PROFESSOR COMET REPORT

(EARLY 2017 – LATE WINTER/EARLY 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

Late Winter/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°)
Encke	2P	P	*8.7 (27 Feb)	Brightening through the early half of March!	6.0	55° N - 90° S	Pisces (1 Jan to 9 Mar) Aquarius (10 Mar to 9 July)	Early Morning (Late April to Late June)	Not observable until Late April & observable to all by Late July!
Johnson	2015 V2	C	*9.7 (7 March)	Predicted to achieve peak brightness by Mid June!	6.0	57° 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
Tuttle – Giacobini – Kresak	41P	P	*9.8 (8 March)	Brightening with an expected peak in Early April!	5.5	86° N - 48° S	Leo, Leo Minor (6 Jan to 11 Mar) Circumpolar (12 Mar to 19 Apr)	Early Evening to All Night (Late Jan – Early June)	*Observable around Draco during perihelion & perigee.*
PanSTARRS	2015 ER61	C	*10.4 (8 March)	Brightening through May with an expected Peak brightness in Early June.	7.0	†52° N - 72° 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!
Honda – Mrkos - Pajdusakova	45P	P	*10.5 (8 March)	Fading from its peak brightness back on 11 Febraury.	6.7	90° N - 54° S	Mostly Leo (25 Feb to 25 June) Leo Minor (2 – 4, 7 – 12 Mar)	Morning (Early Feb to Late Mar) Before Midnight (After 20 Mar)	*Continues to be observable at Mag > 13.0 until Early May!*
NEOWISE	2016 U1	C	11	Fading from peak Brightness in Mid January.	6.1	***Lost in the Daytime Glare!***		Not observable until after 1 July (Early to Mid Morning)	*Unobservable (Visual Mag > 18.0)*
Schwassmann – Wachmann 3	73P	P	12.5	Three known fragments in existence: (C, B, & BT)	12 -12.5	††38° N - 72° 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.
PanSTARRS	2016 R2	C	13	Brightening, but no observations yet! (Expected Peak in January 2018)	10	††47° N - 67° S	Fornax (1 Jan to 5 March) Eridanus (6 March to 1 June)	Early Evening (1 Jan to 25 March)	Observable at low horizons in the SW just after sunset!
LENEOS	315P	P	13	Holding Steady in Brightness peak is predicted for mid Spring.	14.2	78° N - 48° S	Leo, 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!
Hartley 2	103P	P	13.3	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)

*Visual Mag. value is given based on the latest observation field report!

**Comets that are only visible in the most southerly regions of the US and corresponding territories or visible only to observers in the Southern Hemisphere!

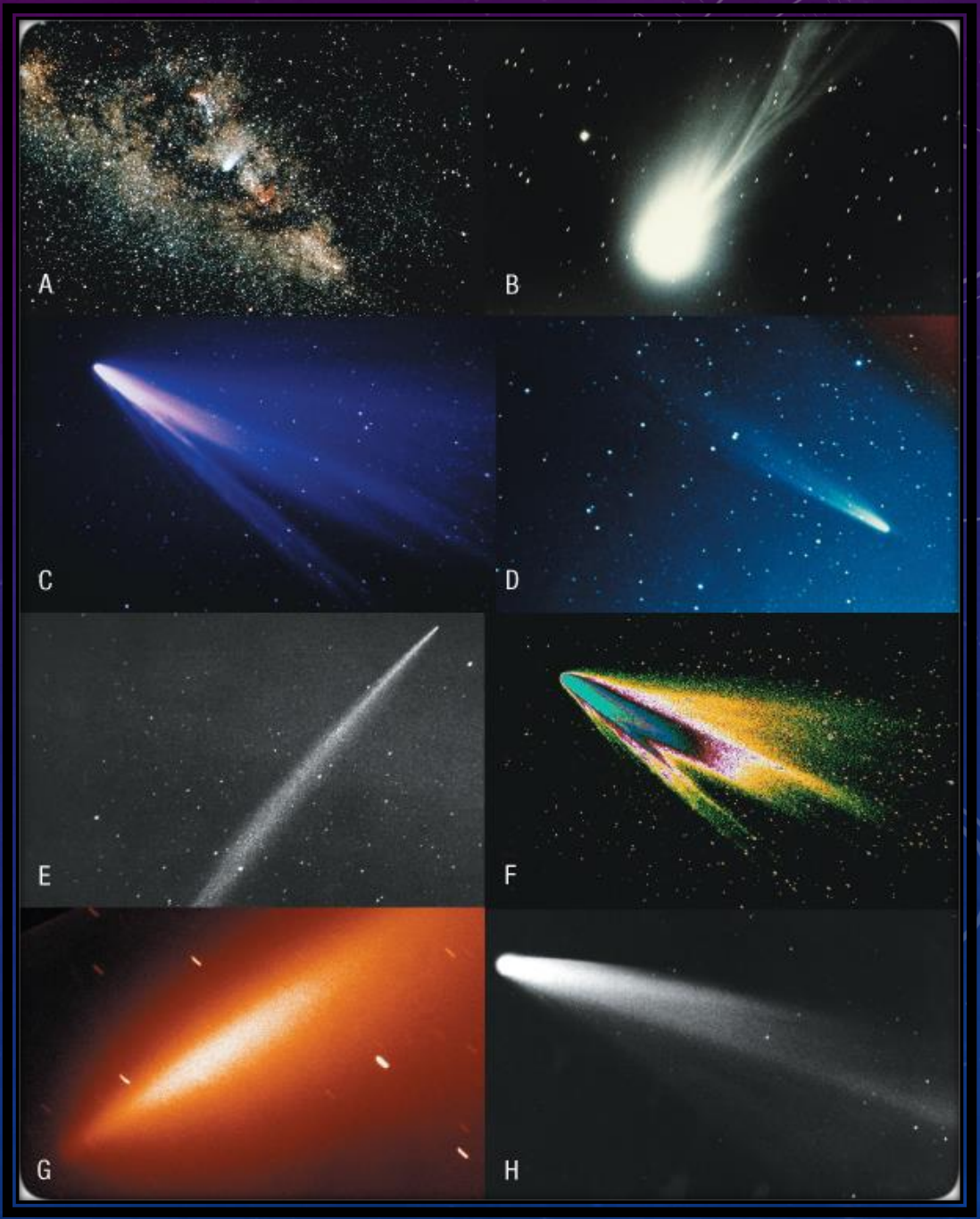
†Not observable at zenith since the comet is lost in the daytime glare either before sunset or sunrise.

This spreadsheet table of data is applied only to bright comets defined by observable stellar magnitudes greater than 13.5 or 14.0 in times of sparely available comets for observation!

††Not observable on the celestial prime meridian for most or all of 2017!

WHAT ARE COMETS?

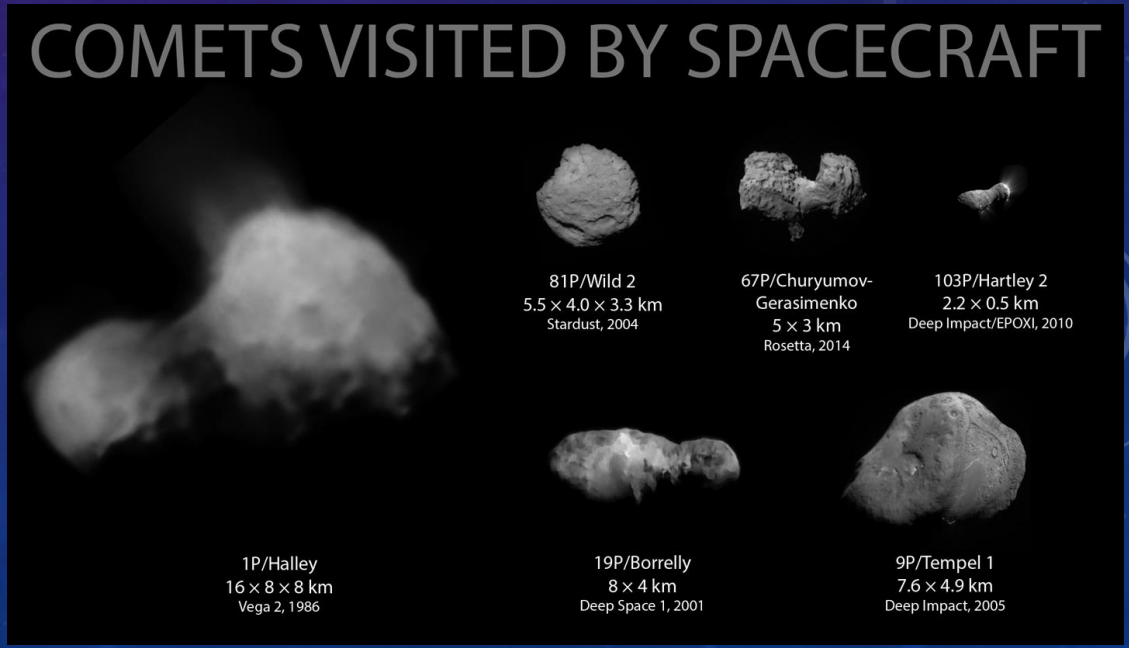
- Comets are known as minor planets like asteroids or other small space debris.
- Bodies composed of metals (rocks), dust, & volatiles (examples: CO_2, H_2O, CN^-, C2, C3, CS, COS, HO^-, etc.)
- Frozen bodies of Dirty Ice (Asteroids coated in and Saturated with Icy Volatiles)!
- Clathrytes are minerals & 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?

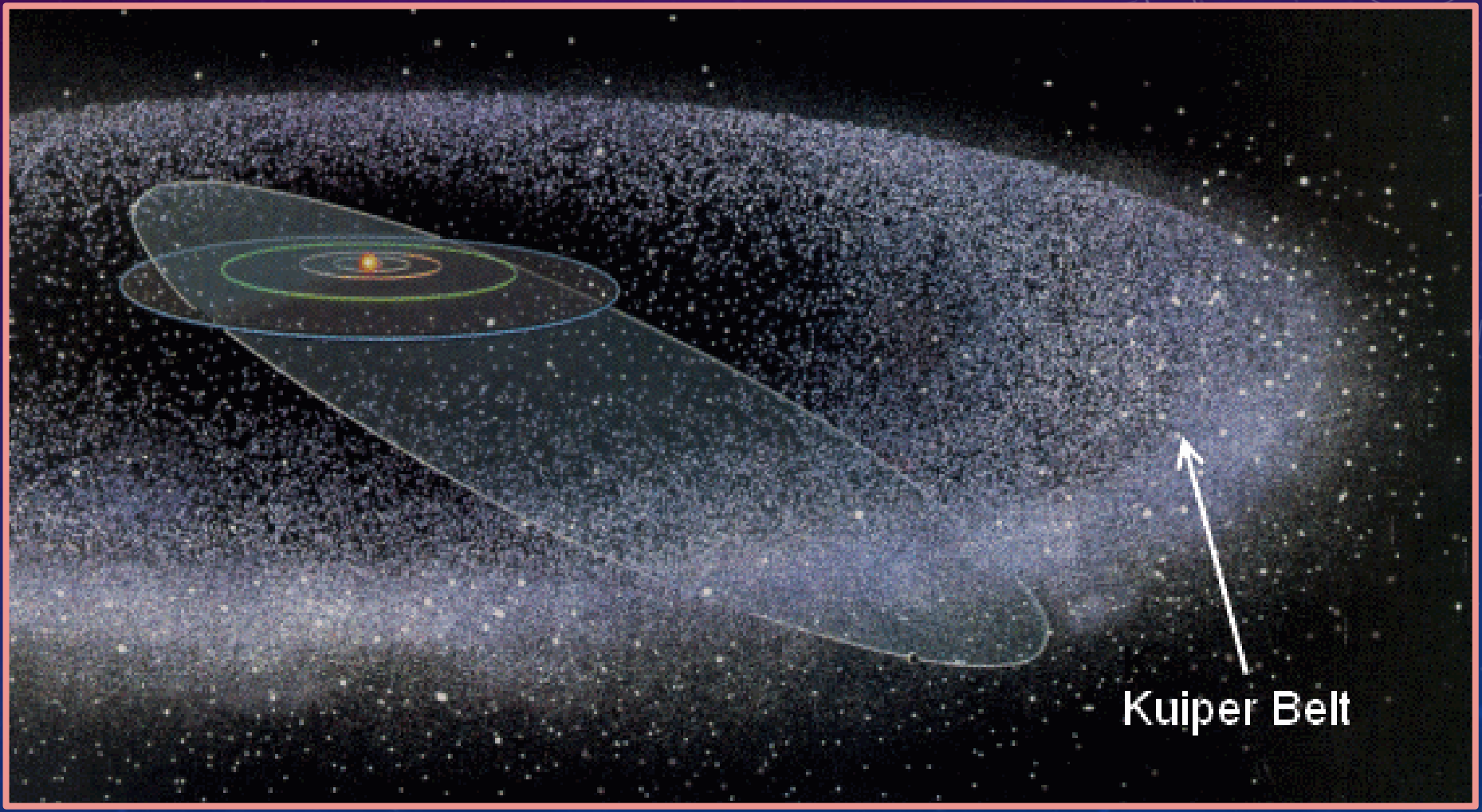
- They have no moons or rings.
- The coma can reach from a few thousands and up to over 2 million km across (example: 17P/Holmes)
- The tails can extend past 900 000 km in length can could theoretically extend up to 1 AU!
- The material from the dust tail is the primary, but not the only source of micrometeroids 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.

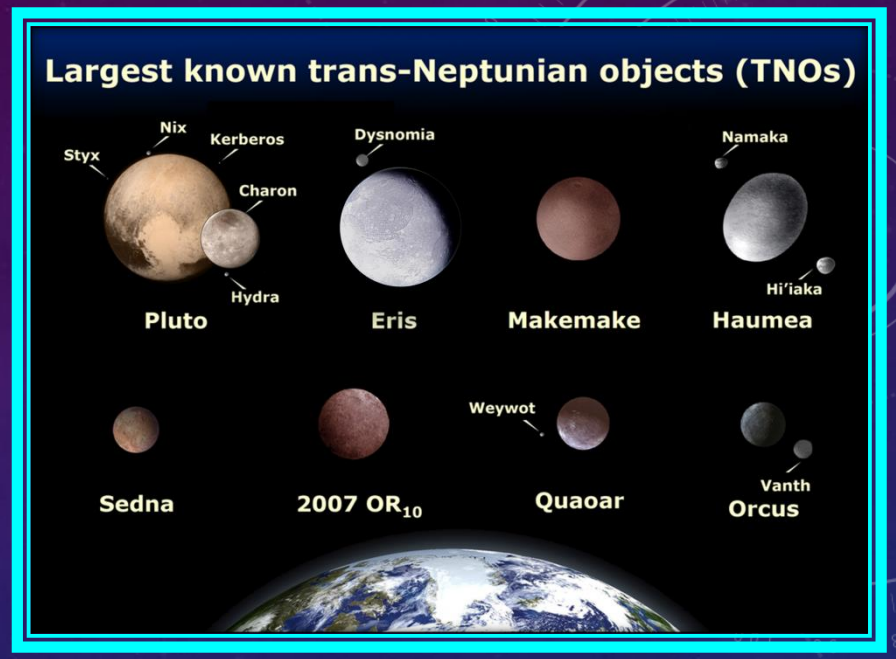


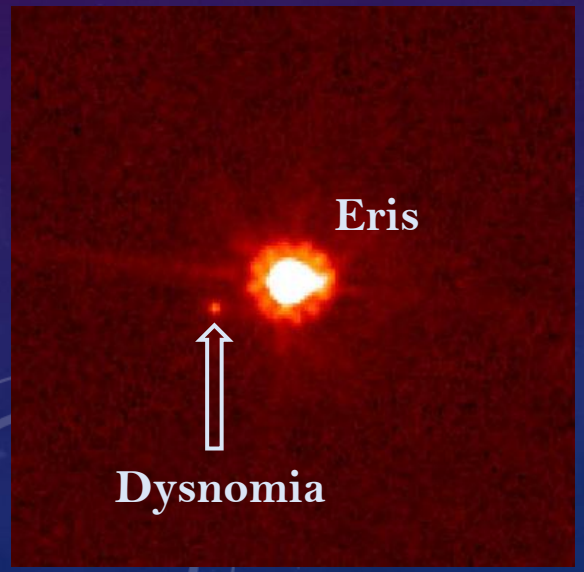
WHERE DO THEY COME FROM?

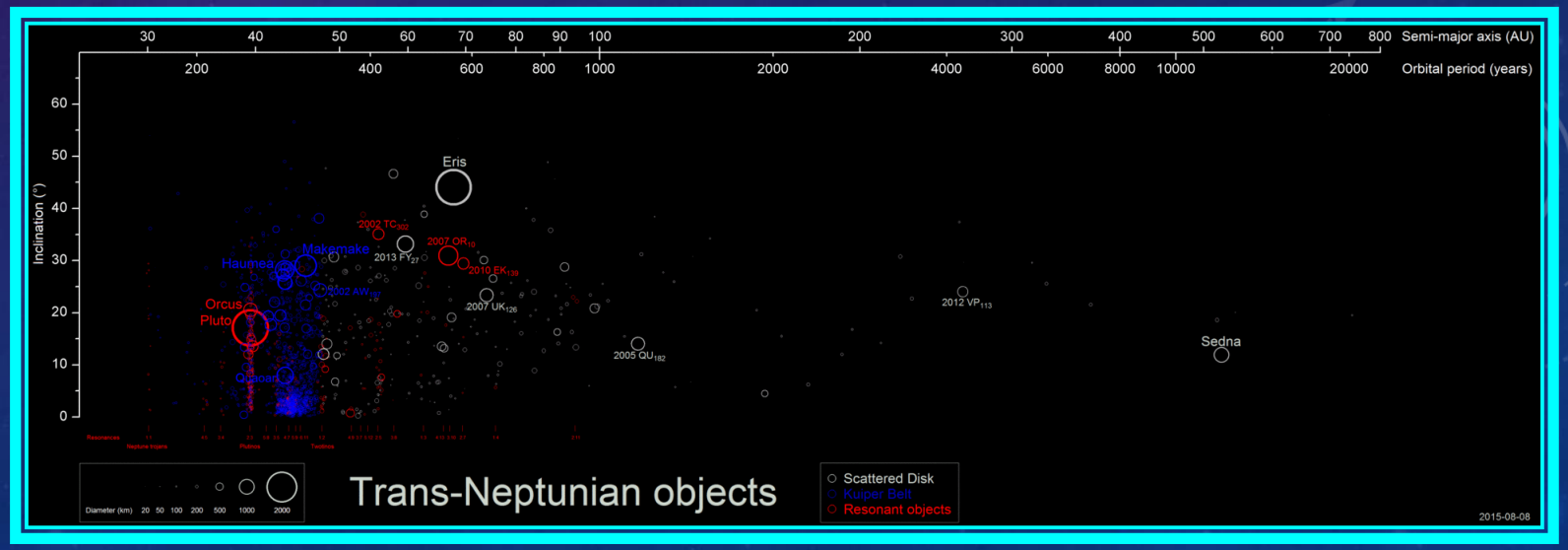
Scattered Disk Region

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° respectfully.

Over 200 have been identified officially as of 2011!



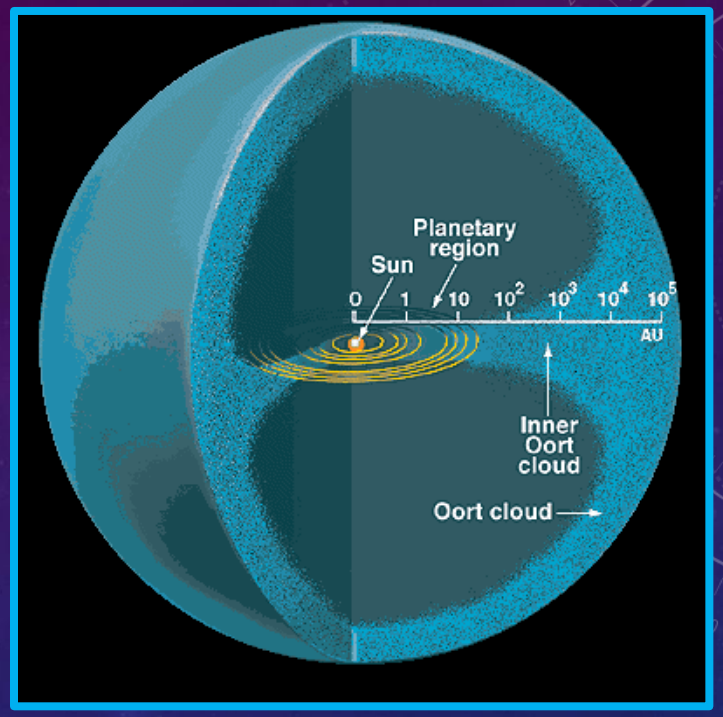


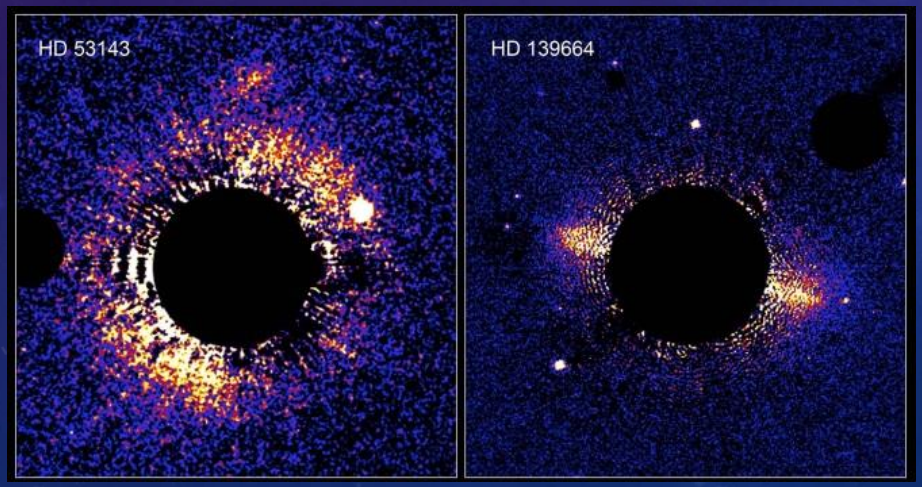


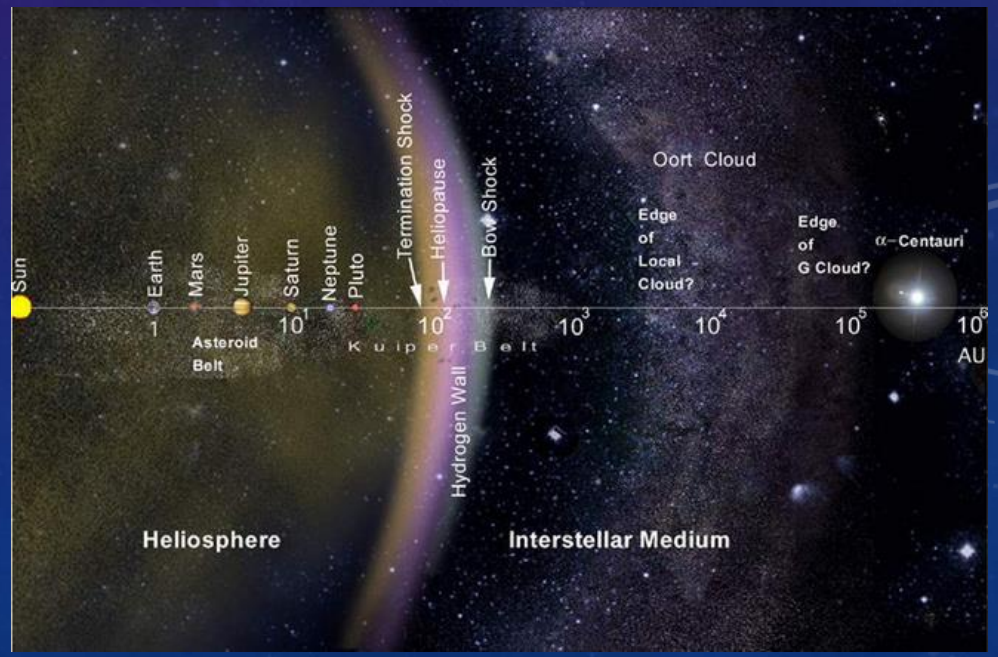
WHERE DO THEY COME FROM?

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!







