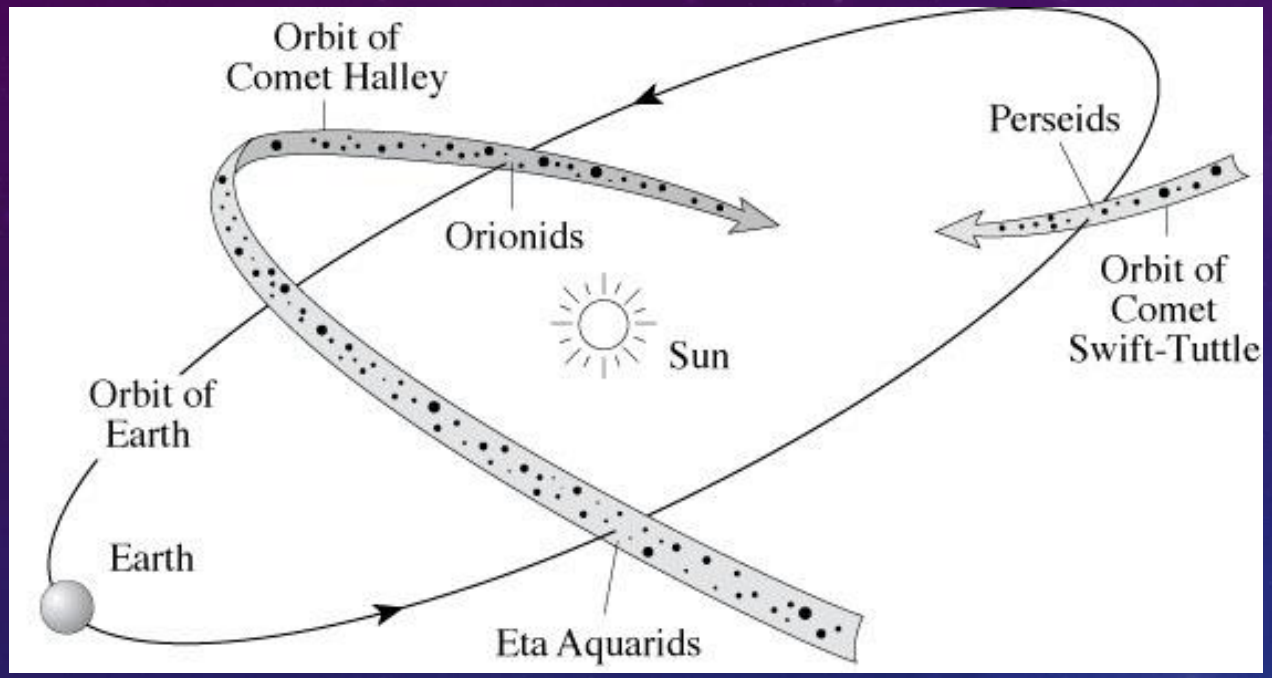


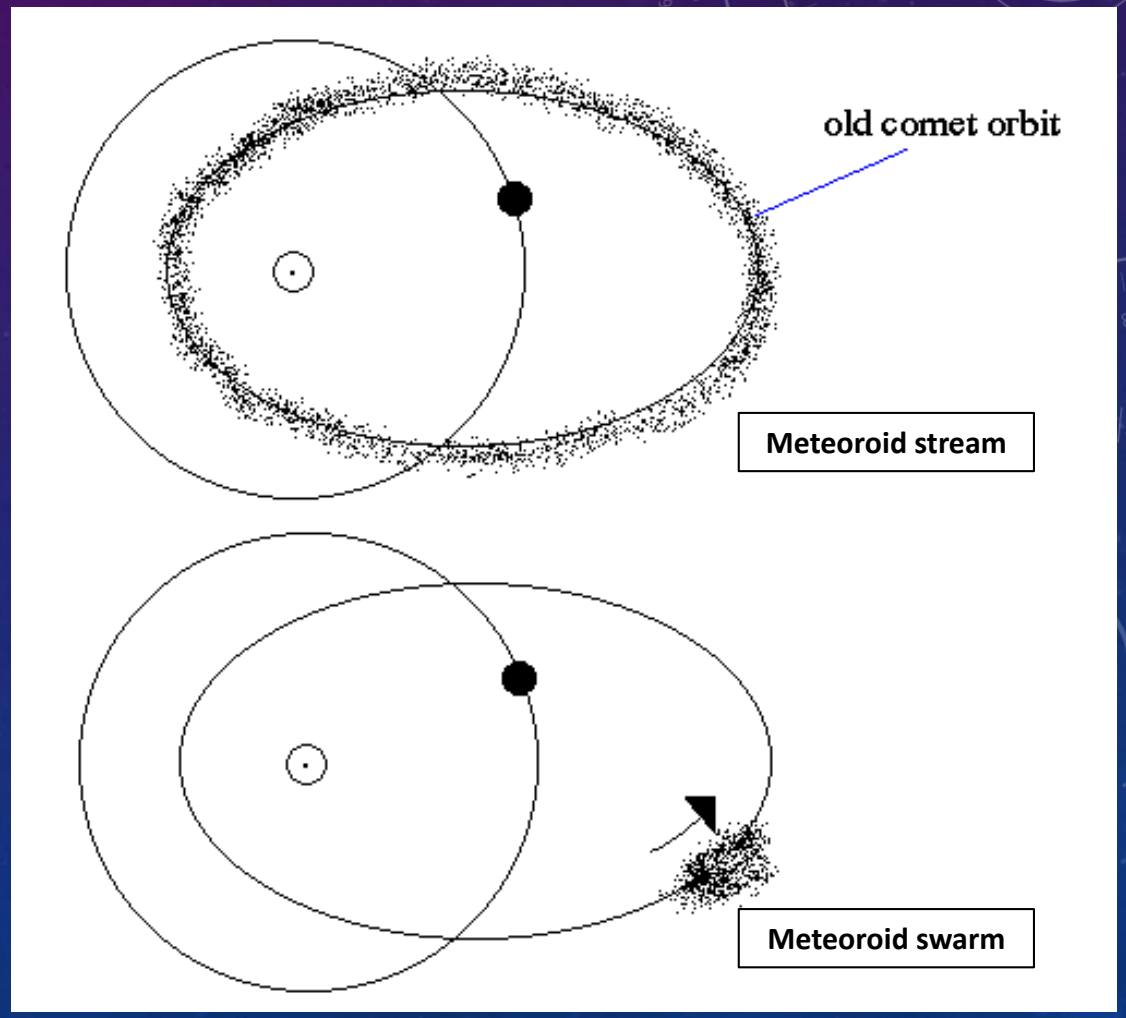



Meteor showers are composed of small fragmentations of rock and metal referred to as meteoroids in space and meteorites if such fragments survive entry into the Earth's Atmosphere!

*All meteor showers originate from the debris tail of comets and comet – like minor planets that orbit about the Sun. This material follows in a parallel path to the comet and will enter any planetary atmosphere forming meteorites due to ram pressure. Ram pressure is brought about by the compression of atmospheric gasses heating up to thousands of degrees Celsius in temperature radiating high thermal heat in a matter of milliseconds. This causes most small and some medium – size meteoroids to vaporize in just a few seconds. The trail left is a path of ionized gasses emitting short bursts of EM radiation especially visible light that lasts for only a few seconds to upwards of a minute before leaving behind a pathway of condensed gasses due to the interaction of materials between the meteor and a planet's atmosphere during a rapid change in atmospheric conditions at extremely high altitudes!*