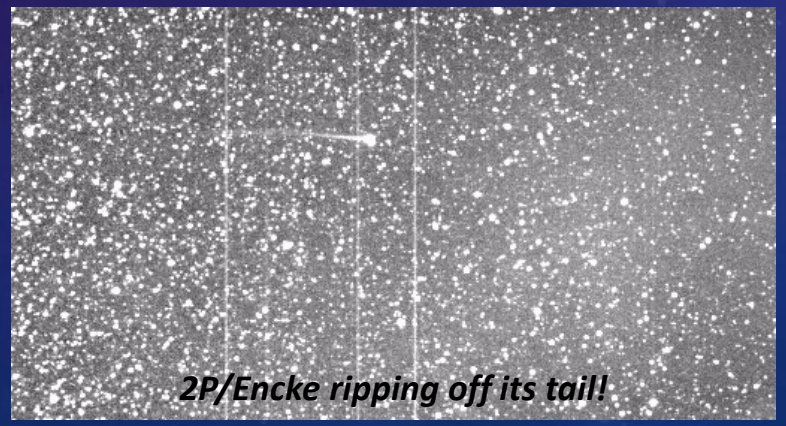
WHERE DO THEY COME FROM?

Jovian (Jupiter) Family of Comets

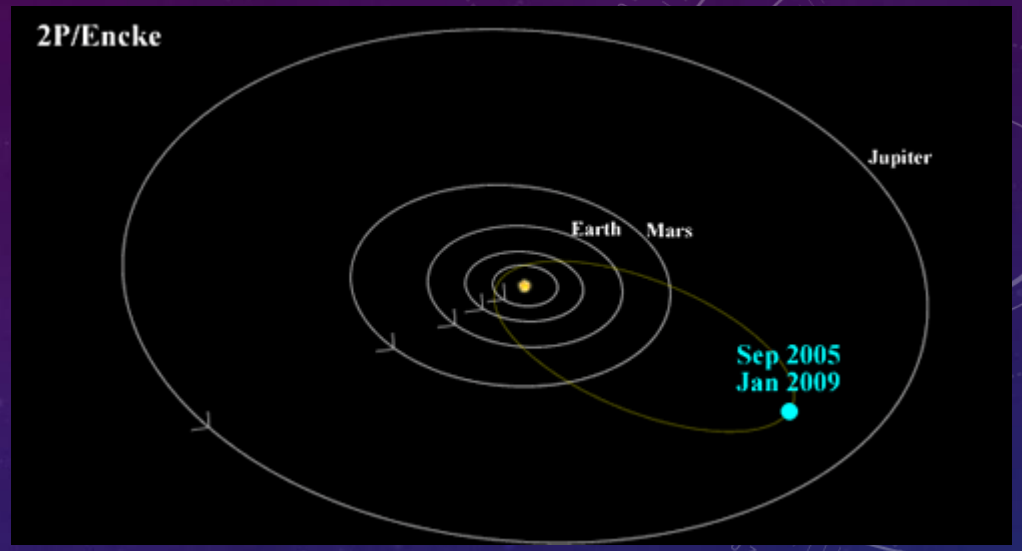
These are nearby comets that reside between the boundary of the inner and outer planetary solar system with orbital periods between 3 – 20 years. There current orbits are influenced by the strong gravitational field of Jupiter which can adjust all or most of the orbital parameters of these bodies are 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!

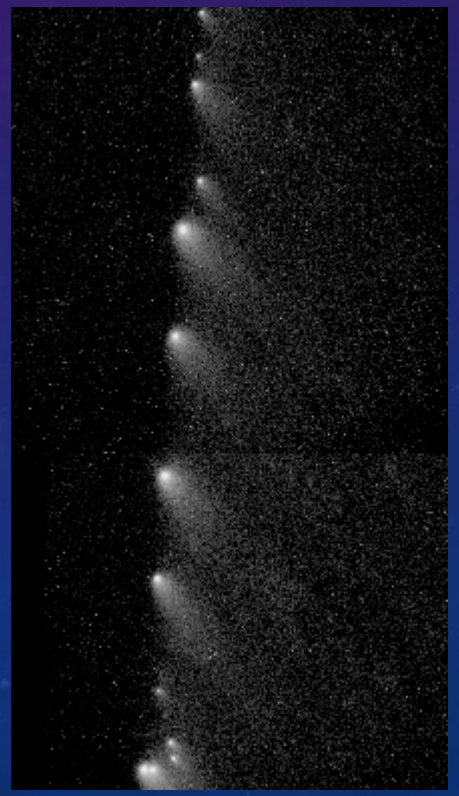
Unlike the longer – periodic comets these bodies these comets have shallower orbital inclinations ≤18° and orbit in the same direction as the planets!

400 of these bodies are known to Science!

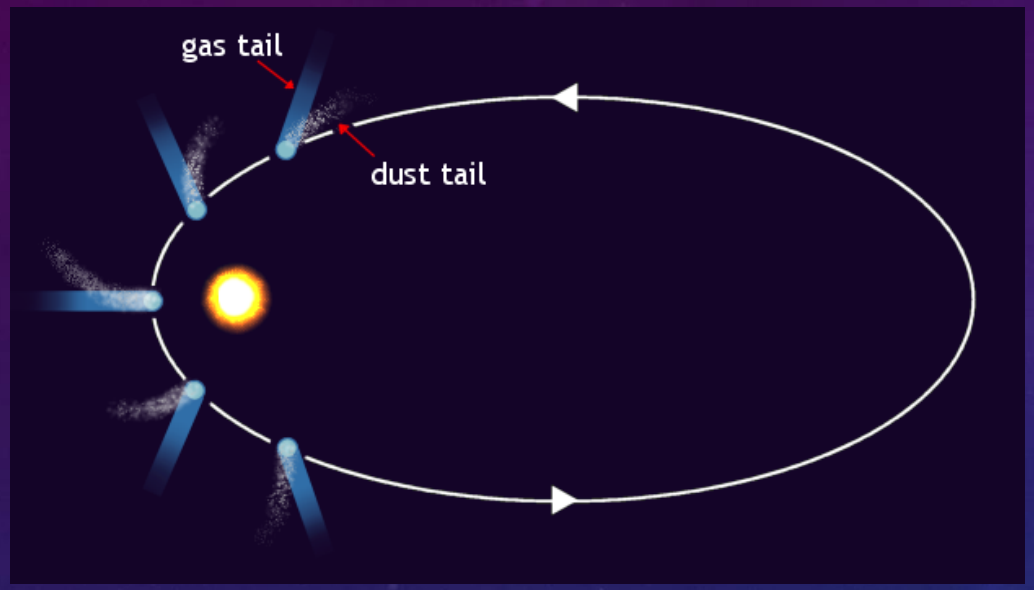


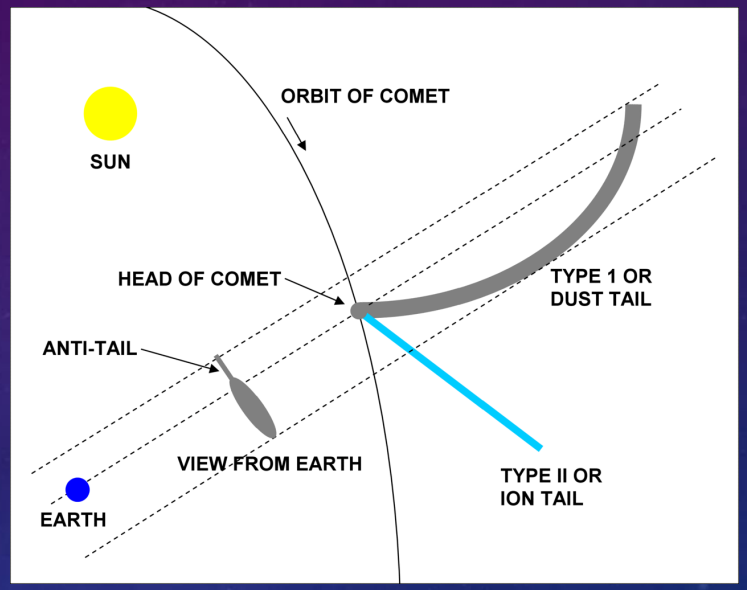
2P/Encke ripping off its tail!

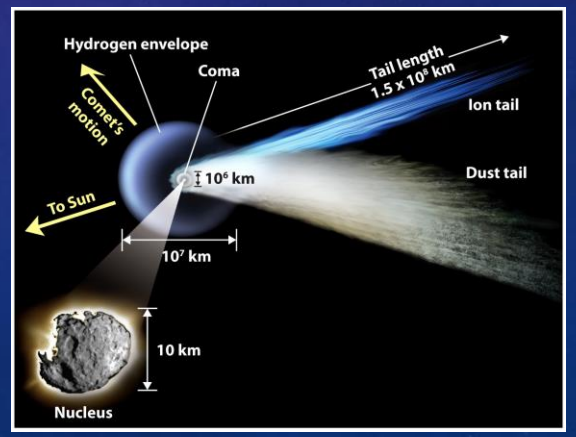




UNDERSTANDING THE STRUCTURE OF COMETS!







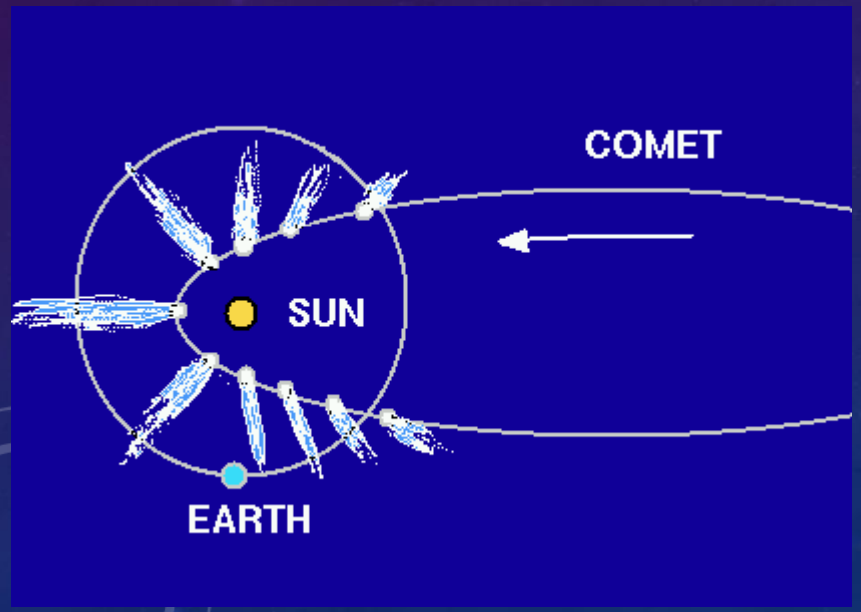
The Four Parts of a Comet!

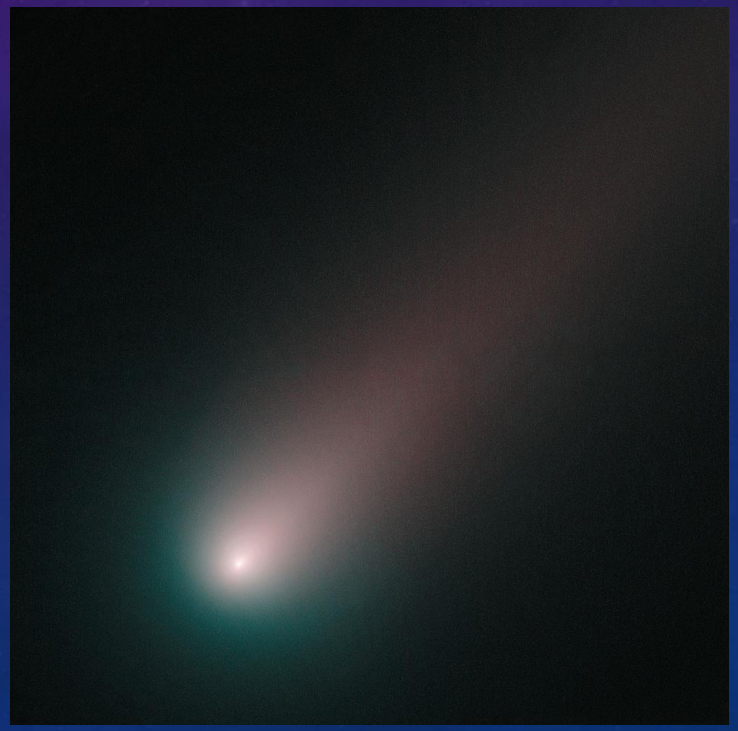
Nucleus
Coma
Hydrogen Envelope
Tails (Dust, Ion, Sodium, etc.)

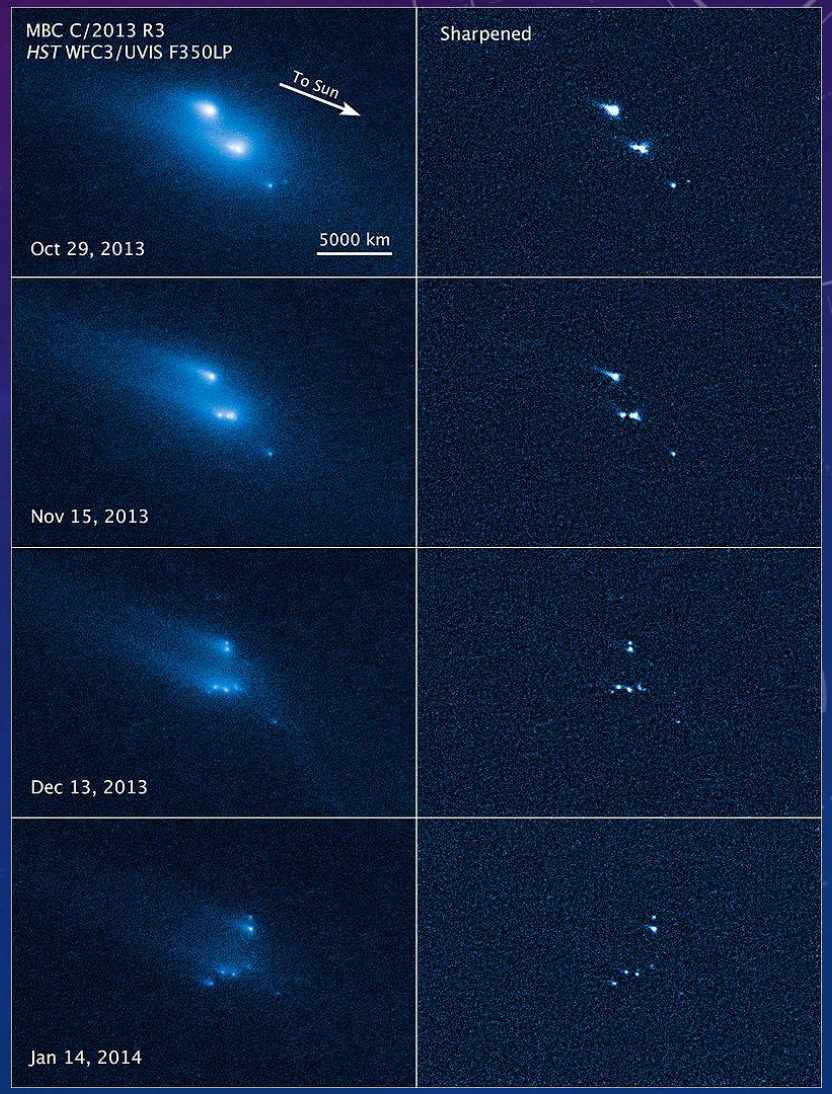
UNDERSTANDING THE STRUCTURE OF COMETS!

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 processes of sublimation, evaporation, ionization, pressure outflow, etc.





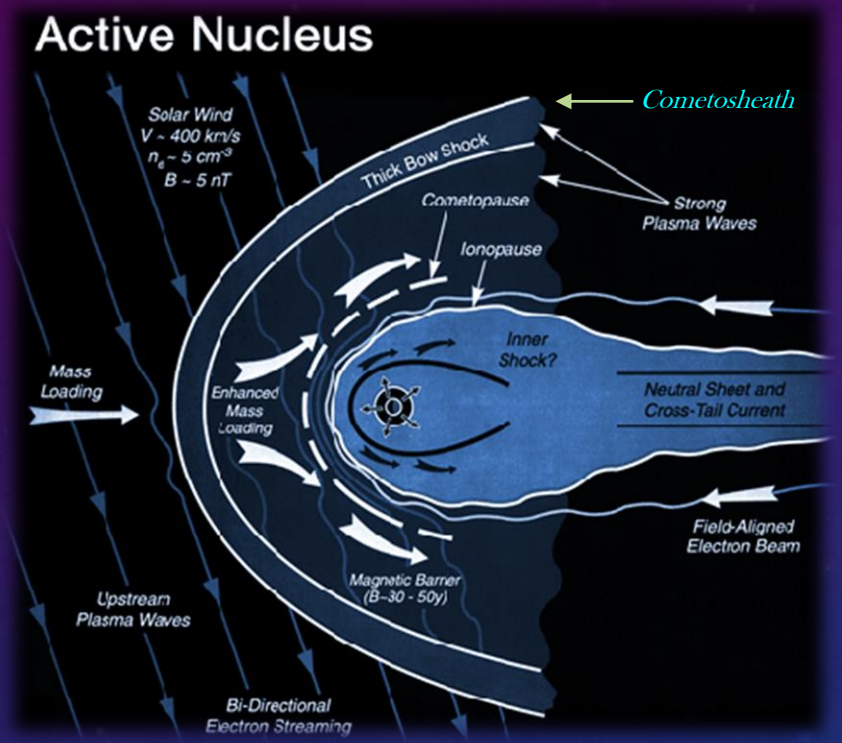


UNDERSTANDING THE STRUCTURE OF COMETS!

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!*** ***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.*** ***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 (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.*** ***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.*** ***Dust Tails can extend up to 100 million km (62.1 million mi) from the Nucleus and Coma!***
Sodium Trail (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 (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.*** ***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!



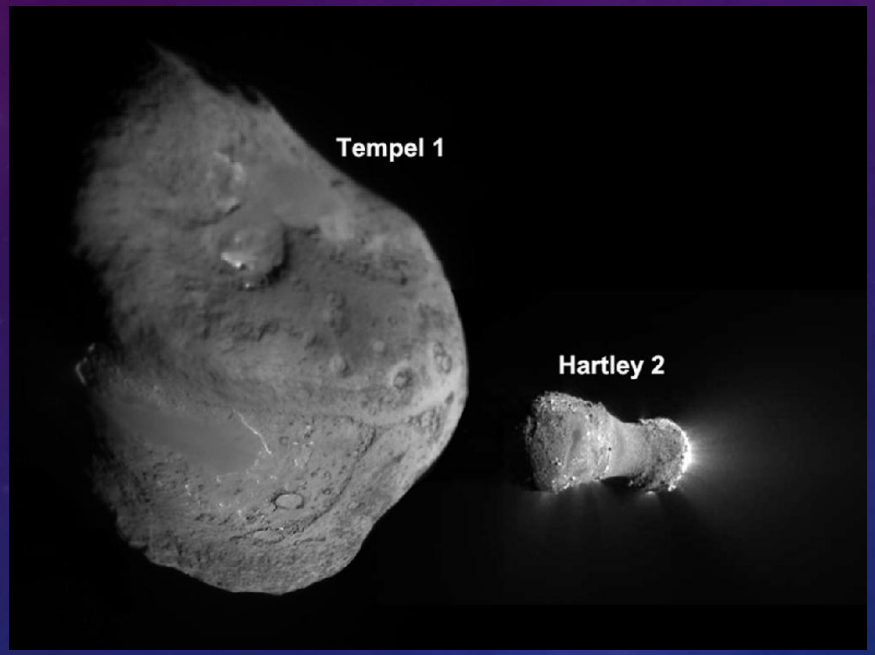
It is okay if you don't entirely understand what is going on here:

*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!

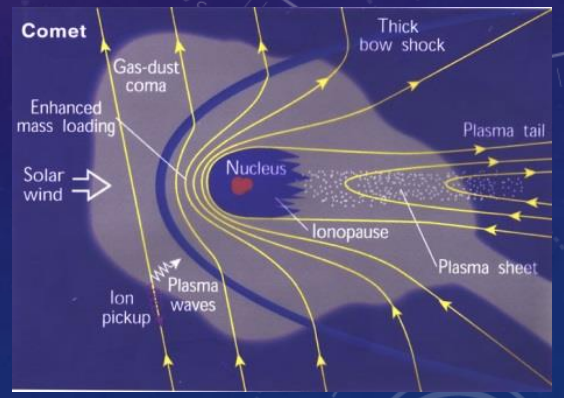
Basic Facts about a Comet's Nucleus:

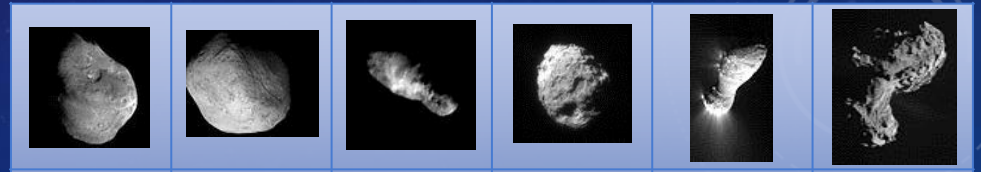
I) All Comet's Are Dirty Snowballs or Icy Dirtballs
II) A composition of Rock, Dust, and Icy Volatiles
III) Complex and exotic organics known only on Earth have been confirmed to exist on one comet!
IV) The Volatiles are effected by the Solar Radiation and sublimate
V) The sublimated Gas form an atmosphere 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





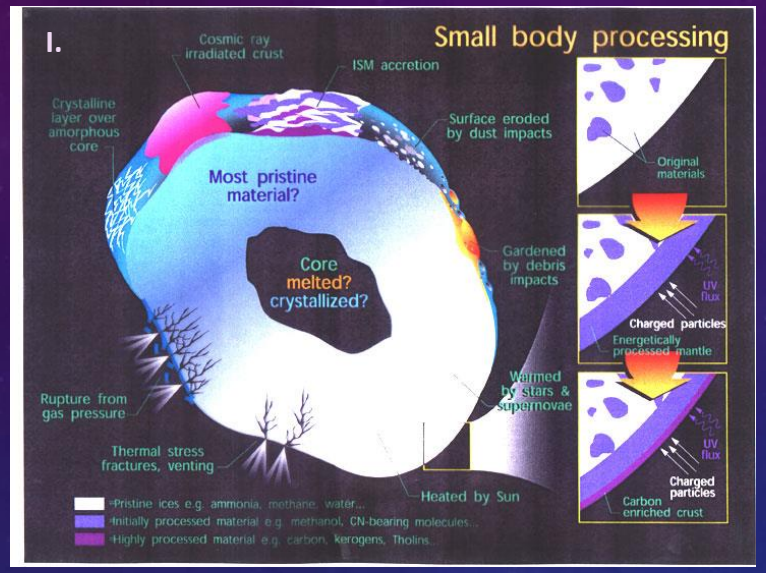
Tempel 1 Deep Impact	Tempel 1 Stardust	Borrelly Deep Space 1	Wild 2 Stardust	Hartley 2 Deep Impact	C-G Rosetta

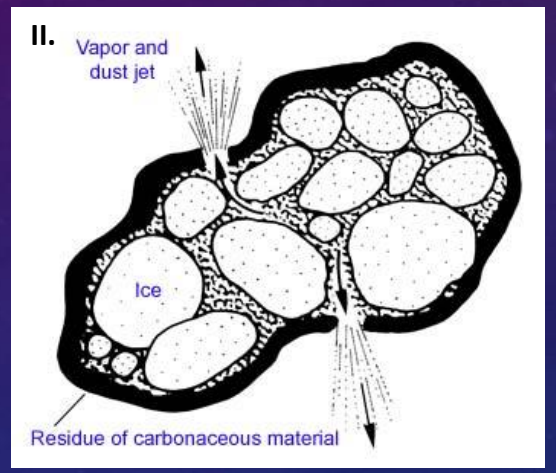
UNDERSTANDING THE STRUCTURE OF COMETS!

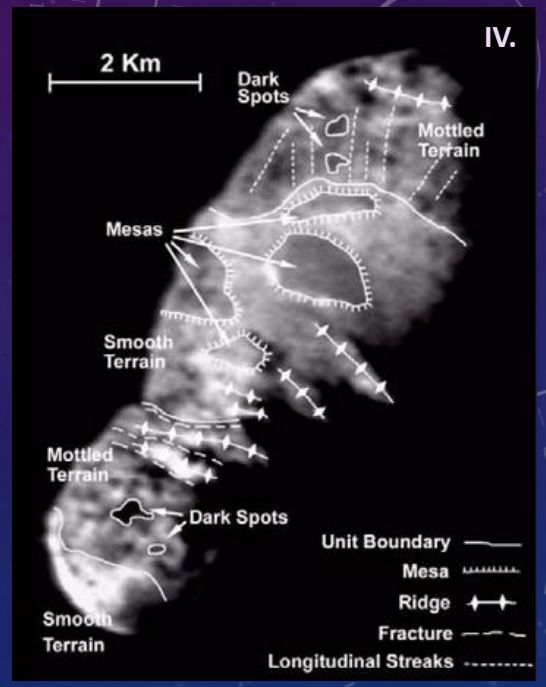
The structure of an comet's nucleus has varying degrees of fragility depending on the distribution, size, and composition of the icy volatiles distributed on the surface and the interior reservoirs within the nucleus.