# METEOR SHOWERS? WHERE DO THEY ORIGINATE?

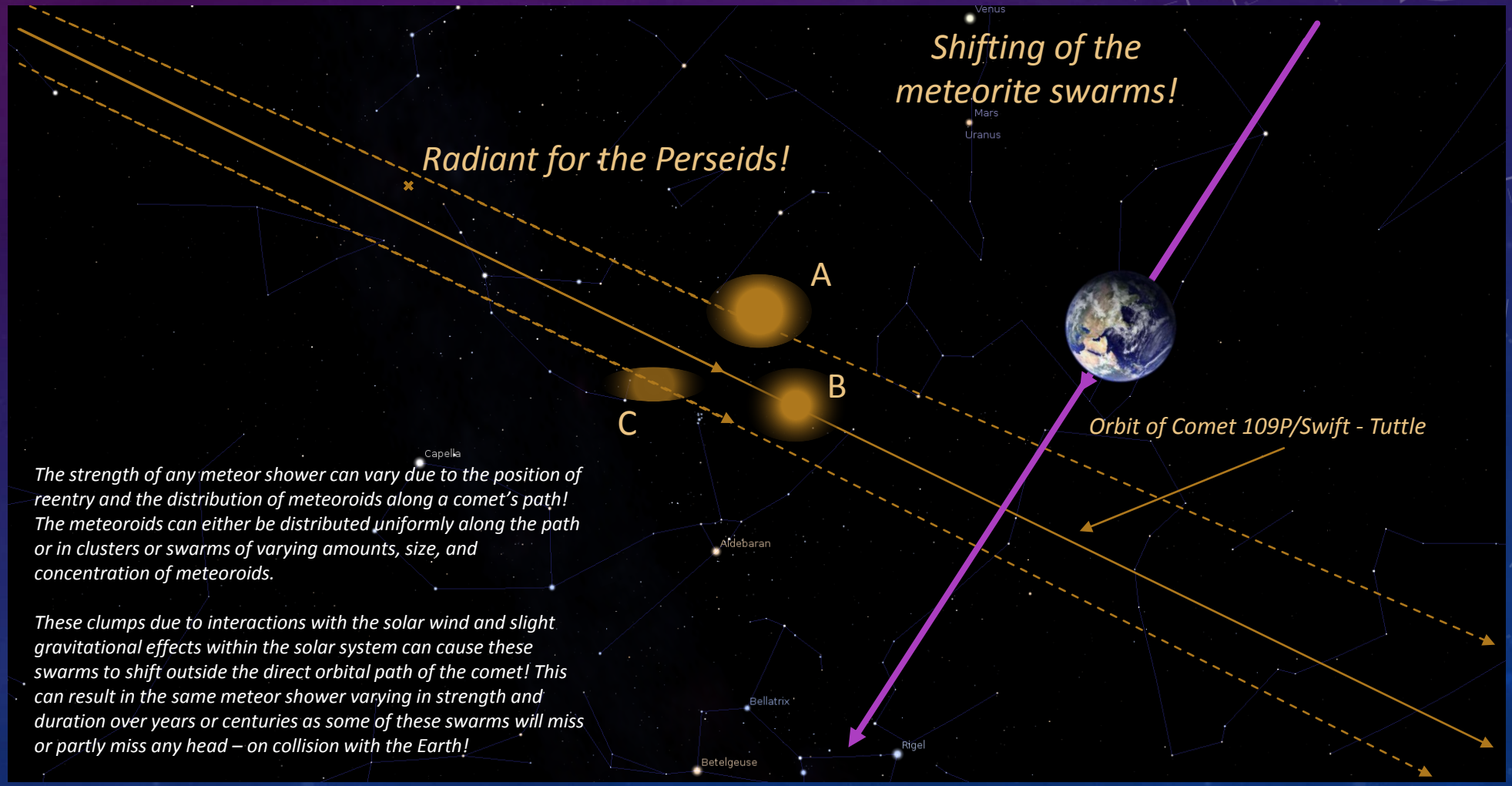



*Every swarm or grouping of meteoroids that enter the Earth's atmosphere as a meteor comes from a known comet and travels in paths radiating from a position known as the radiant. All radiant positions are located in constellations for which the meteor is named!*
*(Example: Eta Aquarids – Source: 1P/Comet Halley).*