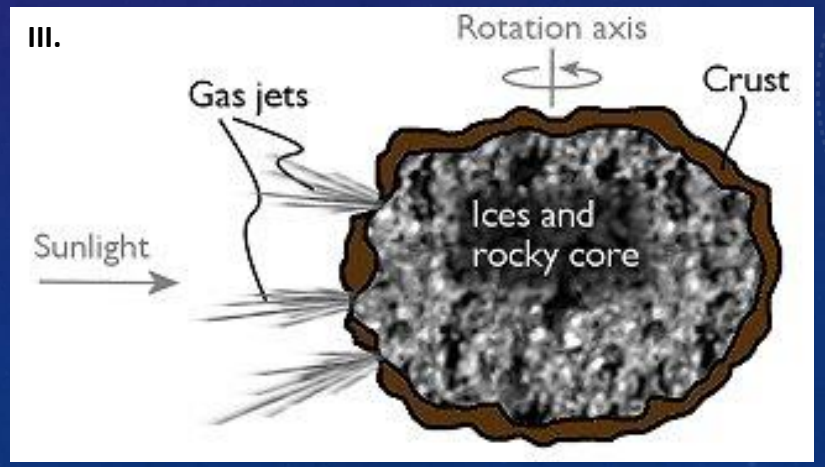
Comet's that do survive many journeys around the Sun until there supply of volatiles is thoroughly exhausted can be reclassified as either C or S – group (stony) asteroids. A small concentration of heavier metals do exist in some nuclei based on spectral analysis. All cometary nuclei that have been studied 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).*

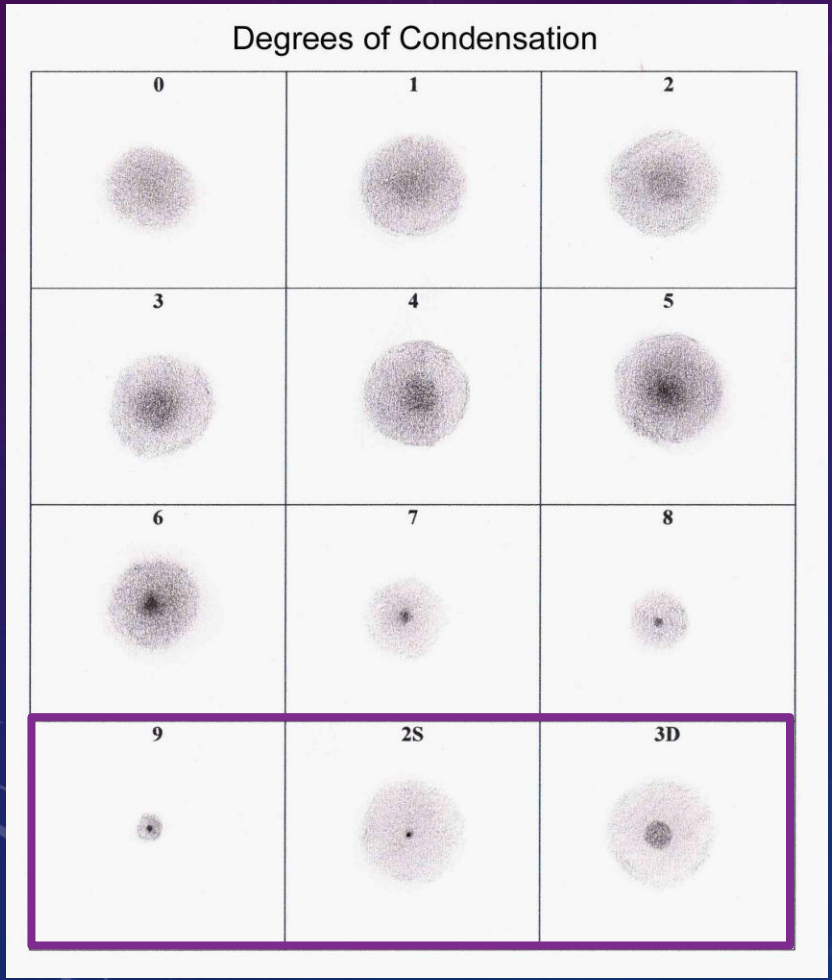
2) *For the coma or a comet's head there two characteristic features that are important for study:*

   - *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)

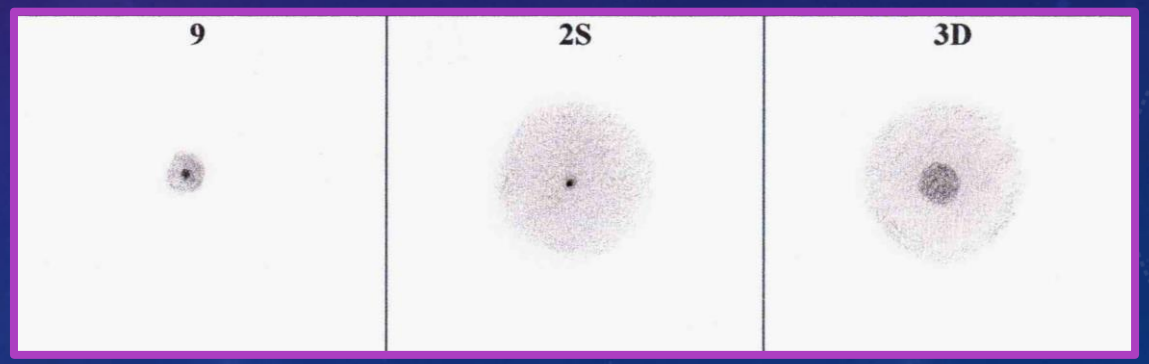


The chart displayed shows a visual comparison to determining the degree of condensation for a comet's coma!

Note the two extra designations:

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

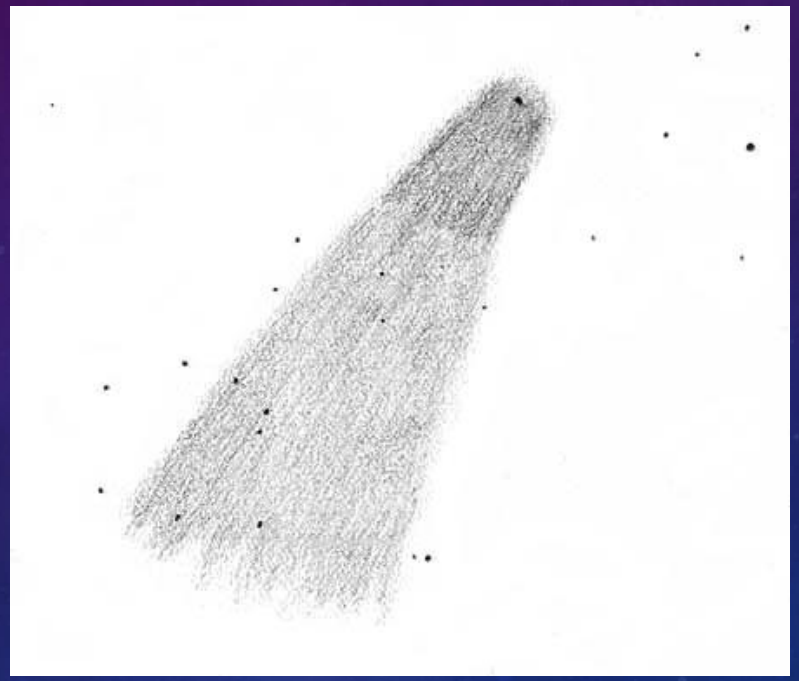
3D: The central condensate disperses with an extremely faint outer coma very little contrast from the background. The condensate is sharply distinguishable from the outer coma.



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

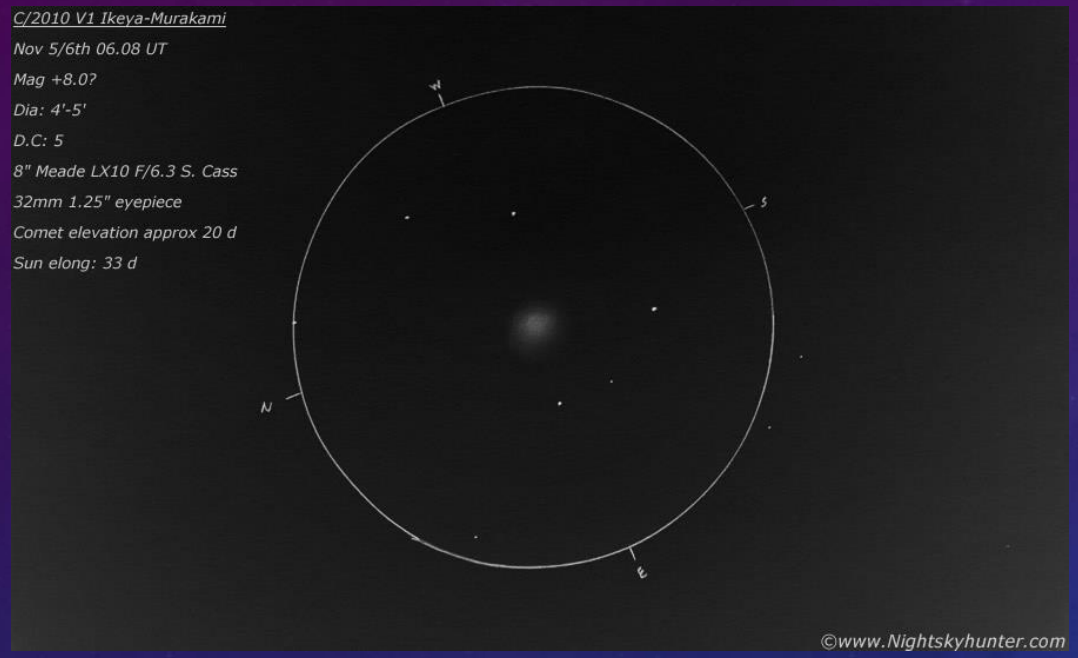


Comet Bradfield
Eric Jamison
6" Astrophysics f/9 refractor
23 November 1987

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!)

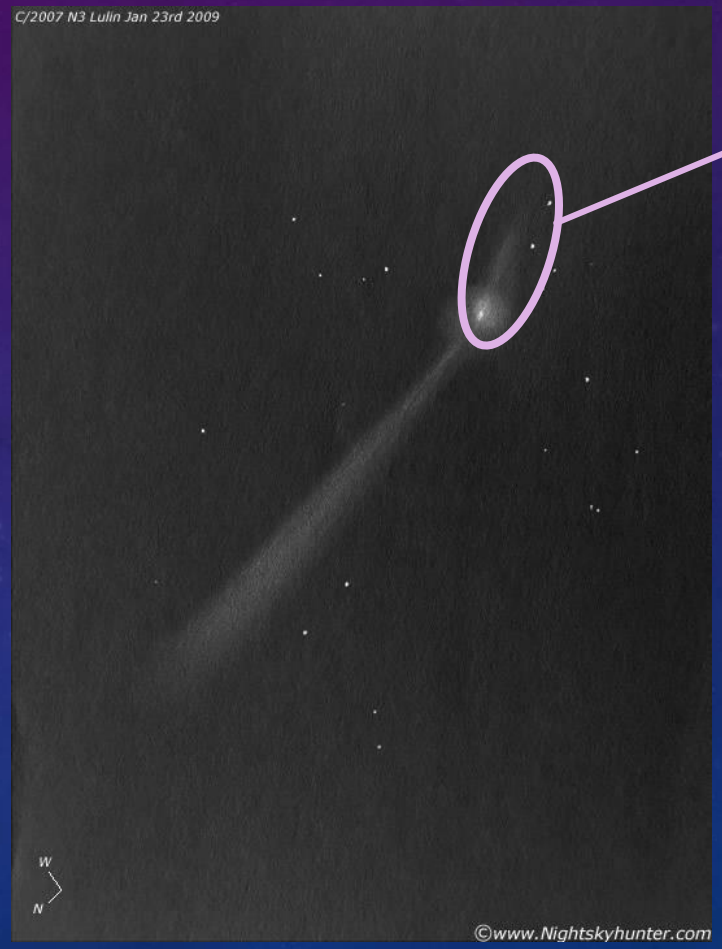
THE TECHNIQUES OF OBSERVING COMETS!



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'!

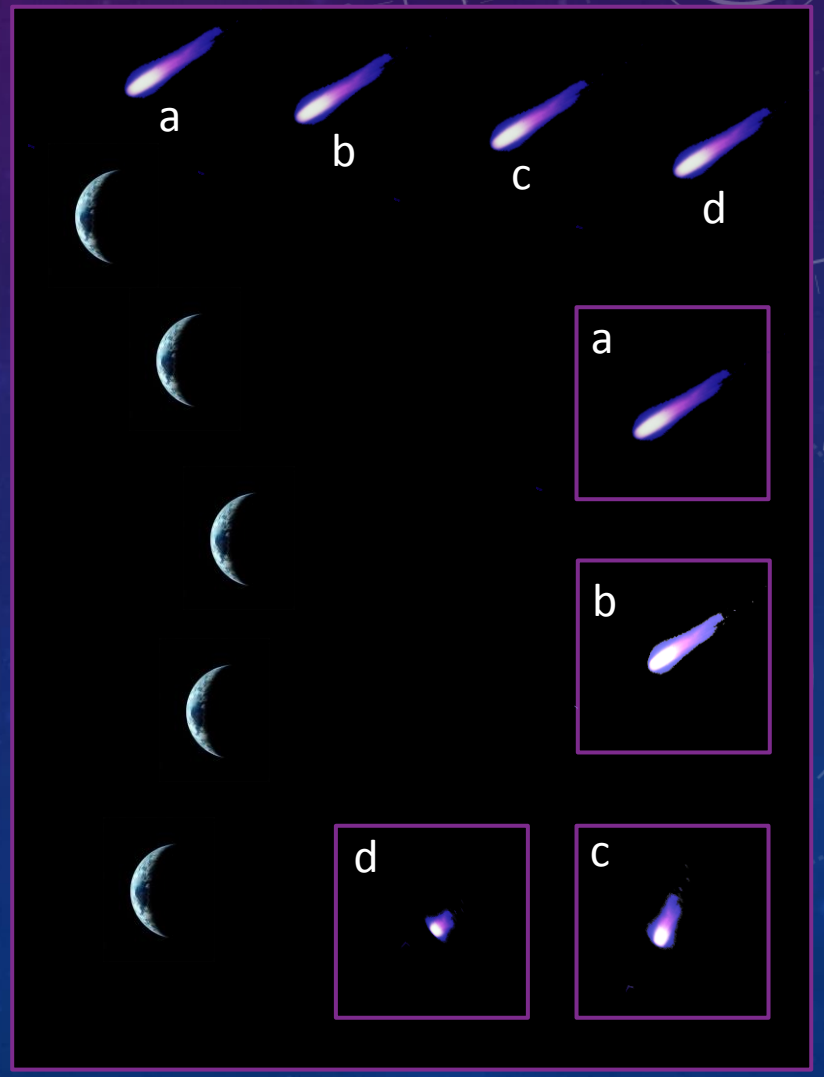
THE TECHNIQUES OF OBSERVING COMETS!

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 20th 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

THE TECHNIQUES OF PREDICTING COMETS!

How to plot a comet across the sky? Orbital Elements

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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

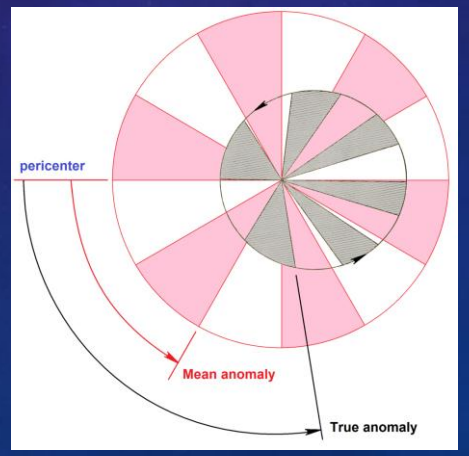
M: mean anomaly

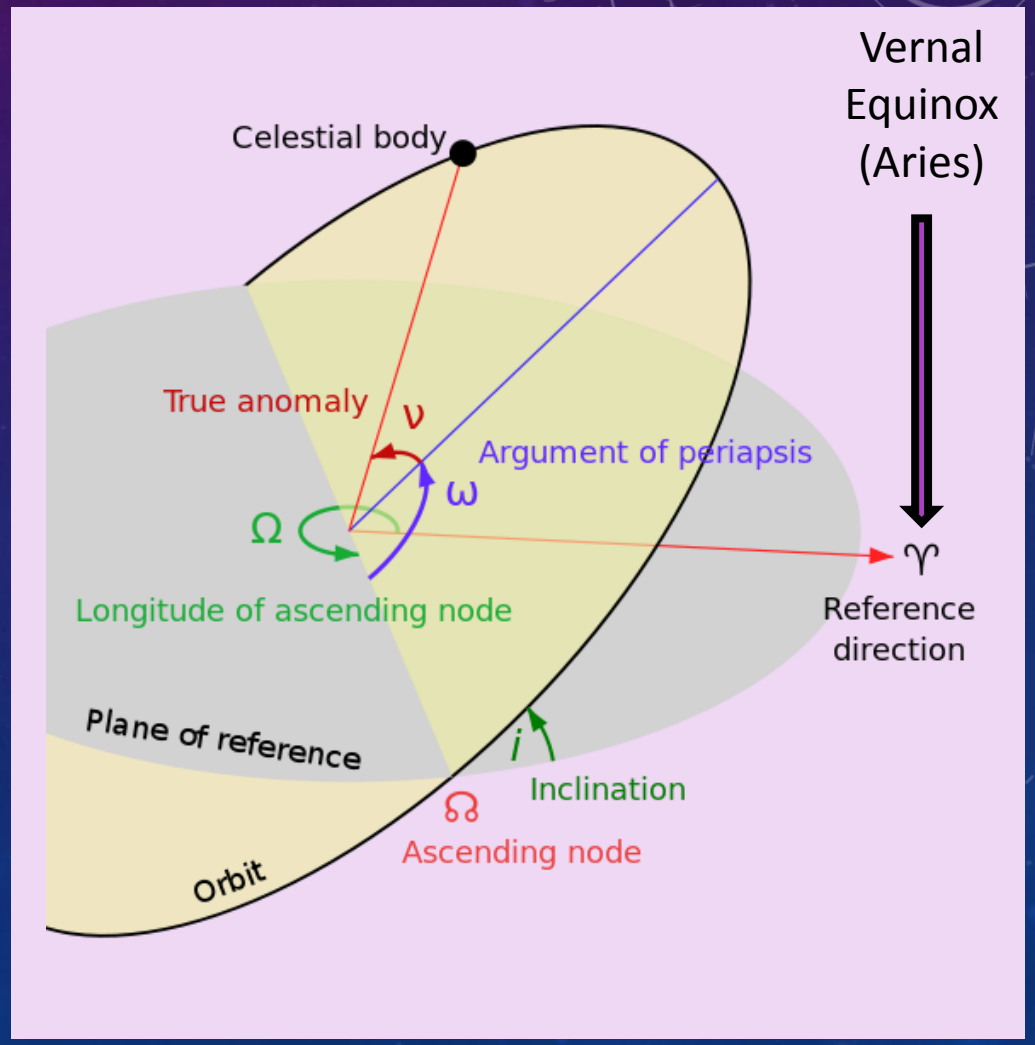
t_p: time of perihelion passage

period: orbital period (measured in years)

n: mean motion (measured in degrees/day)

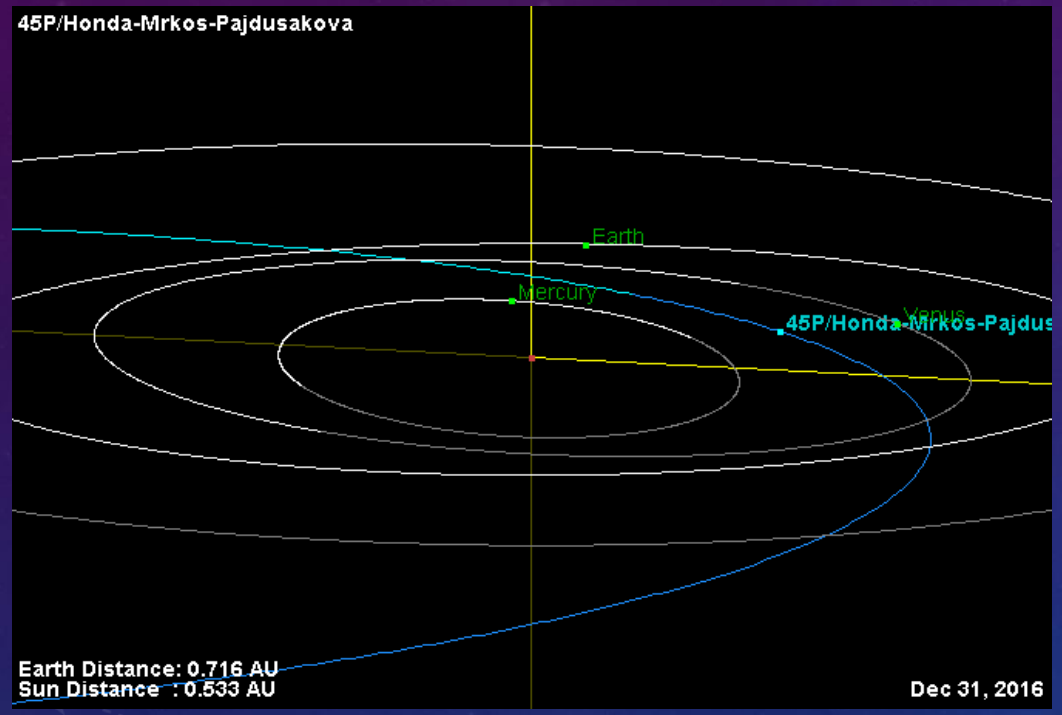
Q: aphelion distance (measured in AUs)

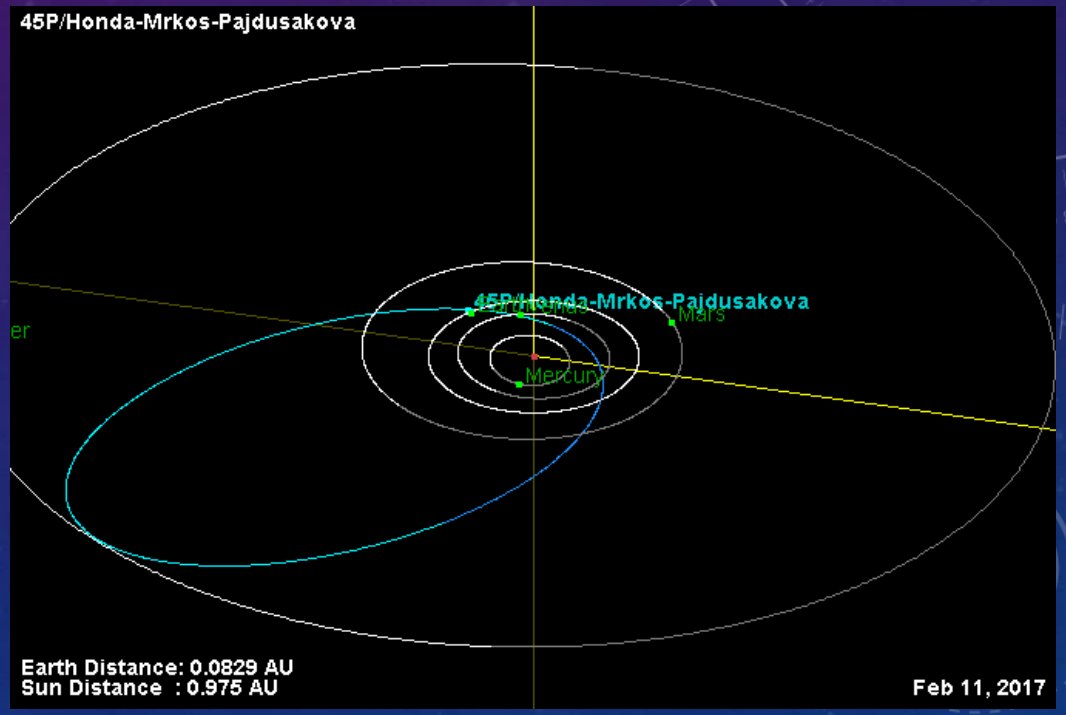




THE TECHNIQUES OF PREDICTING COMETS!

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. *(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. *(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. *(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. *(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!

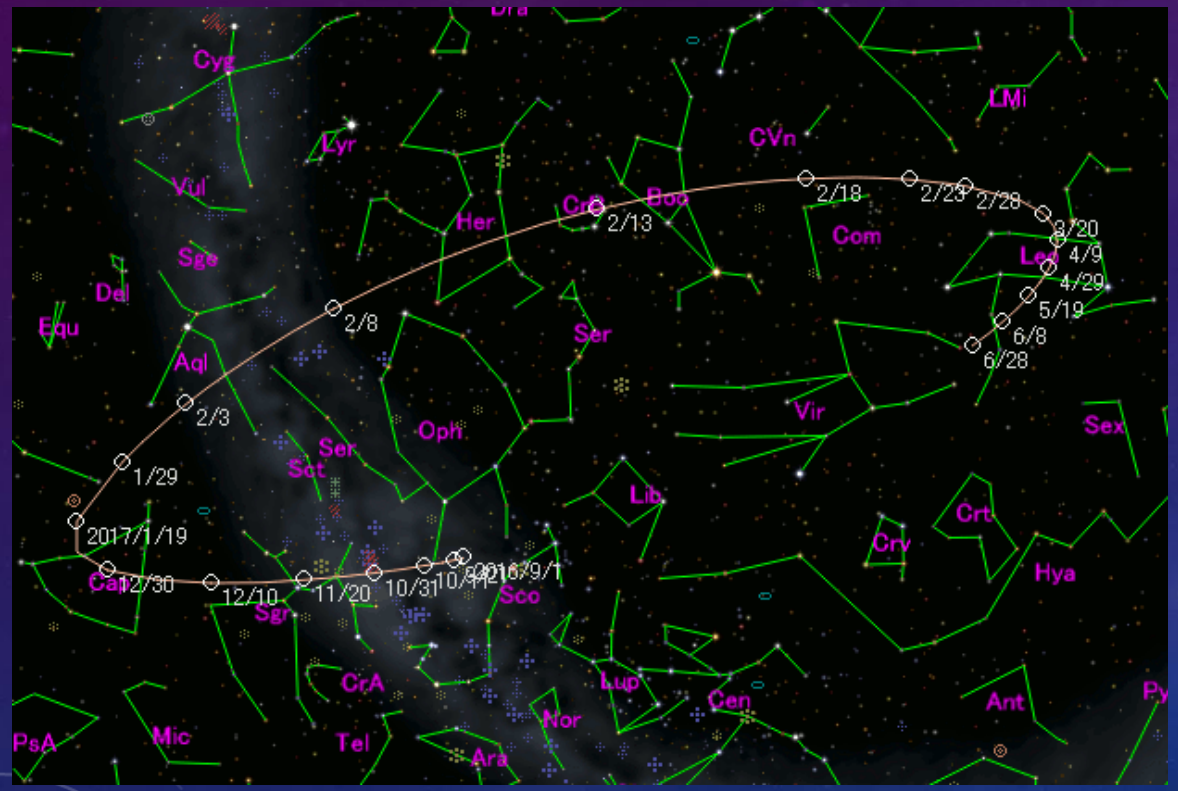
0045P

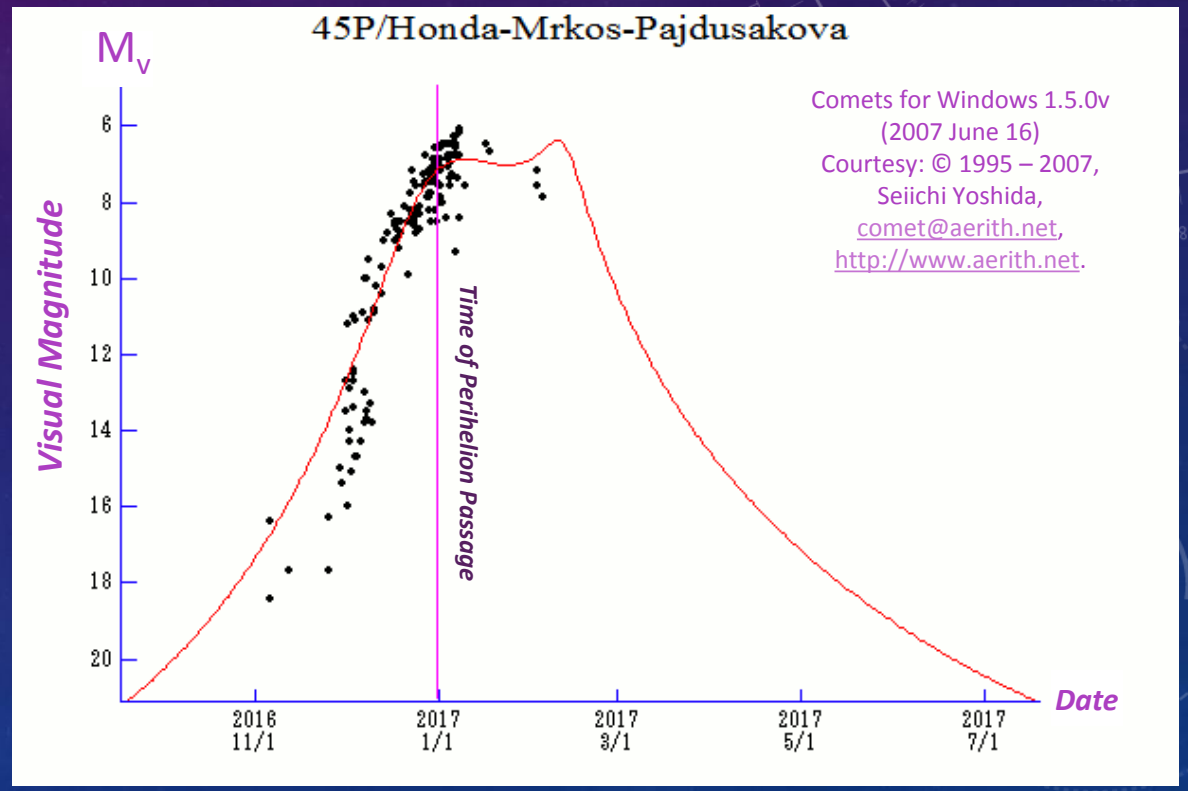
Date	UT h m s	R.A. (J2000)	Decl.	Delta	r	El.	Ph.	m2	Sky Motion "/min	P.A.	Object Azi.	Alt.	Sun Alt.	Moon Phase	Dist.	Alt.
2017 01 19	060000	21 06 42.8	-13 19 30	0.341	0.664	16.3	155.4		1.36	317.3	121	-63	-79	0.56	113	-01
2017 01 20	060000	21 04 54.4	-12 54 55	0.325	0.676	15.1	157.6		1.53	314.3	124	-64	-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?

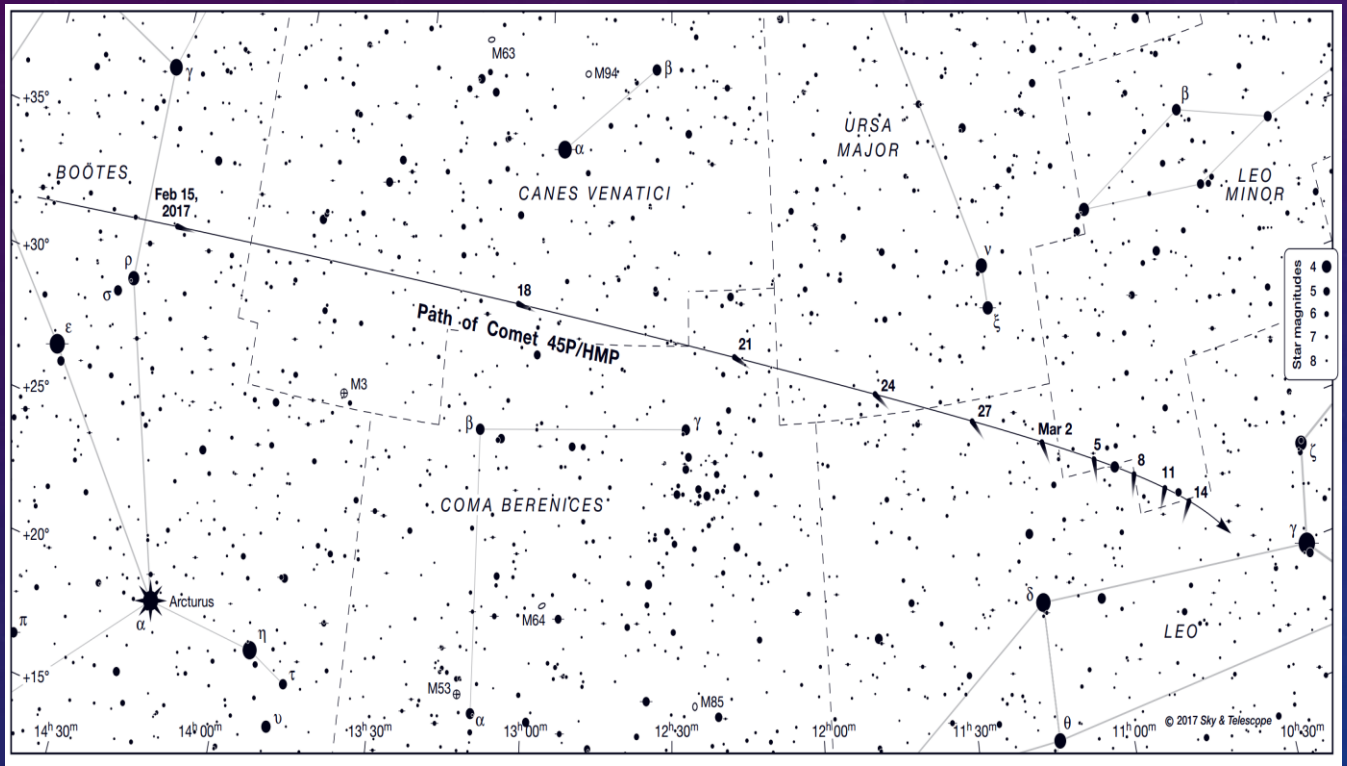


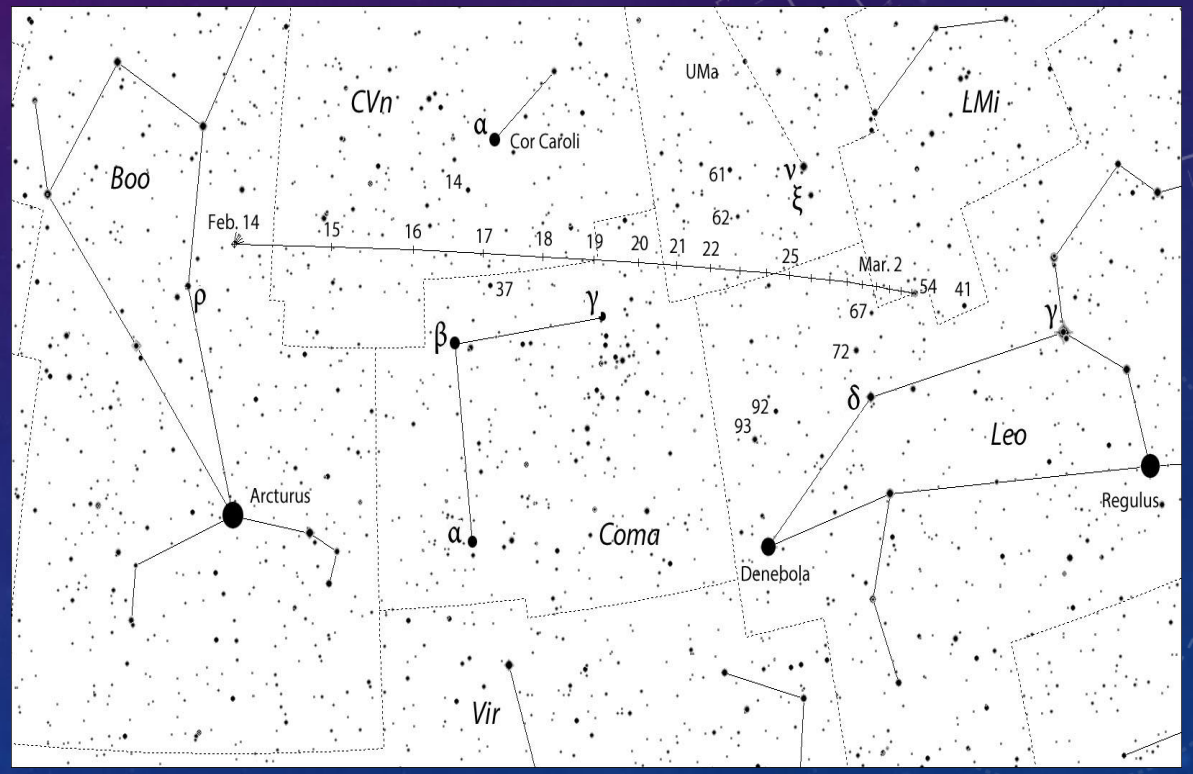


A Good Sky Chart plotting the elements and a photometry profile for when it is the best range of dates to observe at maximum brightness or to chart the changes in brightness!

THE TECHNIQUES OF PREDICTING COMETS!

How to plot a comet across the sky?

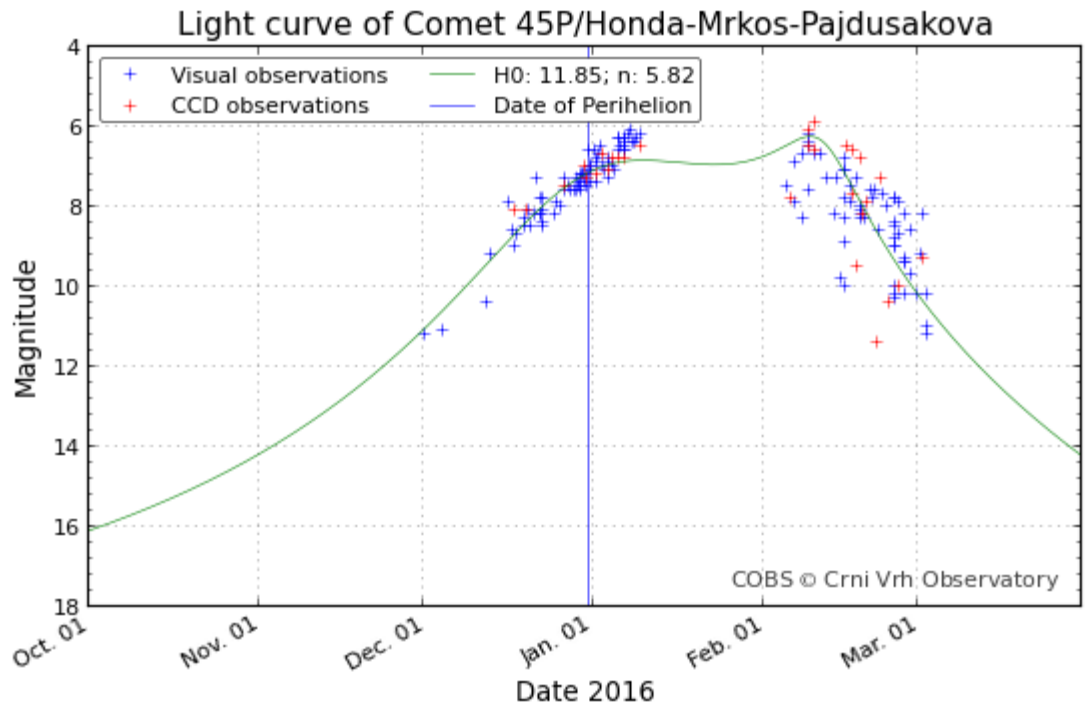


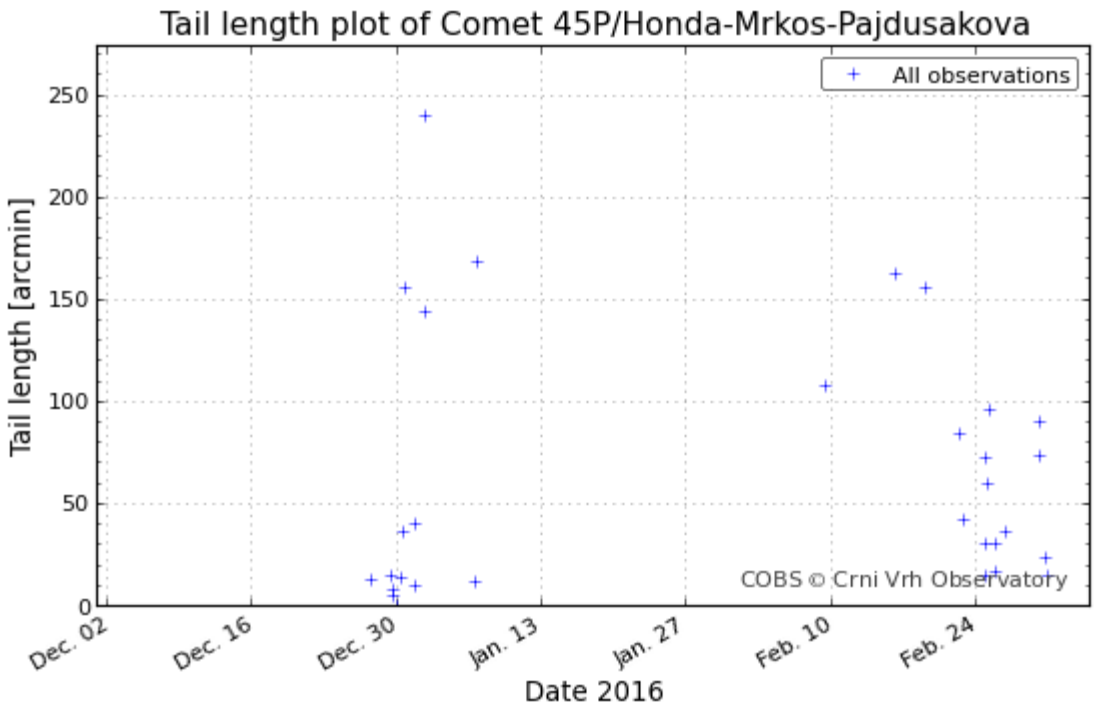


(Both Images) Courtesy: Sky & Telescope, 2017.

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!



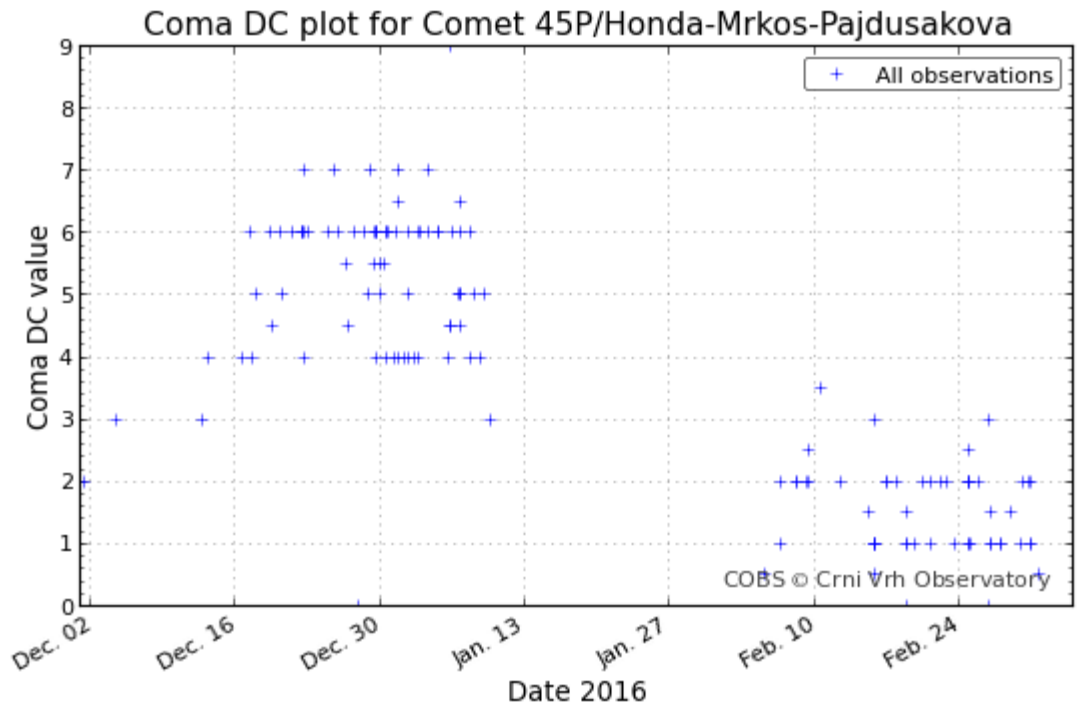


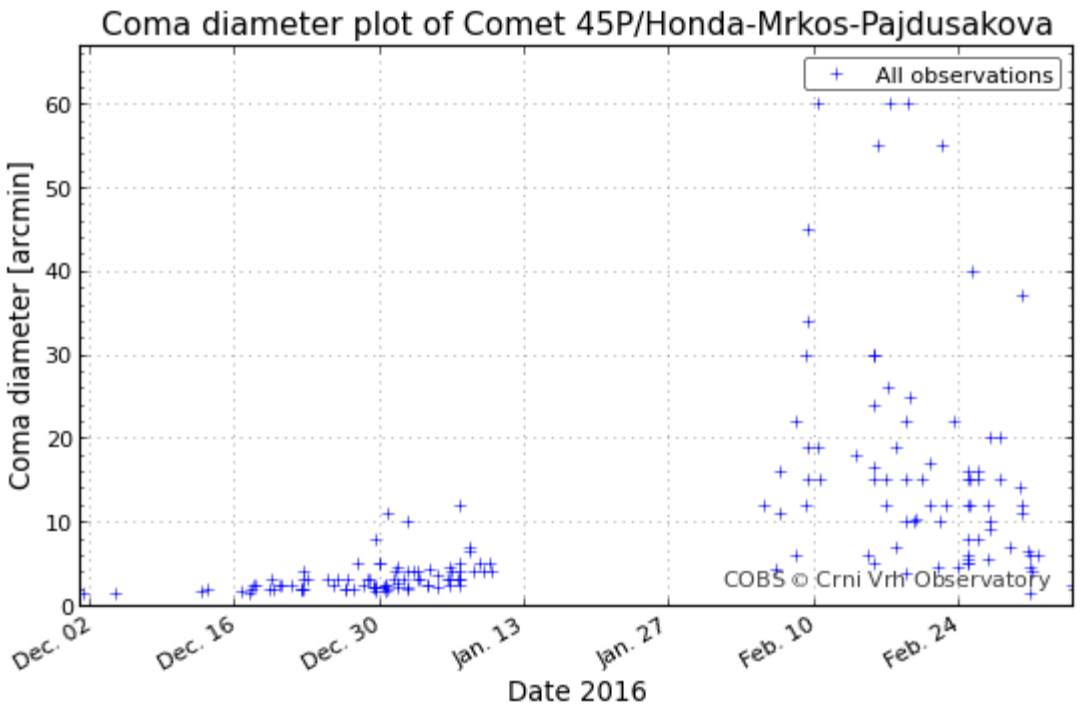
Many of the features to a comet can be plotted based on visual reports and photographic observations as indicated by the 'blue – colored' crosshairs in both of the charts above! Among the physical features that can be plotted as parameters that are distinct in the analysis of comets for predicting future 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!