*Meteorite swarms can be in more than one grouping that do not always intersect with the Earth's orbit or take only a glancing blow to the Earth! The orientation of a comet's dust tail and it's anti – tail can have immediate effects on the location of debris with respect to the comet's path around the Sun!*

# METEOR SHOWERS? WHERE DO THEY ORIGINATE?




*The strength of any meteor shower can vary due to the position of reentry and the distribution of meteoroids along a comet's path! The meteoroids can either be distributed uniformly along the path or in clusters or swarms of varying amounts, size, and concentration of meteoroids.*

*These clumps due to interactions with the solar wind and slight gravitational effects within the solar system can cause these swarms to shift outside the direct orbital path of the comet! This can result in the same meteor shower varying in strength and duration over years or centuries as some of these swarms will miss or partly miss any head – on collision with the Earth!*

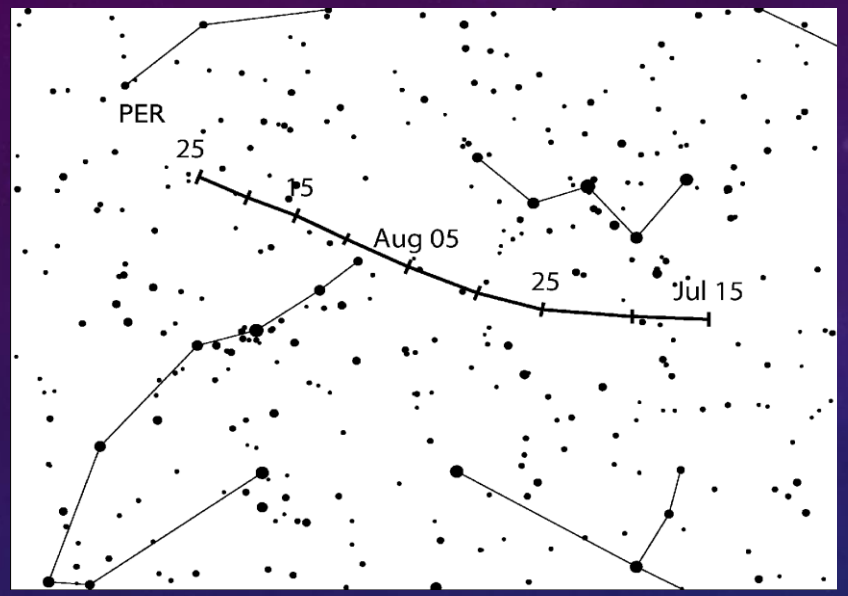
# METEOR SHOWERS? WHERE DO THEY ORIGINATE?

## A Basic Historical Chronology of the Perseids!

| Year | Period of Peak Activity | Peak Time during Max ZHR | Maximum ZHR (Zenith Hourly Rate) | Notes |
|---|---|---|---|---|
| 2016 | July 17 – August 24 | August 11-12 | 150 | |
| 2015 | July 17 – August 24 | August 12–13 | 95 | August 14 – New Moon |
| 2014 | July 17 – August 24 | August 13 | 68 | August 10 – Full Moon |
| 2013 | July 17 – August 24 | August 12 | 109 | |
| 2012 | July 17 – August 24 | August 12 | 122 | |
| 2011 | July 17 – August 24 | August 12 | 58 | August 13 – Full Moon |
| 2010 | July 23 – August 24 | August 12 | 142 | |
| 2009 | July 14 – August 24 | August 13 | ~173 | Fainter meteors were washed out by a Gibbous Moon! |
| 2008 | July 25 – August 24 | August 13 | 116 | |
| 2007 | July 19 – August 25 | August 13 | 93 | |
| 2006 | July 15 – August 25 | August 12 – 13 | 15 - 30 | |
| 2005 | July 17 – August 24 | August 11 – 13 | 90 | |
| 2004 | July 17 – August 24 | August 12 | >200 | |
| 1994 | July 15 – August 20 | August 12 | 250 | |
| 1993 | | | 200 – 500 | |
| 1992 | | August 11[1] | ~90 | Outburst occurred two days before a Full Moon |
| 1864 | | | >100 | |
| 1863 | | | 109 – 215 | |
| 1861 | | | 78 – 102 | |
| 1858 | | | 37 – 88 | |
| 1839 | | | 165 | |