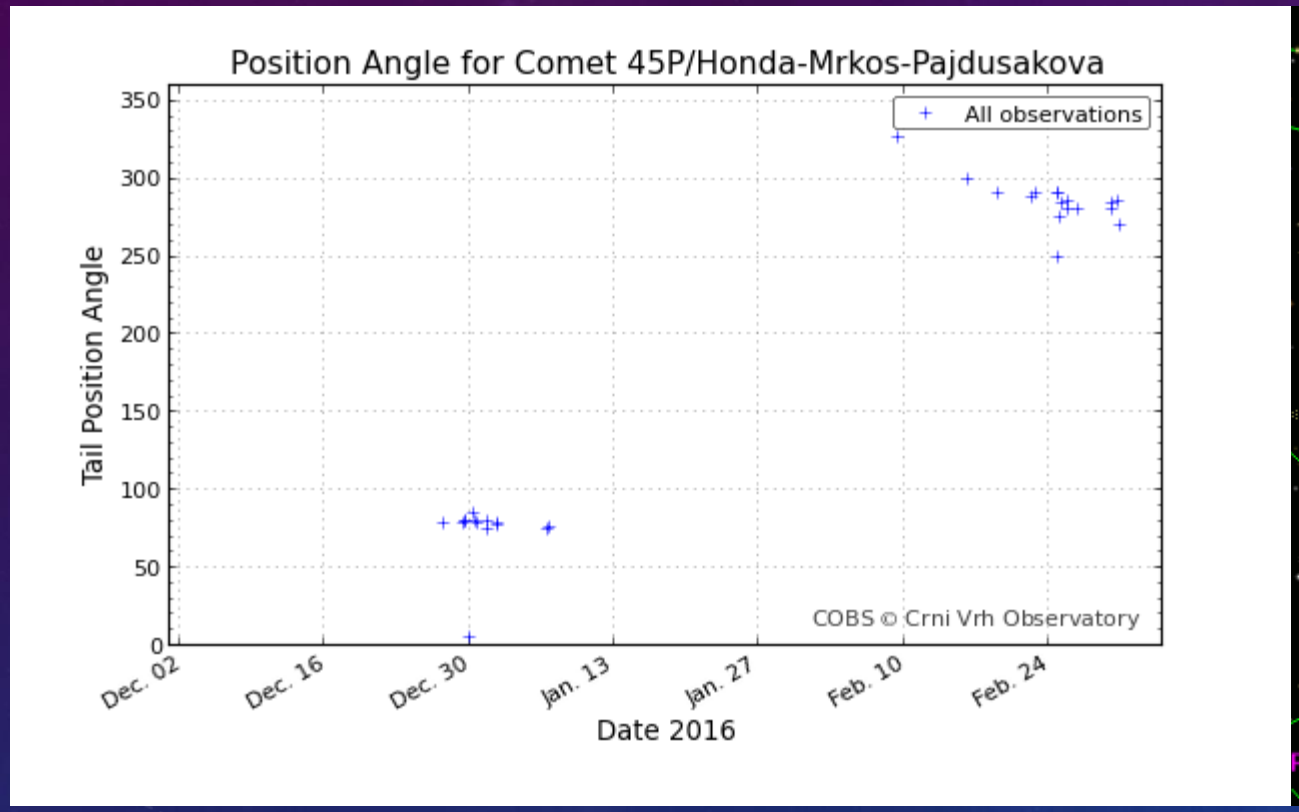


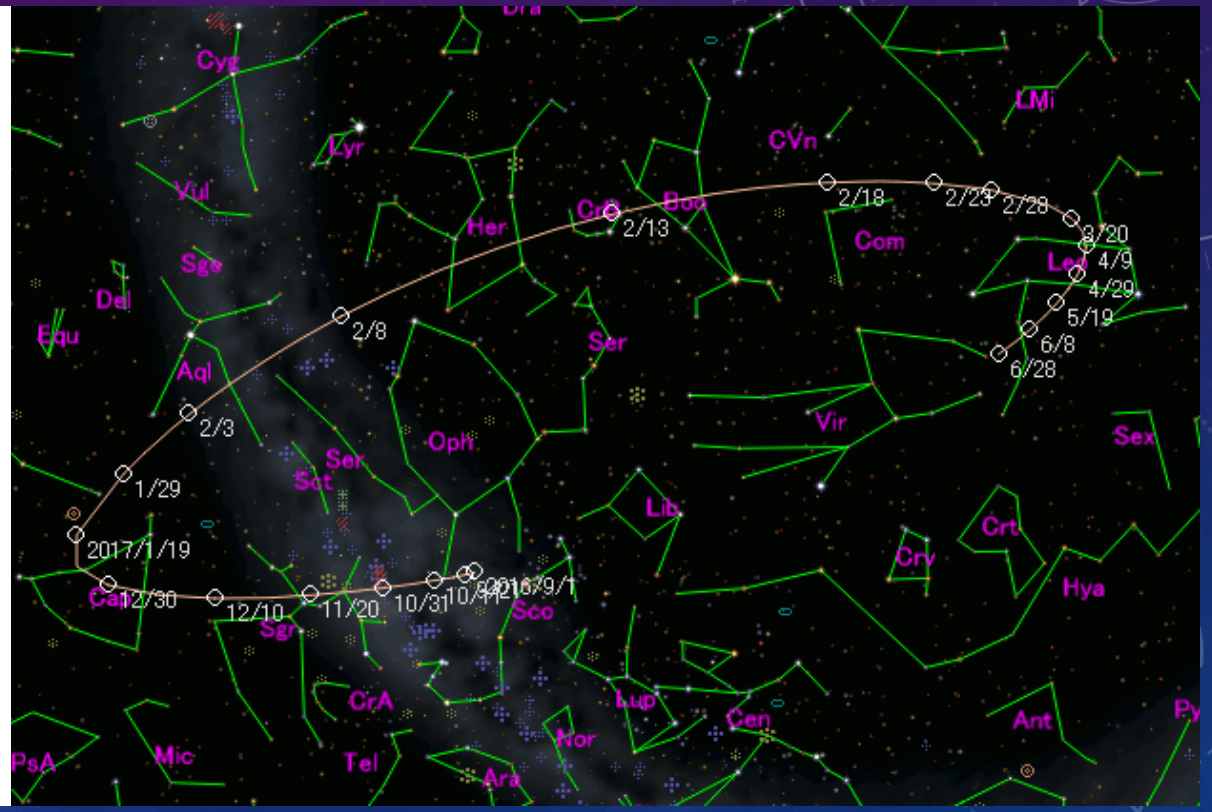


Be aware that the horizontal axis for these plots in spite of being designated as 'Date 2016' the dates above are plotted from 5 Dec 2016 through 20 Feb 2017! Based on the plots above Comet 45P before perihelion passage appeared to show a wide change in its coma structure with reports indicating DC values 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!



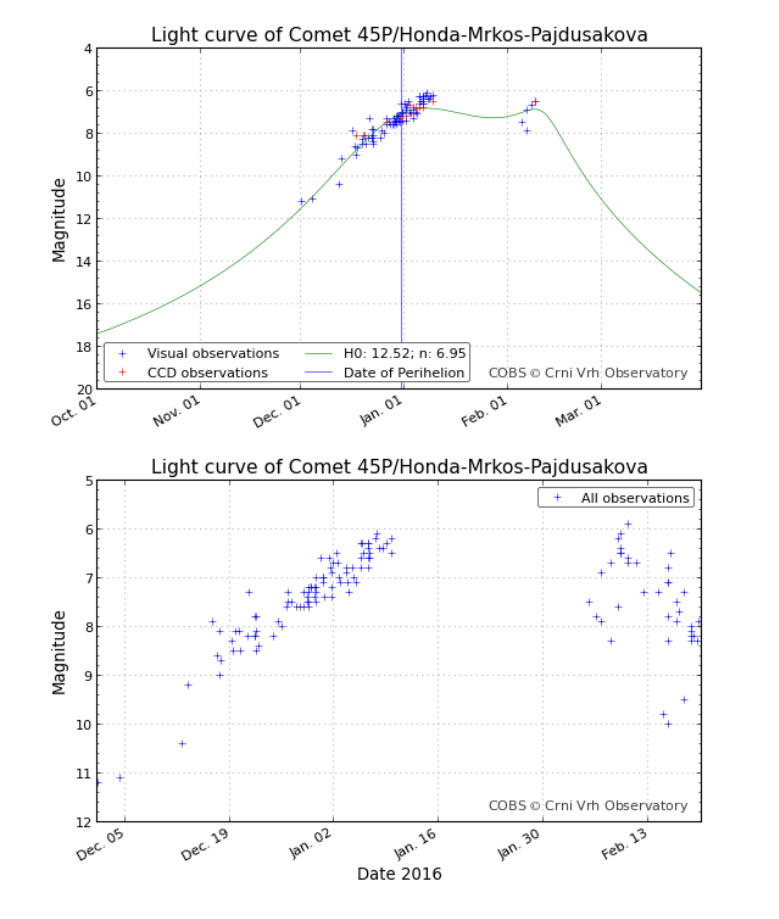


Comet 45P like any comet in which a tail is report can look towards the orientation of its tail with respect to the direction of the North Celestial Pole much the same way that the 'Position Angle' is applied to stellar binaries. Based on the few field reports plotted above the comet's P.A. (Position 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

m1 = 14.2 + 5 log d + 23.0 log r [,0] (- 2016 Dec. 31)
m1 = 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

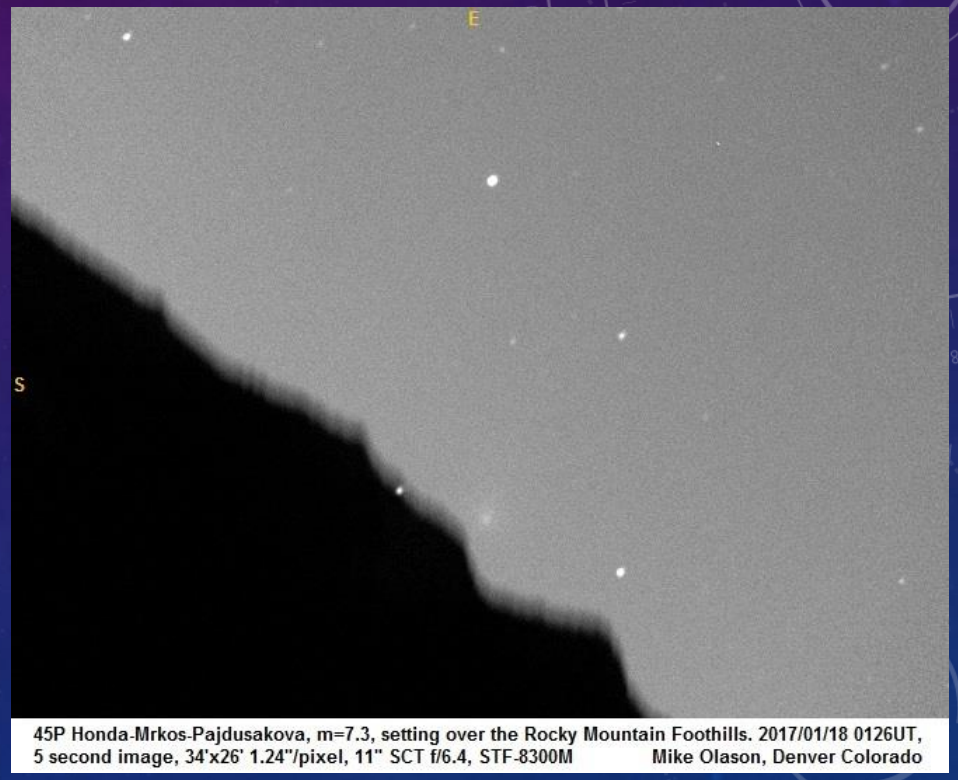
Date	Delta	r	M1
2/4/2017	0.126	0.879	6.661686
2/5/2017	0.116	0.893	6.585062
2/6/2017	0.107	0.907	6.511028
2/7/2017	0.099	0.921	6.44207
2/8/2017	0.093	0.936	6.411552
2/9/2017	0.088	0.950	6.388267
2/10/2017	0.084	0.965	6.389306
2/11/2017	0.083	0.979	6.457131
2/12/2017	0.084	0.993	6.575635
2/13/2017	0.087	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.

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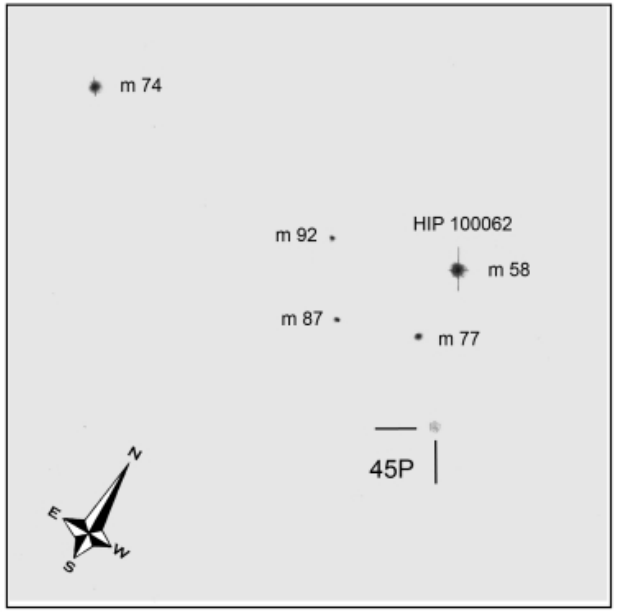
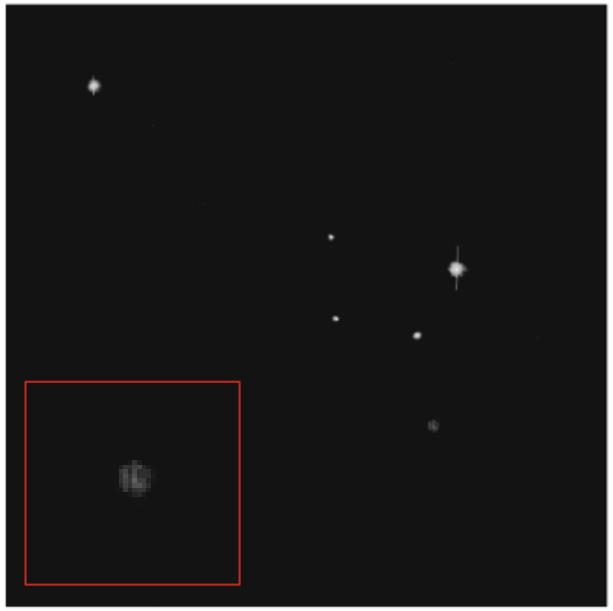
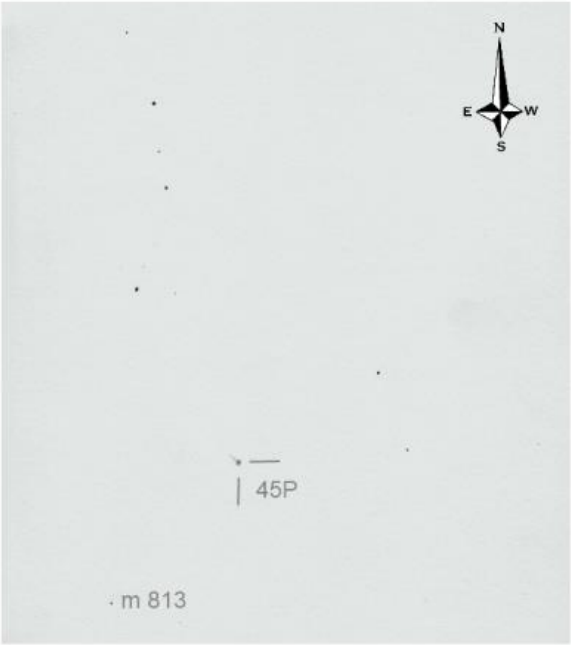
Comet: 45P/Honda – Mrkos – Pajdusakova



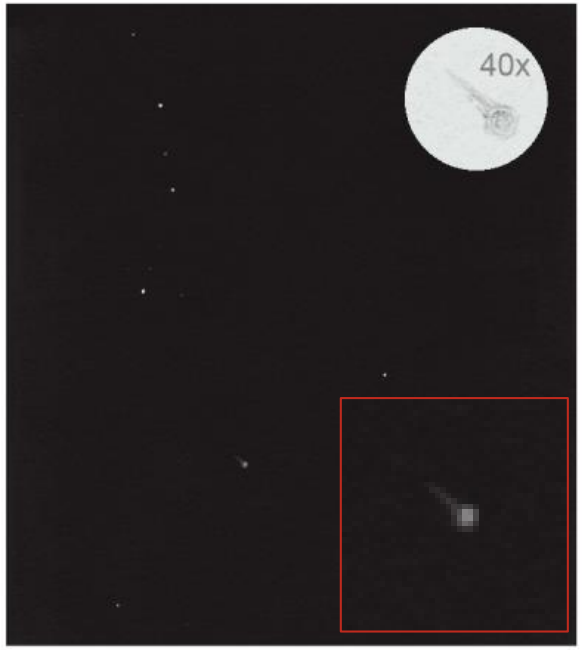
45P (Honda-Mrkos-Pajdusakova)
Bino Vixen 2x126mm 25x



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



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

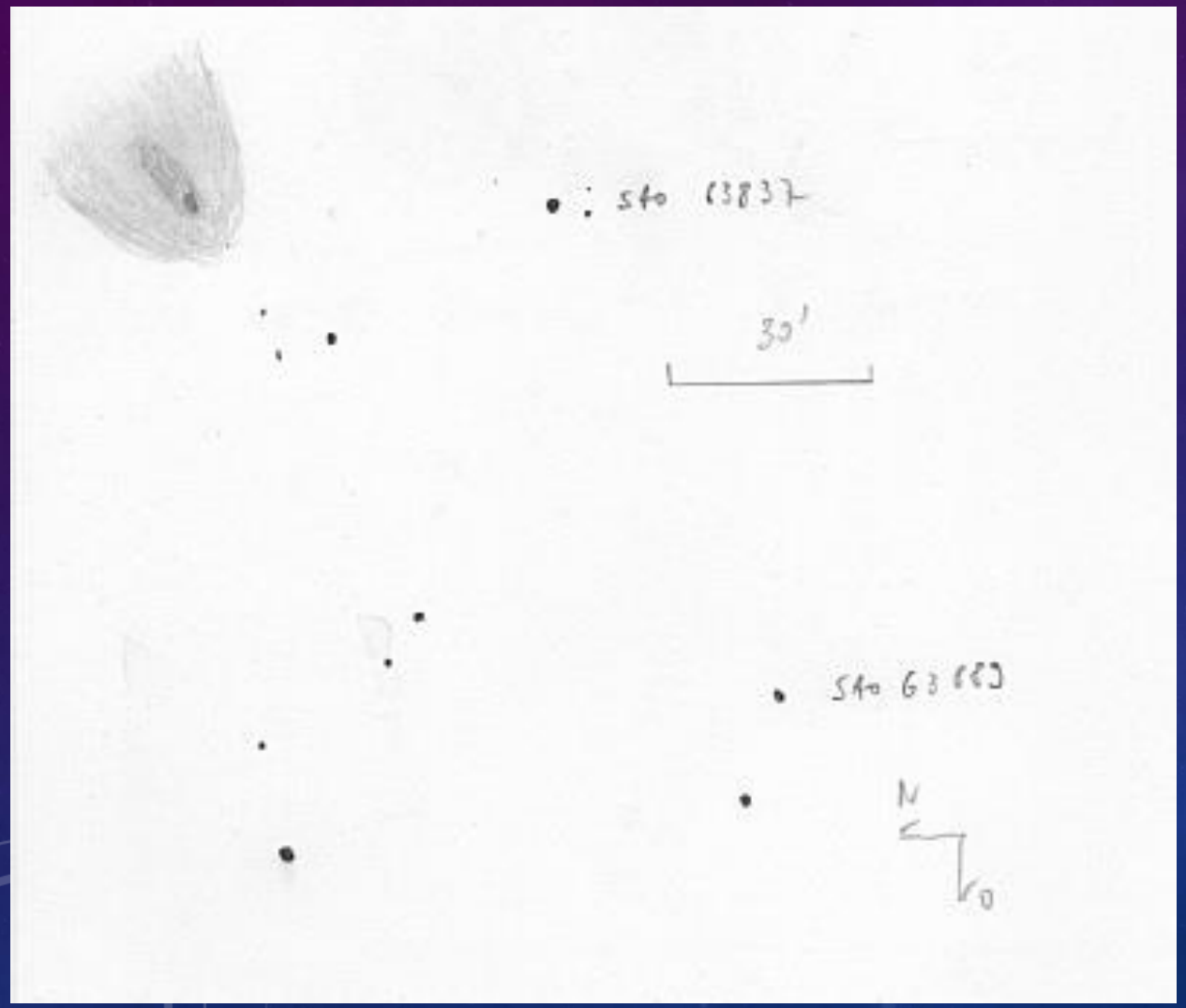


27/12/2016 17h50 UTC
FOS : 60' - Michel Deconinck

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%		*11 - 12 Feb 2017 - 0% (No Tail Visible)*
15 Jan 2017 – 43%		*1 Mar 2017 – 72%*
27 Jan 2017 – 79%	***(Maximum Effect)***	***4 – 7 Mar 2017 – 75%***
1 Feb 2017 – 65%		*1 Apr 2017 – 61%*
15 Apr 2017 – 57%		*(22 April to 23 May) 2017 – 55%*
1 June 2017 – 57%		

LETS GO PICK SOME COMETS!

41P/Tuttle – Giacobini – Kresak

24 February 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)

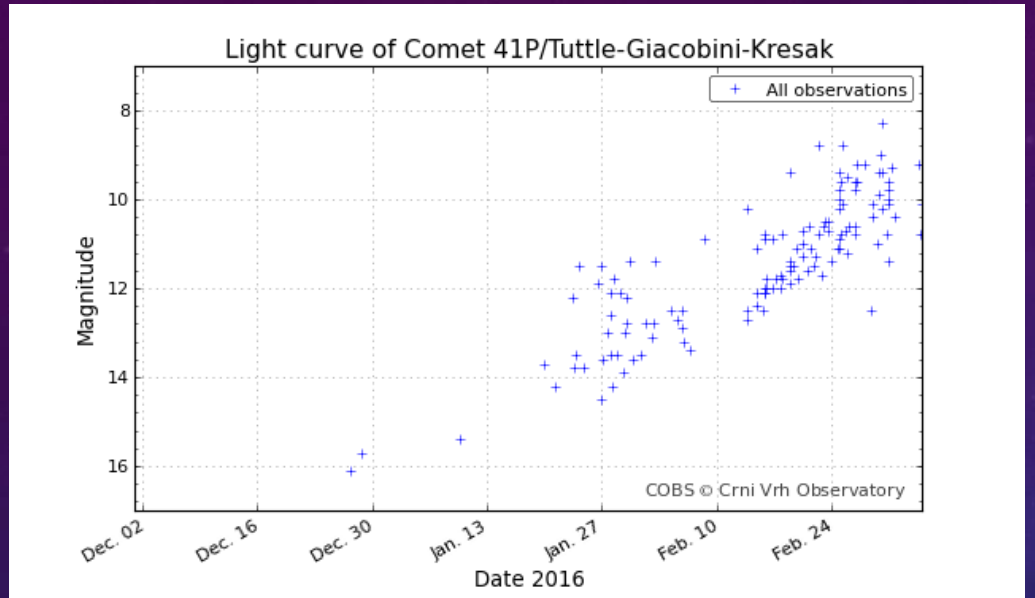
Instruments: 15 inch refractor (1858)
(Great Harvard Observatory, Cambridge, Massachusetts, USA)
30 inch refractor (1907)
(Nice Observatory, Mont Gros, Nice, France)
60 cm Zeiss Parabolic reflector w/ Maksutov Camera (1951)
(Skalnaté Pleso Observatory, Modern Day Solvakia, EU)

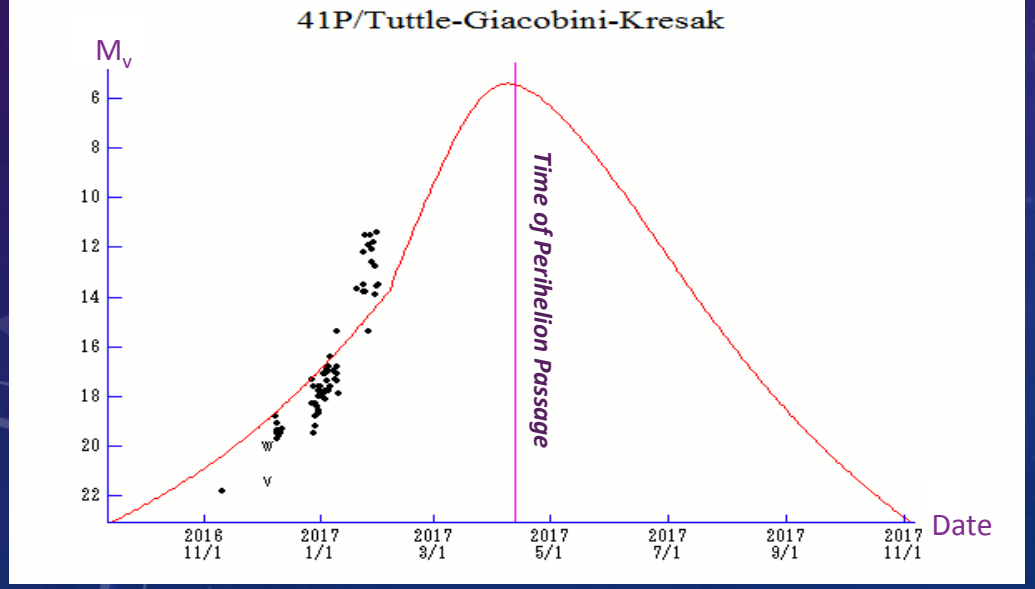
Epoch (Time – based reference point): 6 March 2006
Aphelion: 5.122 AU
Perihelion: 1.048 AU
Semi – Major Axis: 3.085 AU
Eccentricity: 0.6604 (Very Elliptical Orbit)
Orbital Inclination: 9.2294^0 or (9^0 13' 45.84")
Minimum Orbital Intersection Distance (MOID)

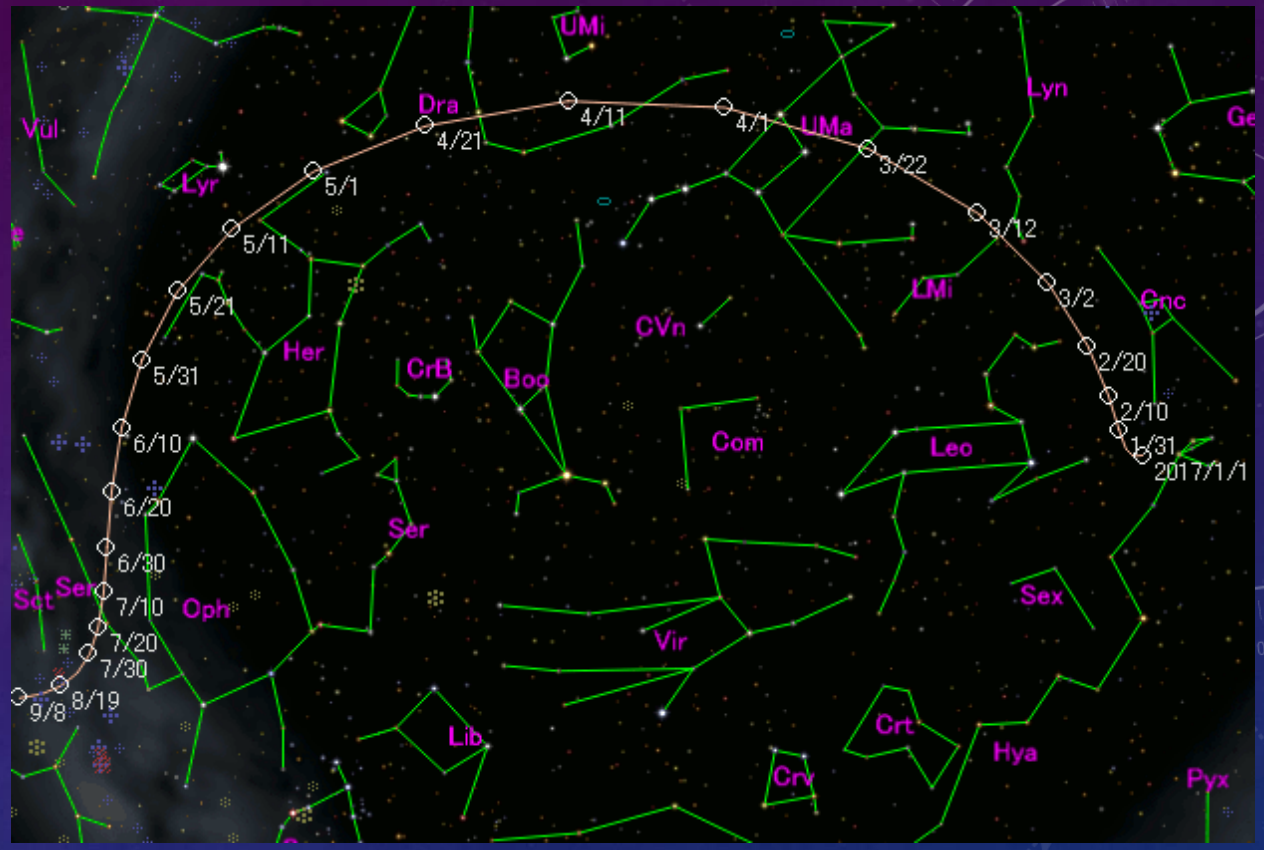
- *Perigee – 0.13 AU*
- *Perijove (closest distance to Jupiter) – 0.48 AU*

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 -)

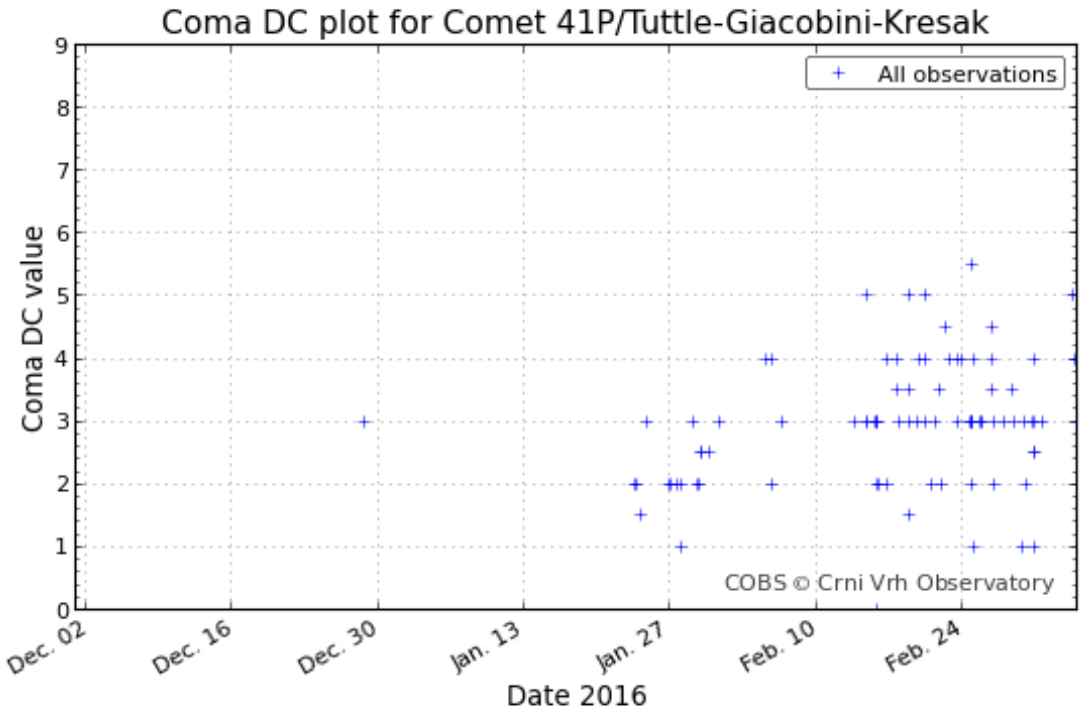
Time of Perigee Passage: 0.142 AU on (30 March – 3 April) 2017
(21,242,897.6 km or 13,199,684.8 mi)

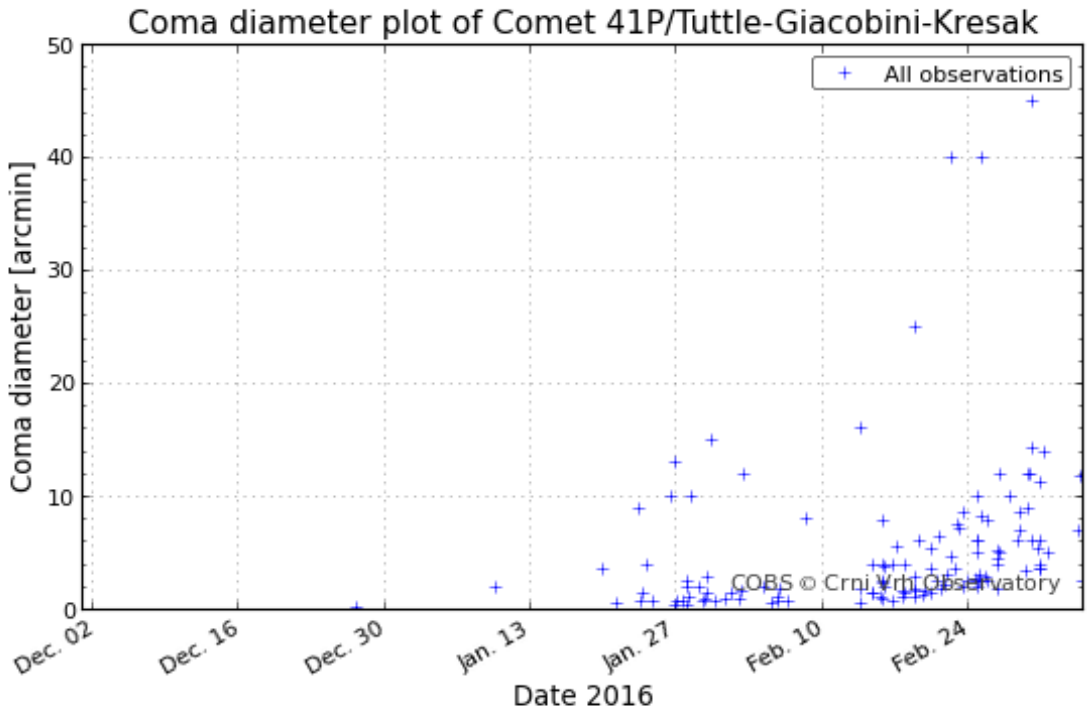
Time of Perihelion Passage: 1.045 AU on (11 – 14) April 2017
(156,329,774.9 km or 97,138,525.6 mi)

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!



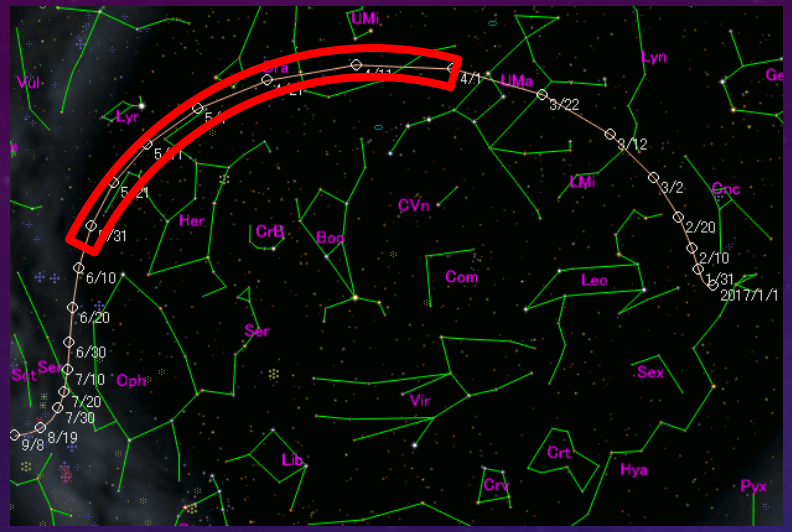


Note that the most important component to any comet is it's coma. It is the most distinguishing physical property for any comet being the first and last parameter to be observed, photographed, studied, and analyzed! The two important characteristics of any coma is the DC and Coma diameter (although it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

DC for Comet 41P has been reported from wide range of values (1 – 5.5) with the most of visual reports giving the coma a DC of 3 which indicates a bright outer coma with a faint, but distinct inner coma. The coma diameter field reports are in two distinct categories with larger diameter range of 10 – 45 arcminutes and a smaller diameter range of 0.25 – 15 arcminutes). The majority of field reports in the statistical distribution of the data places the coma diameter in the smaller range of size.

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

LETS GO PICK A COMET!

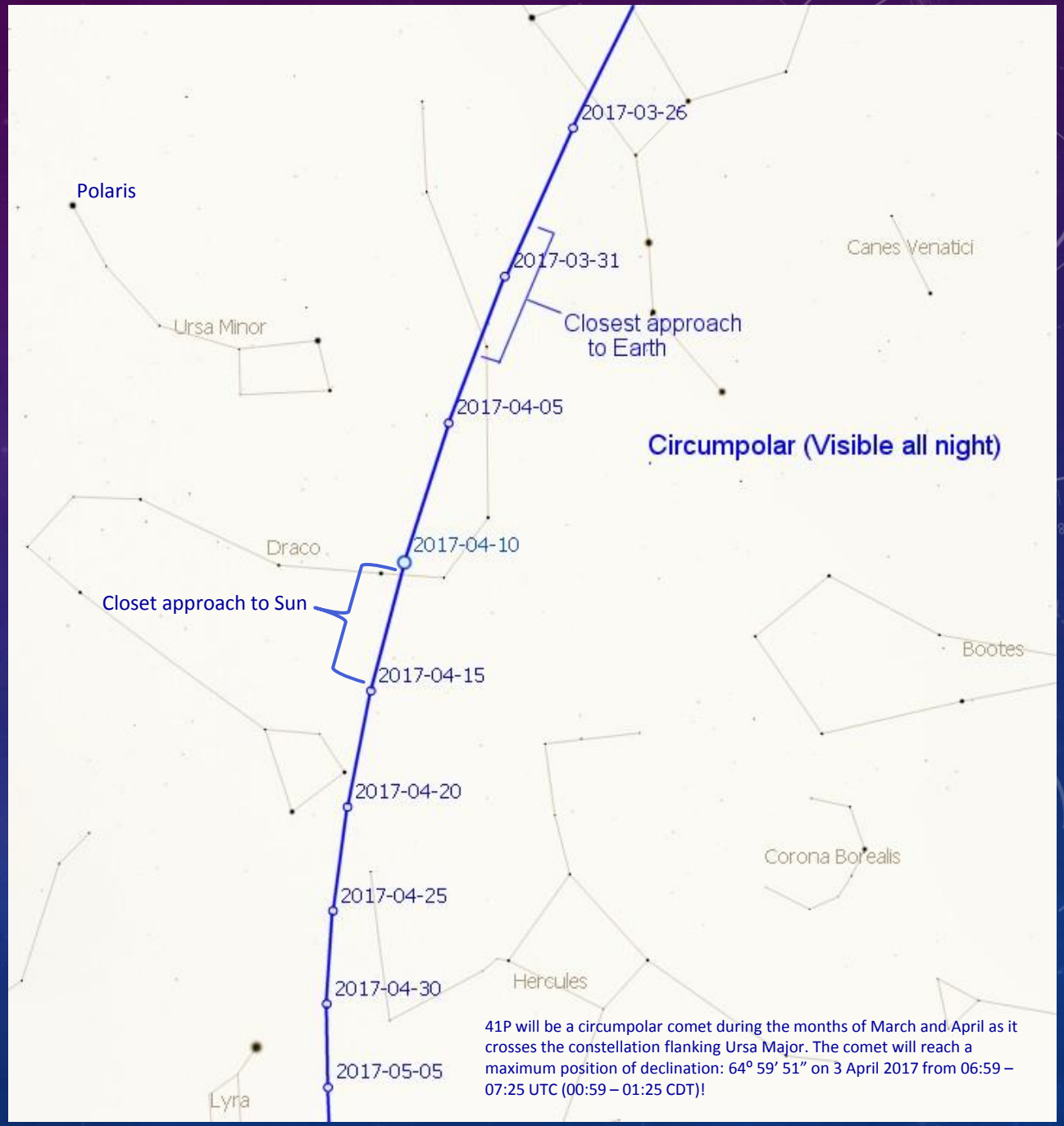


Brightness Projections

$m_1 = 13.5 + 5 \log d + 18.0 \log r$ [,-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 -)

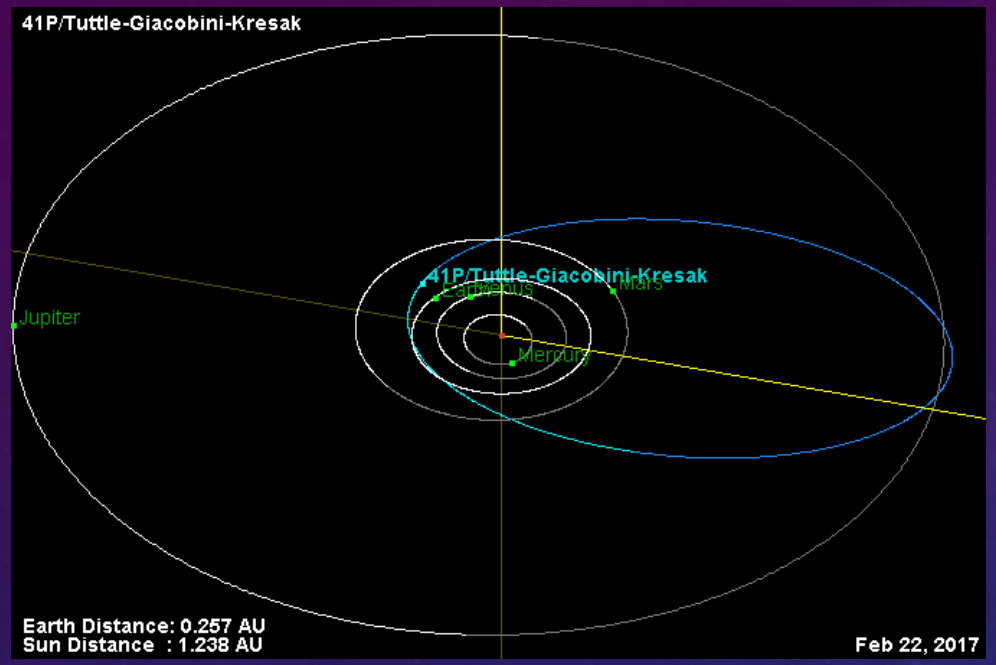
Progression Rate Across the Sky!

	P.A.	"/min		P.A.	"/min
March 30	068.6 – 075.6	4.79 – 5.26	April 7	104.6 – 111.7	4.51 – 4.93
March 31	072.9 – 080.1	4.79 – 5.25	April 8	108.6 – 115.6	4.45 – 4.86
April 1	077.5 – 084.7	4.77 – 5.23	April 9	112.3 – 119.2	4.37 – 4.77
April 2	082.1 – 089.4	4.75 – 5.20	April 10	115.7 – 122.6	4.29 – 4.69
April 3	086.8 – 094.1	4.72 – 5.17	April 11	118.9 – 125.7	4.21 – 4.59
April 4	091.4 – 098.8	4.68 – 5.12	April 12	121.9 – 128.6	4.12 – 4.50
April 5	096.0 – 103.3	4.63 – 5.07	April 13	124.6 – 131.3	4.03 – 4.40
April 6	100.4 – 107.6	4.58 – 5.00	April 14	127.1 – 133.8	3.94 – 4.30



41P will be a circumpolar comet during the months of March and April as it crosses the constellation flanking Ursa Major. The comet will reach a maximum position of declination: 64° 59′ 51″ on 3 April 2017 from 06:59 – 07:25 UTC (00:59 – 01:25 CDT)!

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-16.0] K173/1 (default)

Orbital Elements at Epoch 2457800.5 (2017-Feb-16.0) TDB
Reference: JPL K173/1 (heliocentric ecliptic J2000)

Element	Value	Uncertainty (1-sigma)	Units
e	.6611147062340617	1.9234e-06	
a	3.083813412556593	2.6171e-05	au
q	1.045059014233582	2.9971e-06	au
i	9.229278166983901	2.0822e-05	deg
node	141.0751349947704	0.00013453	deg
peri	62.14626981062538	0.00037619	deg
M	349.8535614649919	0.00015134	deg
t_p	2457856.249592138521 (2017-Apr-12.74959214)	0.00031052	JED
period	1978.019489362778	0.025179	d
	5.42	6.894e-05	yr
n	.1820002289845862	2.3168e-06	deg/d
Q	5.122567810879605	4.3472e-05	au

Orbit Determination Parameters

# obs. used (total)	571
data-arc span	3994 days (10.93 yr)
first obs. used	2006-02-03
last obs. used	2017-01-10
planetary ephem.	DE431
condition code	4
fit RMS	.81589
data source	ORB
producer	Davide Farnocchia
solution date	2017-Jan-19 13:48:03

Additional Information

Earth MOID = .133596 au
Jupiter MOID = .488653 au
T_jup = 2.828

Additional Model Parameters

Parameter	Value	Uncertainty (1-sigma)
A1 [EST]	5.538164118152056E-9	6.069E-10
A2 [EST]	-5.111285158060904E-10	3.225E-10

[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	13.5	mag	1.	K173/1	2 parameter fit from 137 observations, autocmod 2.6h
comet total magnitude slope	K1	22.		n/a	K173/1	autocmod 2.6h
comet nuclear magnitude	M2	17.3	mag	0.9	K173/1	from 355 observations, autocmod 2.6h
comet nuclear magnitude slope	K2	5.		n/a	K173/1	autocmod 2.6h
comet nuclear phase coefficient	PC	0.03		n/a	K173/1	autocmod 2.6h
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!!!

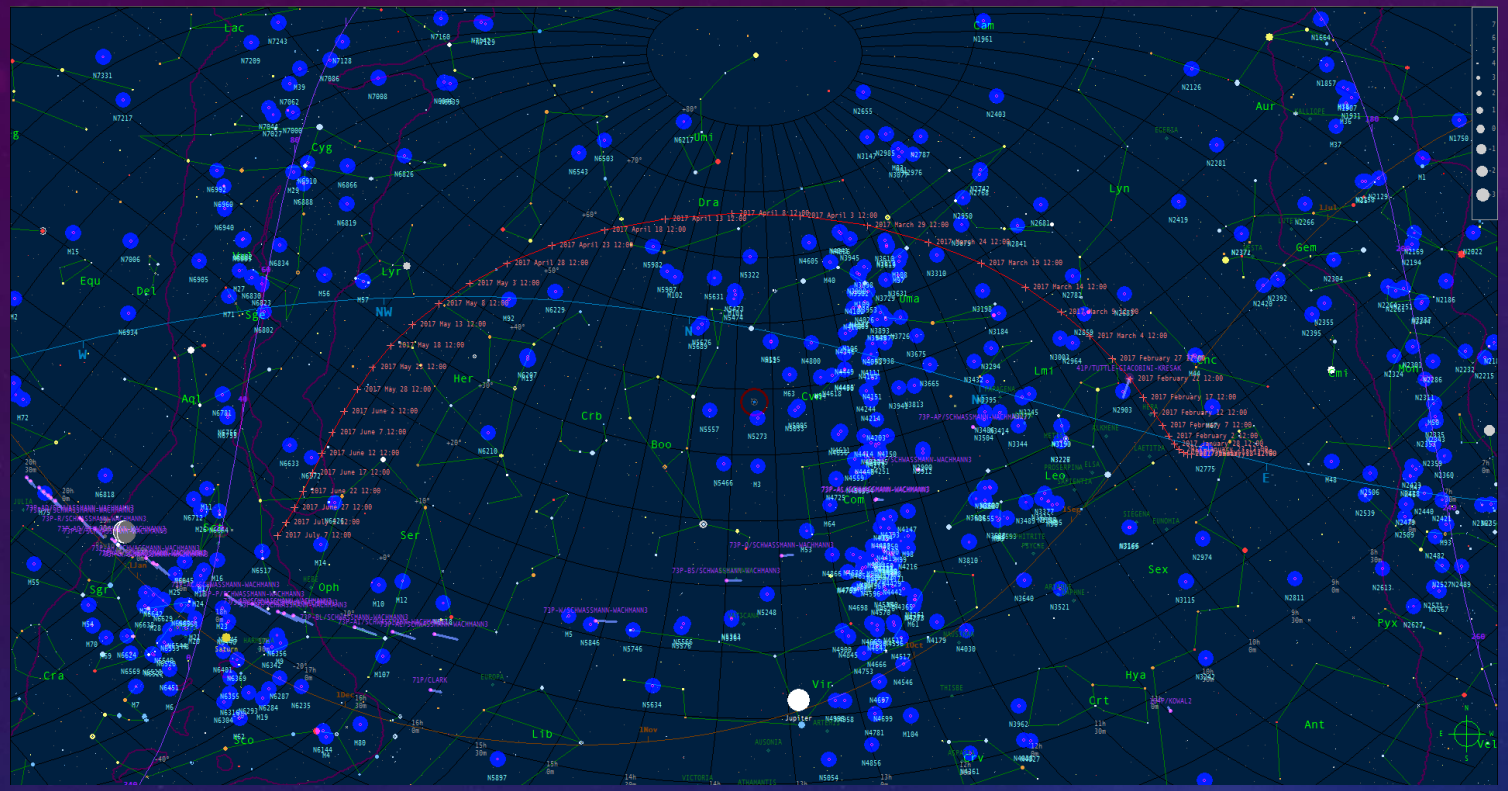
e: eccentricity – elliptical shape of an orbit!
1. e = 0 it is circular
2. 0.01 to 0.99 from slightly oval to extremely oval
3. e = 1 it is a parabolic path
4. e > 1 it is a hyperbolic path

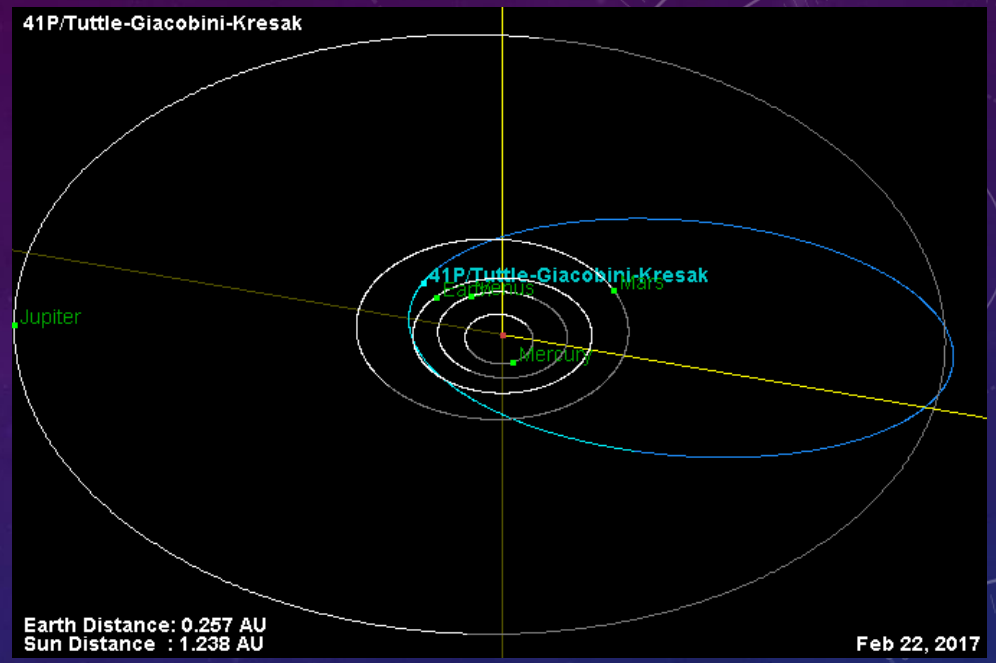
a: semi – major axis (measured in AUs)
Not to be confused with perihelion, aphelion, apogee, or perigee!
q: perihelion distance (measured in AUs)
(The tilt to the plane of the ecliptic – plane of the Earth's orbit measured in degrees!)