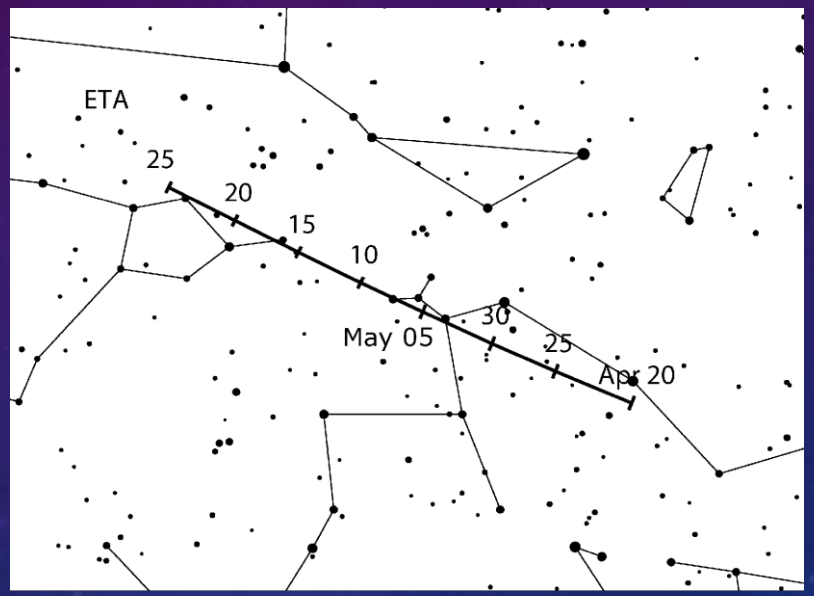
Any changes in the ZHR value when the radiant is at its maximum altitude above the horizon facing due south is in part due to the drifting of the meteoroid swarms or streams from a comet's pathway! Note the 2006 event where the ZHR value was very low indicate that the swarms or streams where far from intersecting the Earth's orbit while the ZHR in 1993 was a rare event in which a heave swarm or series of swarms took a direct hit on the Earth! The last time this happened was in 1860 and the next time will be in 2126 which occurs always one year after Comet Swift – Tuttle makes it 133 year orbital journey around the Sun!

# METEOR SHOWERS? WHERE DO THEY ORIGINATE?




Perseids Radiant Drift Map: 2016
Source: 109P/Swift - Tuttle

Active: 17 July – 24 August
Maximum: 12 August @ 13:00 – 15:30 UTC
Solar Longitude: 140°- 140.1°
ZHR: 150
Radiant Position: 48° or 3h 12m R.A. & +58° Dec.
Radiant Drift:
Jul 15 6° R.A. & +50° Dec.
Aug 25 63° R.A. & 58° Dec.
V = 59 km/s R = 2.2




Eta Aquariids Radiant Drift Map: 2017
Source: 1P/Halley

Active: 19 April – 28 May
Maximum: 6 May @ 02:00 UTC
Solar Longitude: 45° 30'
ZHR: 50 (periodic variation 40 – 85)
Radiant Position: 338° or 22h 32m R.A. & -1° Dec.
Radiant Drift:
Apr 20 323° R.A. & -7° Dec.
May 25 353° R.A. & +7° Dec.
V = 66 km/s R = 2.4