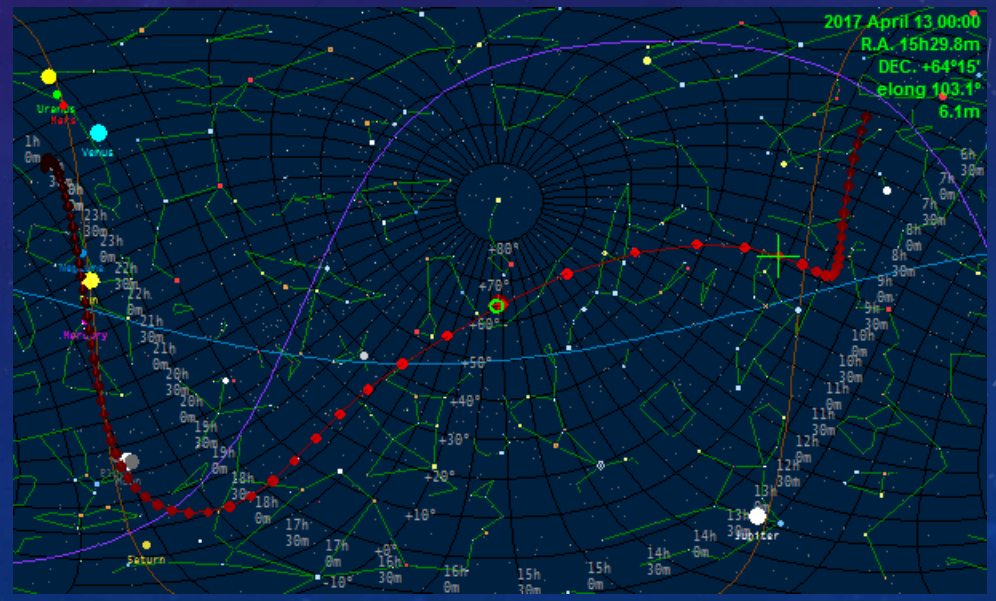
i: orbital inclination
M: mean anomaly
t_p: time of perihelion passage
peri: the argument of perihelion
node: longitude of the ascending node
period: orbital period (measured in years)
n: mean motion (measured in degrees/day)
Q: aphelion distance (measured in AUs)

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° 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!

41P/Tuttle-Giacobini-Kresak

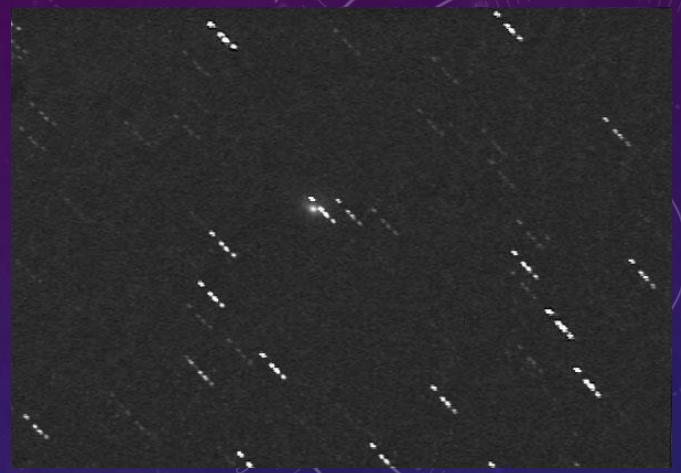
Perturbed ephemeris below is based on elements from *MPEC* 2017-A77.

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 SOME COMETS!

C/2015 V2 (Johnson)

24 February 2017

Roland Fichtl

Discoverer: A. Jess Johnson

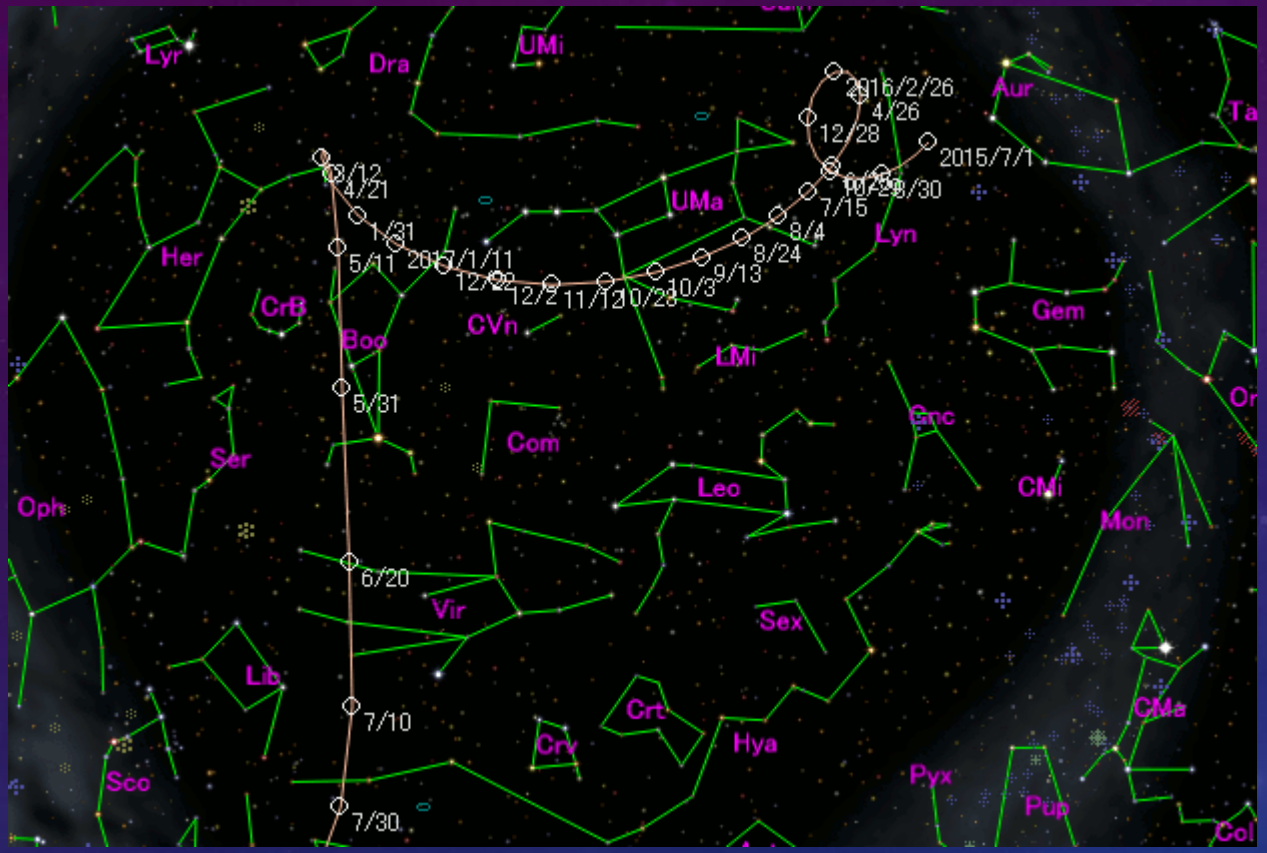
Discovery Date (Original) : 3 November 2015

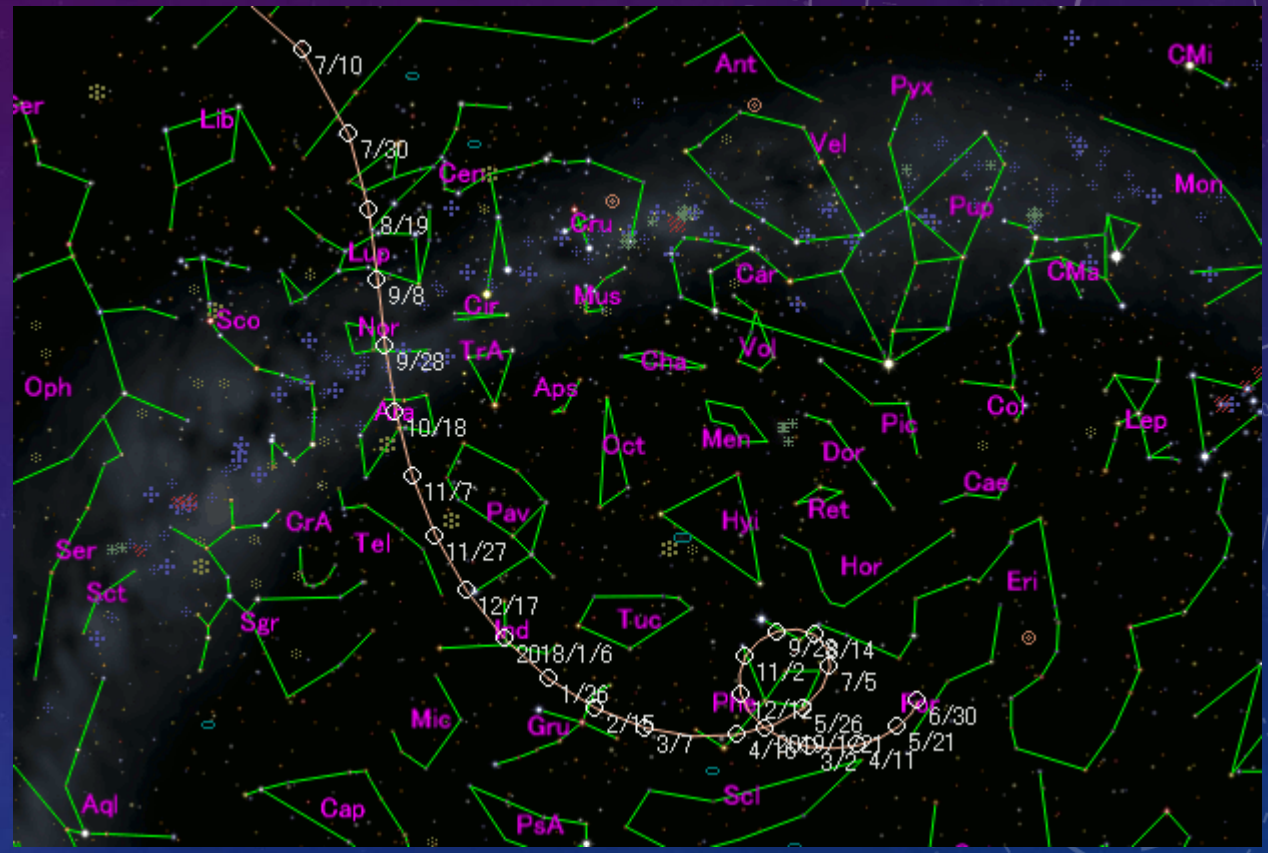
Instruments: 0.68 m (27 in) Schmidt – Cassegrain Reflector
(Catalina Sky Survey, Mt. Lemmon IR Observatory, Stewart Observatory, Univ. of Az., NASA, Arizona, USA)

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!

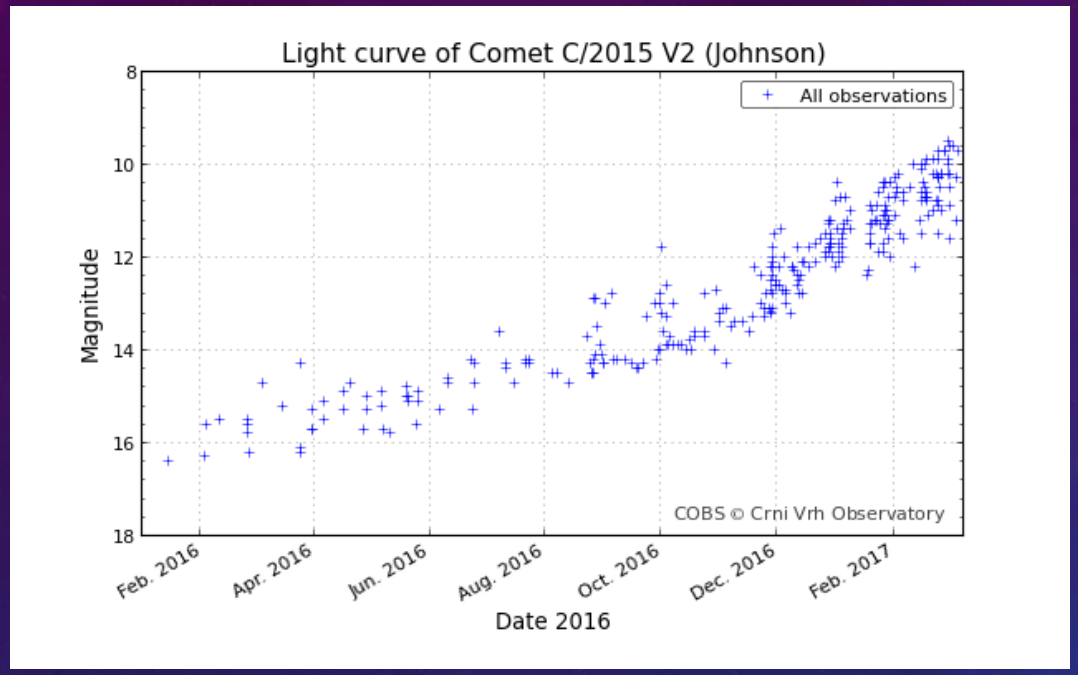




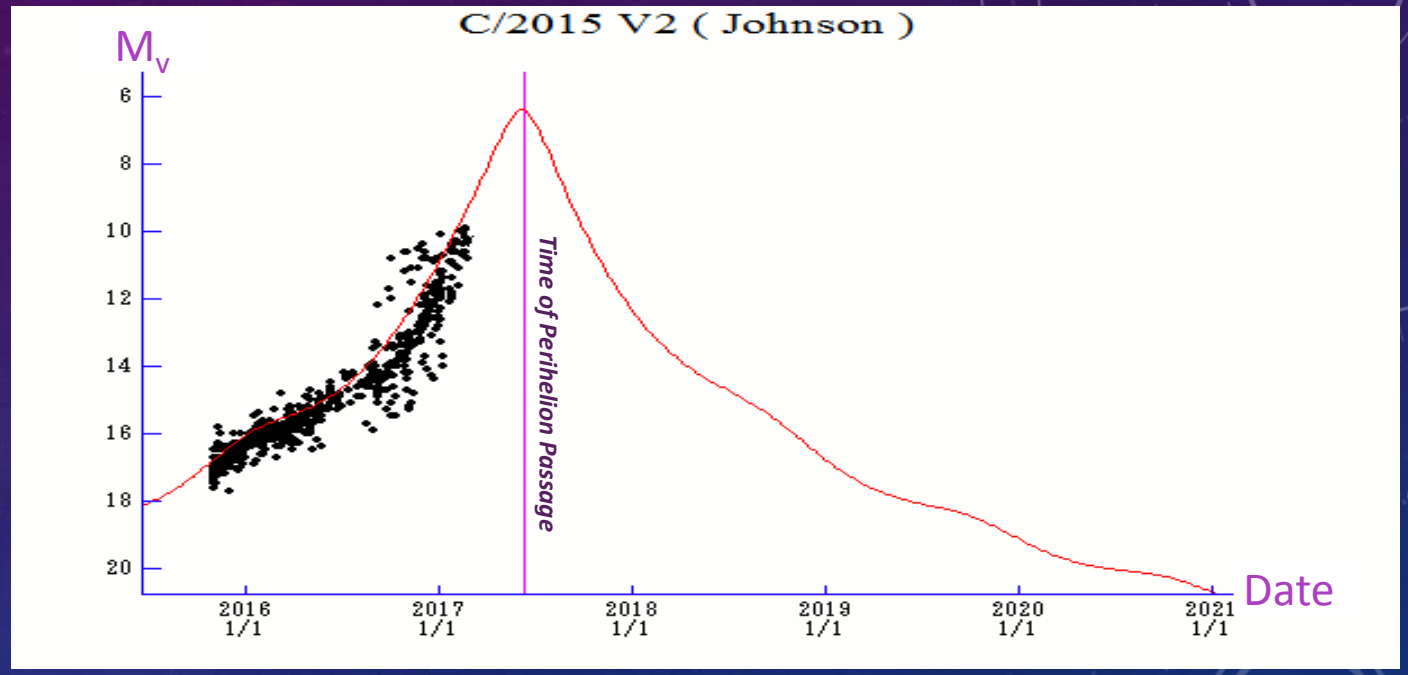
Courtesy: Seiichi Yoshida's Home Page – C/2015 V2 (Johnson) webpage, http://www.aerith.net/comet/catalog/2015V2/2015V2.html, Updated: 27 February 2017.

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° 04' 2.1" S (J2000 Epoch) on 19 November 2017 during the period of (14:50 – 16:44) UTC.

LETS GO PICK SOME COMETS!



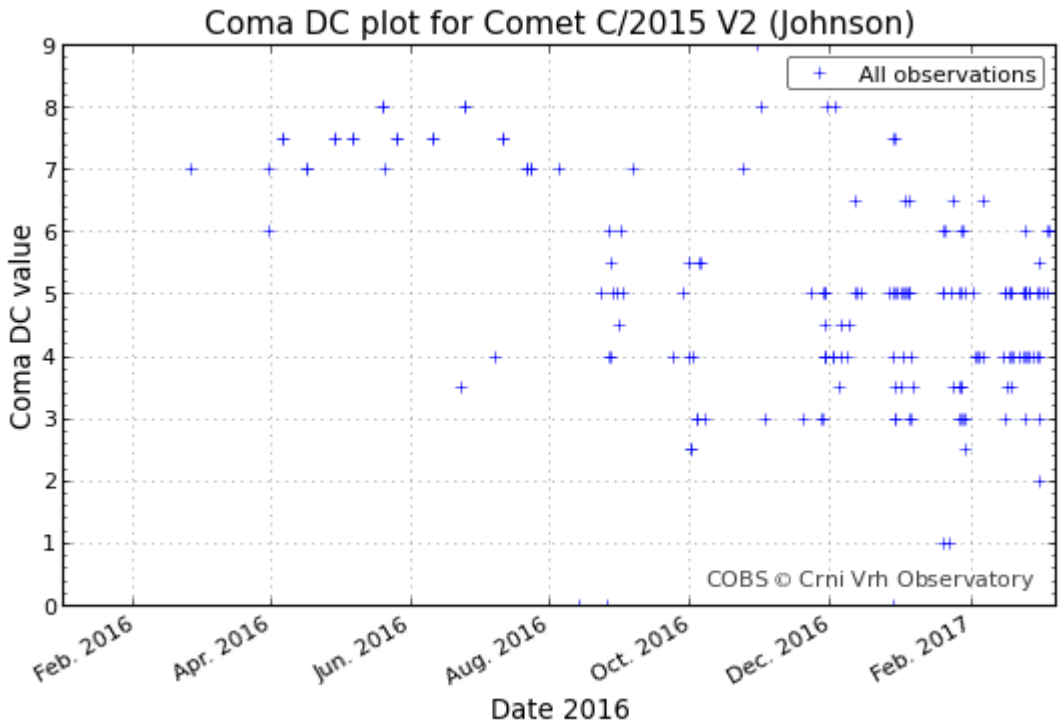
Courtesy: COBS (Comet Observations Database), http://www.cobs.si/analysis, Cache: 8 March, 2017, 2010.

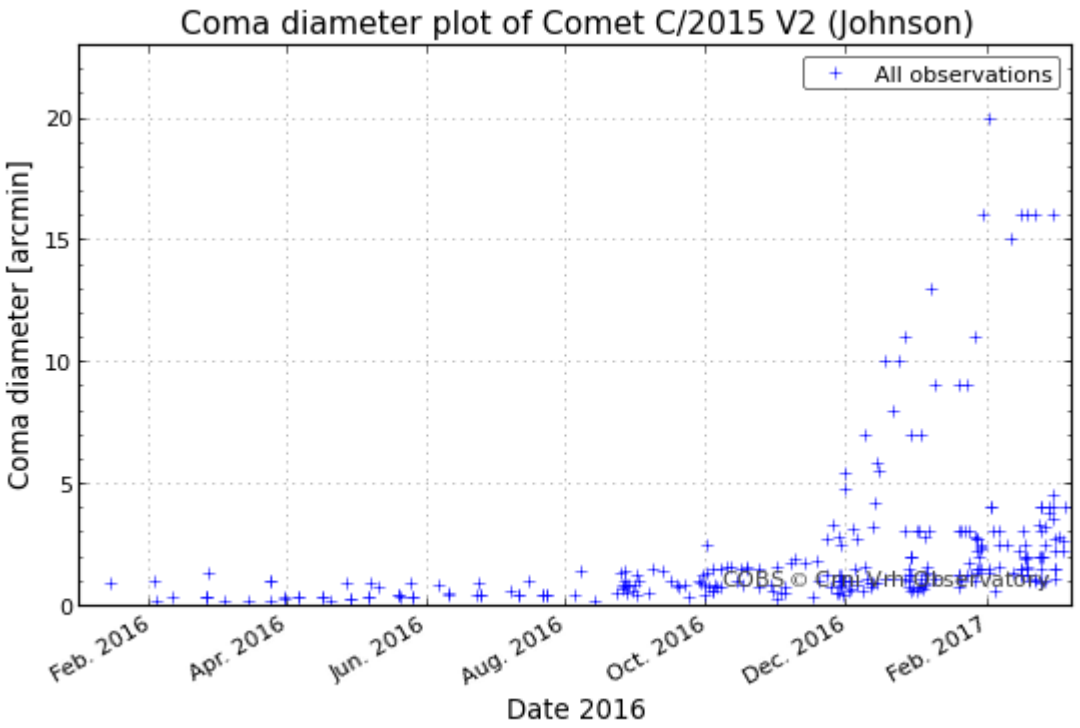


Courtesy: Seiichi Yoshida's Home Page – C/2015 V2 (Johnson) webpage, http://www.aerith.net/comet/catalog/2015V2/2015V2.html, Updated: 27 February 2017.

Progression of the visual and measured brightness of C/2015 V2 showing a gradual brightening of the comet from 16.4 (15 Jan 2016) to a peak brightness between visual magnitudes of 5 – 6 by the time of perihelion passage on 12 June 2017! Currently the last reported visual magnitude based on the left graph is 9.5 on 2 March with average varying around 10.6 – 10.7! 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!