Another factor in the quality of meteor showers:

Radiant Drift

*Due to the shifting of the meteoroid swarms or streams from the main orbital path or trajectory of a comet source. The shifting of the radiant can result in meteor showers either having a high or low ZHR depending on the orientation of the radiant to the meteoroids. The solar longitude can also have an effect on the drifting of a radiant which can alter the density and intensity of a meteor shower if the Earth is not in perfect alignment with the meteoroid debris from a comet for any particular meteor shower!*

***Courtesy: 2016 & 2017 Meteor Shower Calendars, Complied by Jürgen Rendtel, International Meteor Organization, 2015 – 2016.***

# METEOR SHOWERS? WHERE DO THEY ORIGINATE?

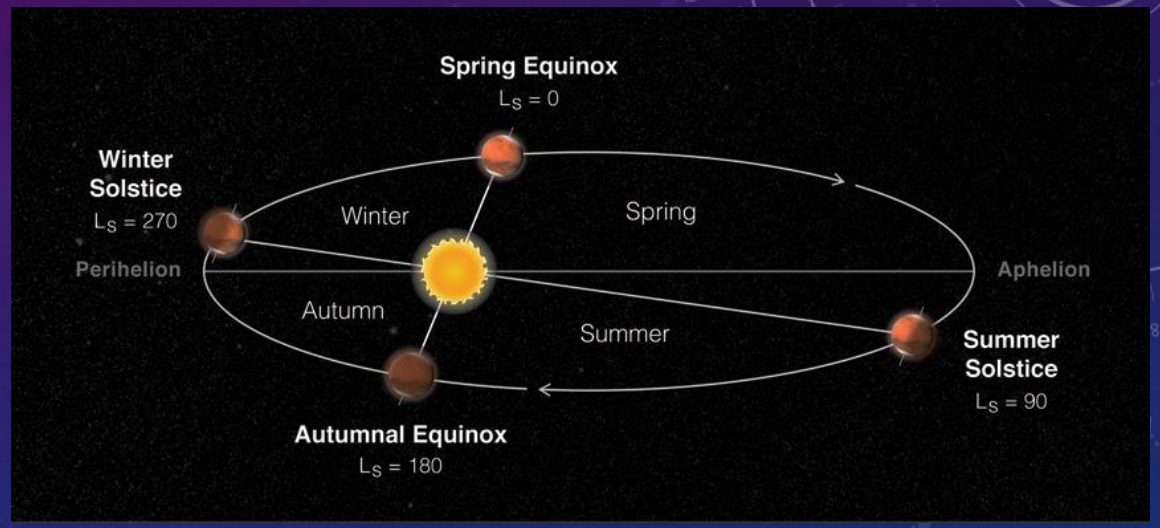
## International Meteor Organization (IMO) Terminology

*Solar Longitude – the precise measurement of the Earth's position in its orbit which is independent on the unexpected or fluctuating changes in the standard Julian calendar. All solar longitude values are given in the J2000 Epoch.*

*r – Represents the population index as a term which is computed from each shower's meteor magnitude distribution.*

- *r between (2.0 – 2.5) indicates a larger fraction of bright meteors than the overall average.*
- *r at 3.0 or greater implies a far richer concentration of fainter meteors than the overall average.*

*V – The atmosphere or apparent meteor velocity in (km/s). The velocities for meteors upon atmospheric entry has a range: (11 – 72) km/s with 40 km/s being the overall averaged velocity value.*

**ZHR – Zenith Hourly Rate*

**For those of you who are not familiar with the term ZHR it is calculated value on the estimated maximum number of meteors entering the atmosphere that anyone would be able to observe from the radiant in ideal, perfectly dark, clear skies. There are times when the ZHR which is the number of meteors observable per hour can be greater than predicted for extreme conditions than can occur in the time period of an hour or less. In less than ideal conditions the reported ZHR values can be below the predicted ZHR for an observed meteor shower.*