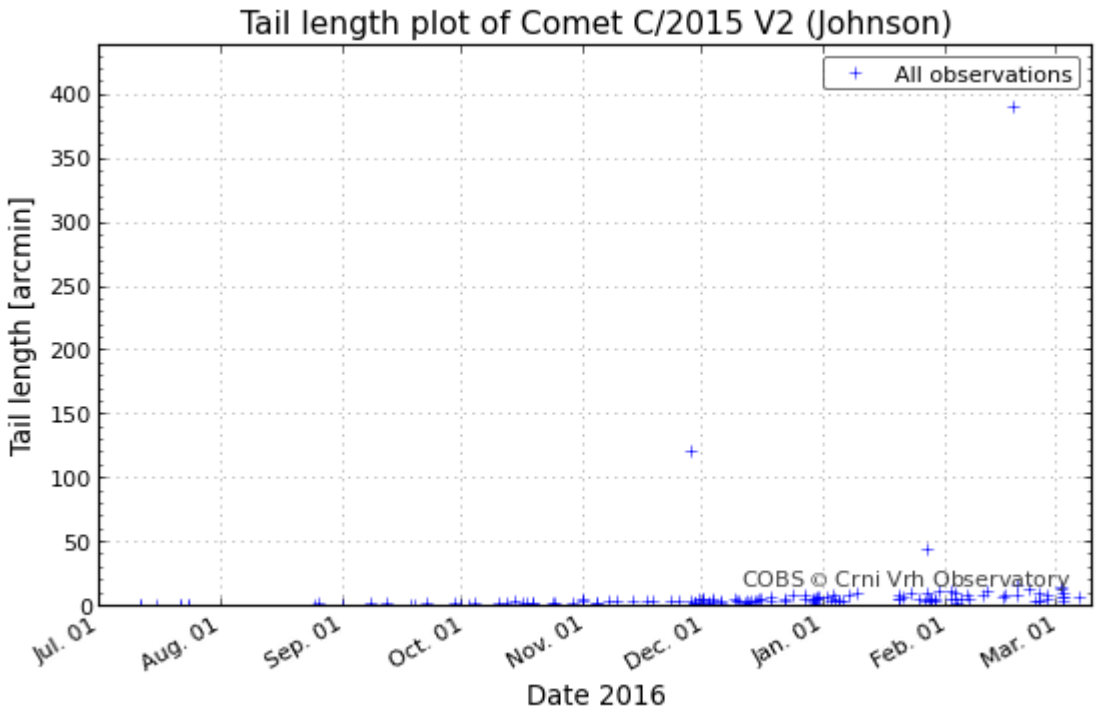
LETS GO PICK SOME COMETS!

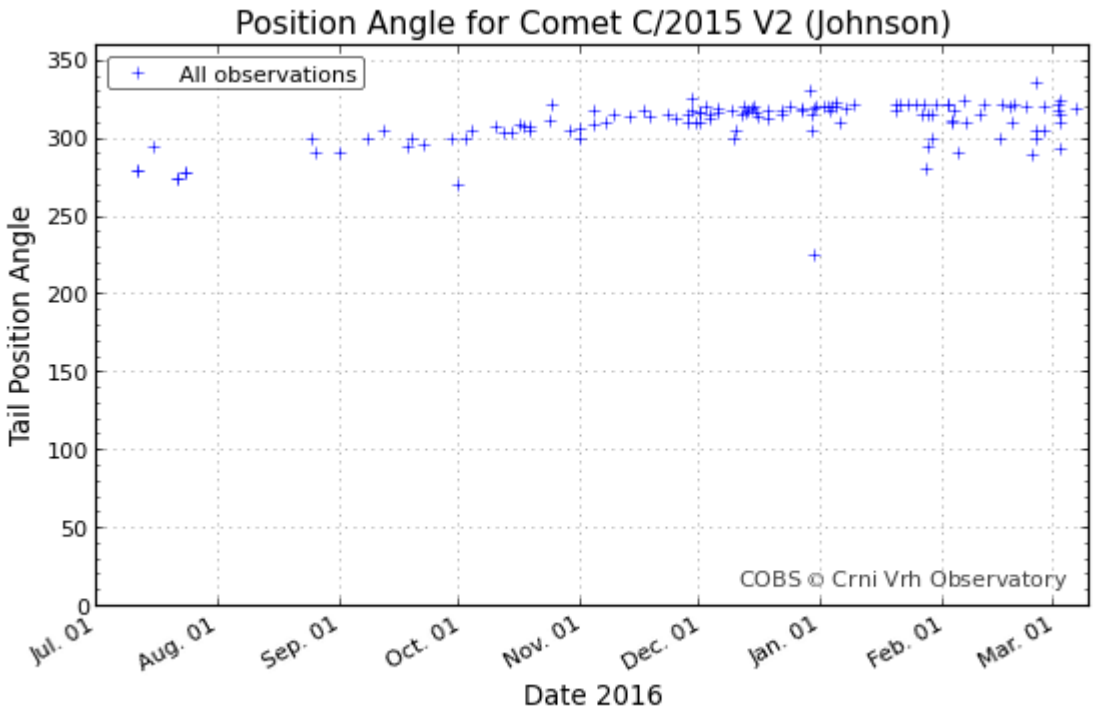




The DC for Comet Johnson for the period of (late February to Early August) 2016 was in a tight range of 7 – 8. All later observation reports show a greater range of DC values from 1 to 8 from Oct 2016 thru January 2017 and becoming a tighter from 2 – 6 since the end of January 2017. This indicates that the comet is attempting to produce a bright, distinguishing outer coma with a sharper defined inner coma prior to perihelion. Notice on the right plot for Coma diameter as the size range for all of 2016 was very tight; <0.1 to 2 arcminutes. Since the star of December 2016 two noticeable pathways in the change of the coma size from all recorded field reports. A rapid increase in size from 2 to 20 arcminutes stabilizing at 16 and a more gradual and semi-stable condition of 1 – 4.5 arcminutes in the early quarter of this year!

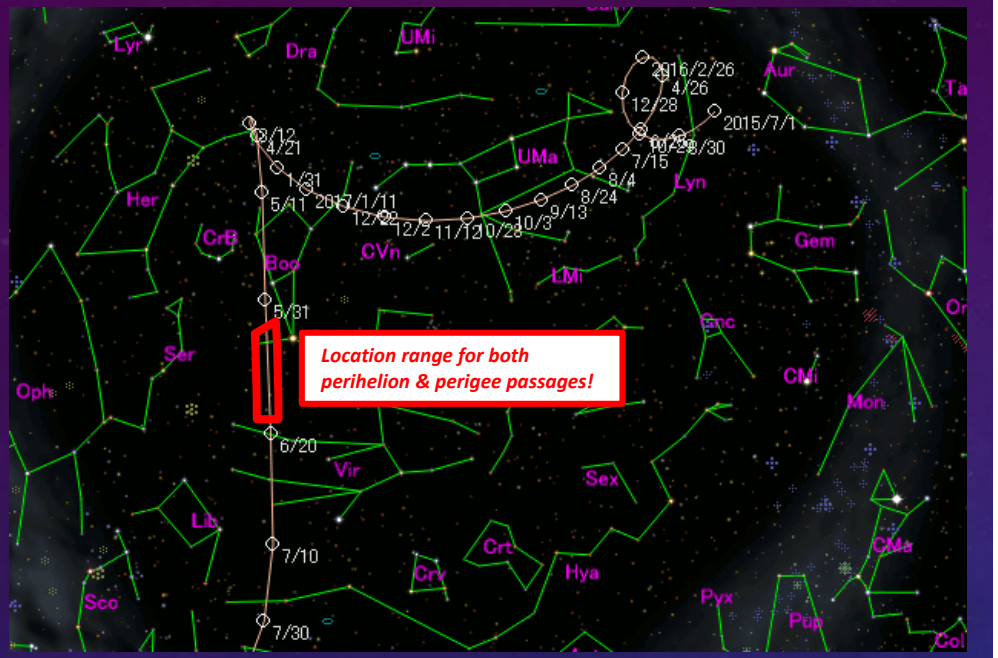
LETS GO PICK SOME COMETS!





The tail length for Comet Johnson based on all previous field reports (visual and CCD imaging) shows a very narrow tail <10 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.

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

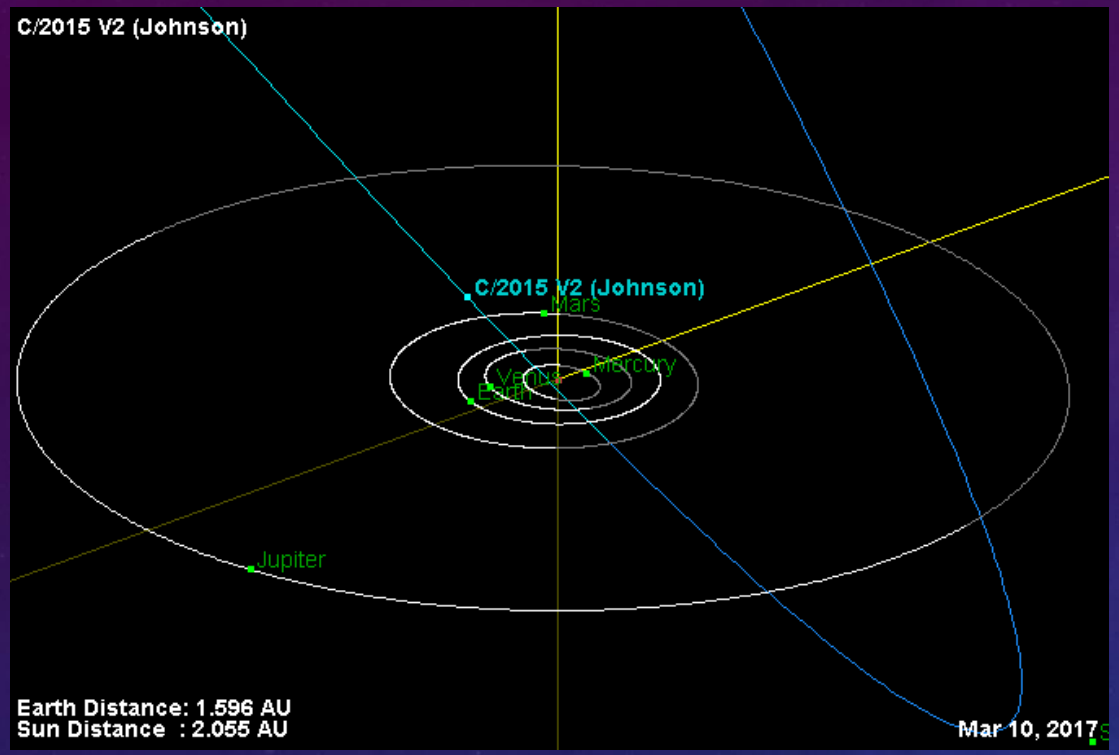
[Ephemeris | Orbit Diagram | Orbital Elements | Physical Parameters]

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

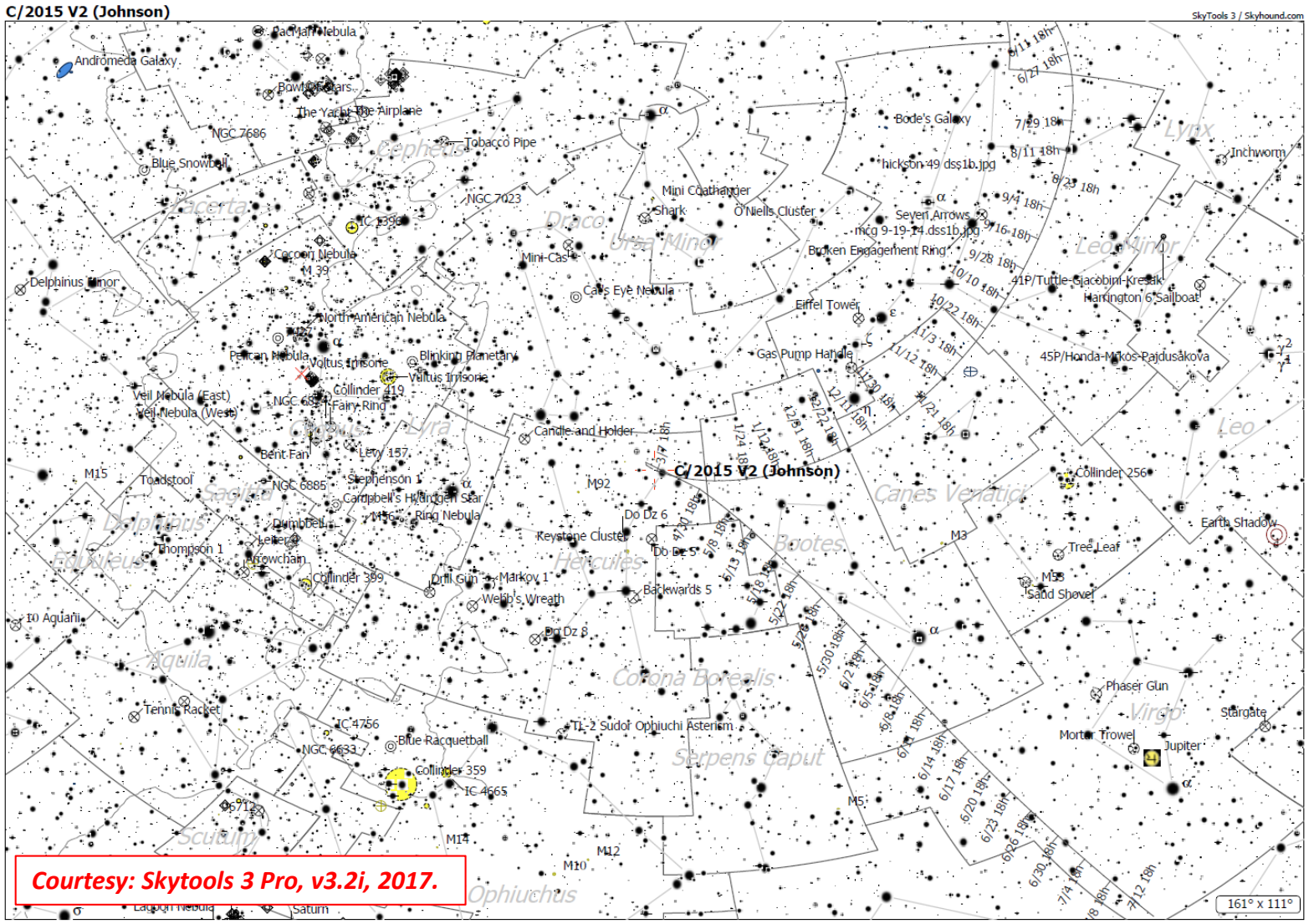
Perturbed ephemeris below is based on elements from *MPC* 102953.

CK15V020

Date	UT h m s	R.A. (J2000)	Decl.	Delta	r	El.	Ph.	m1	Sky Motion "/min	P.A.	Object Azi.	Object Alt.	Sun Alt.	Moon Phase	Moon Dist.	Moon 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!

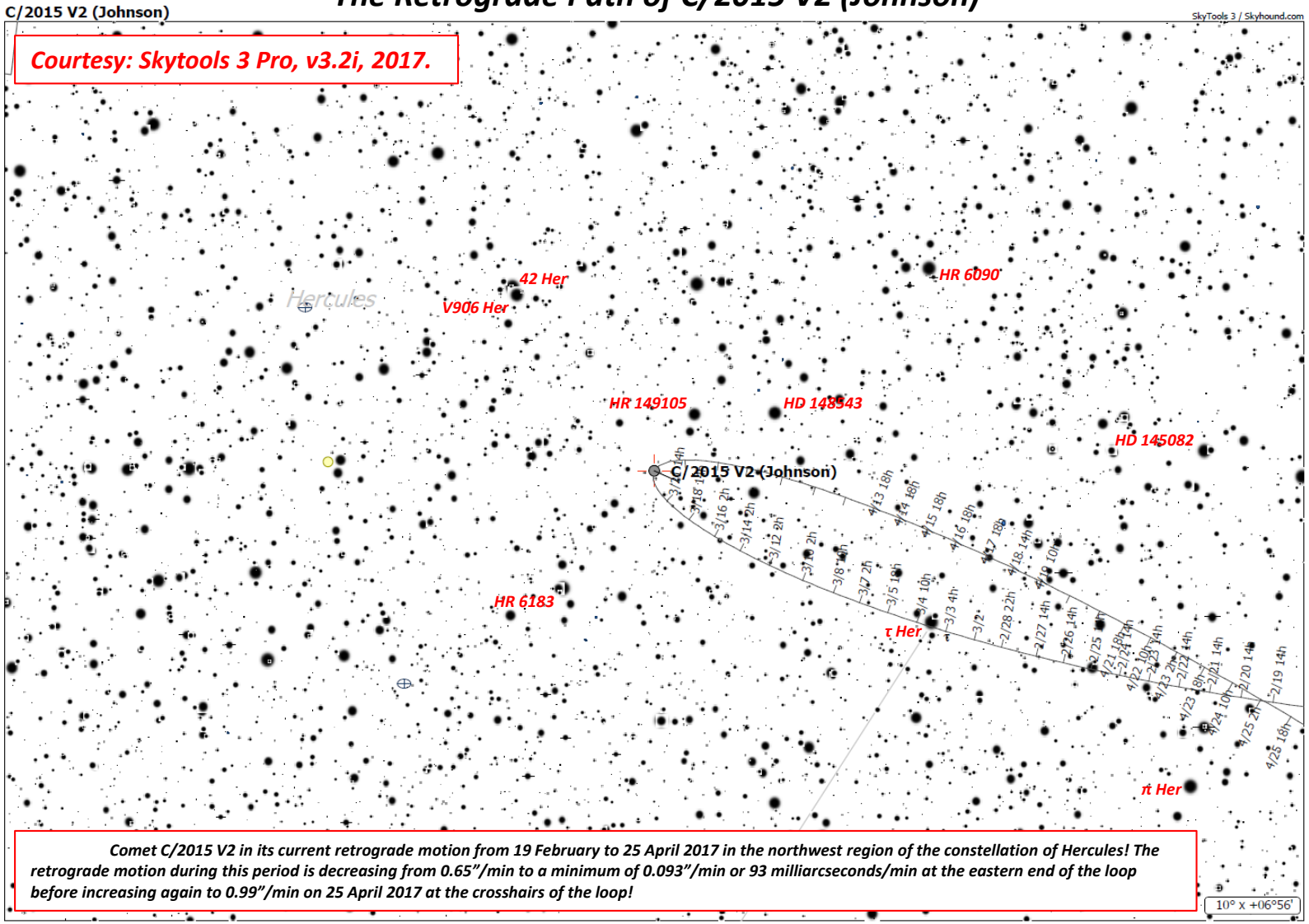
The Current & Projected Path of C/2015 V2 (Johnson)



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!

The Retrograde Path of C/2015 V2 (Johnson)



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!

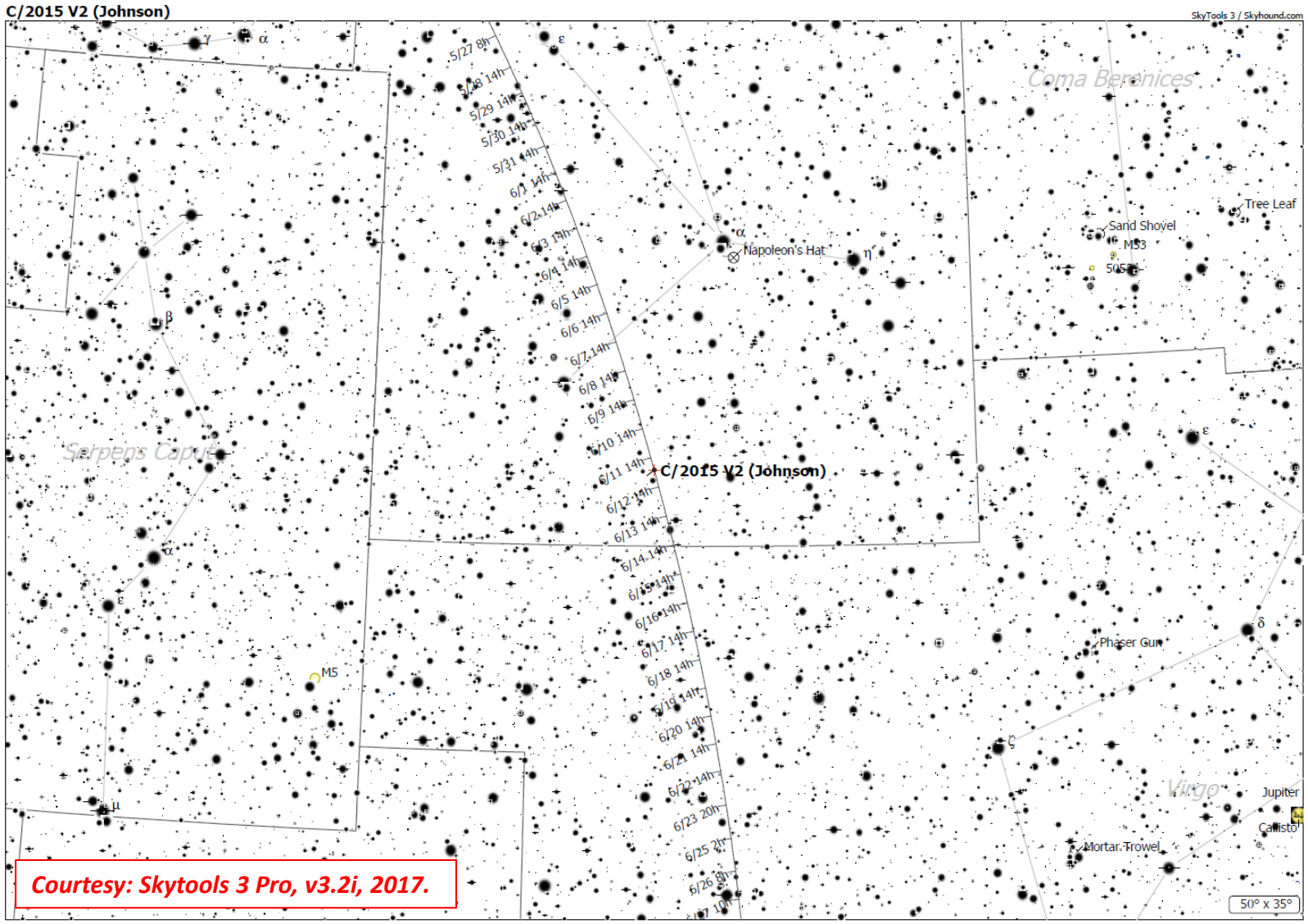
LETS GO PICK SOME COMETS!

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%*



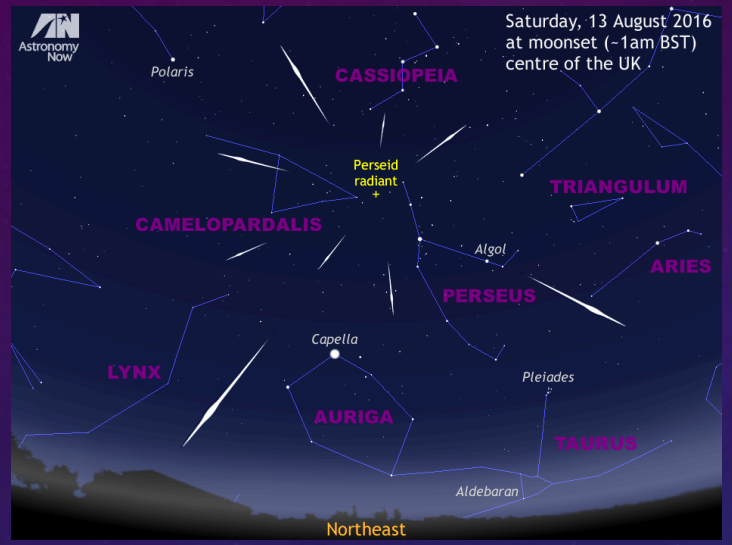
Courtesy: Skytools 3 Pro, v3.2i, 2017.

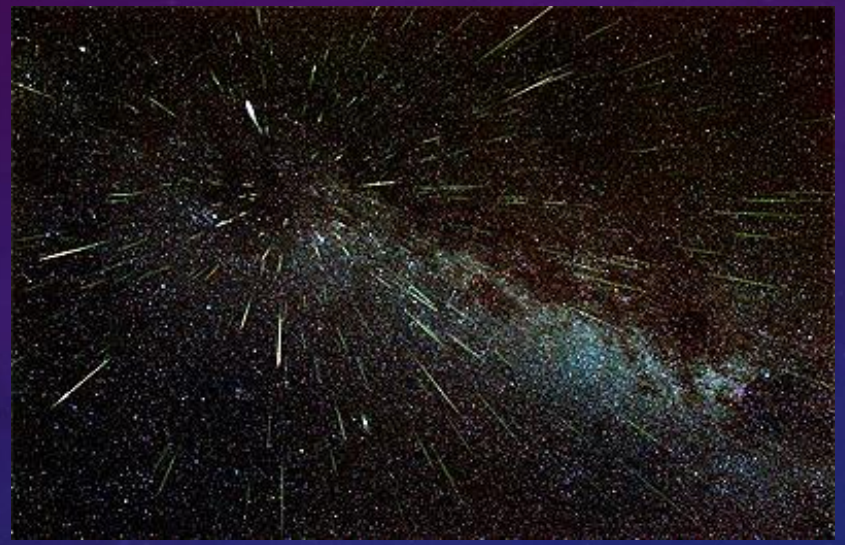
Moon Phases for Comet C/2015 V2 (1 March – 1 July) 2017:

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!

METEOR SHOWERS? WHERE DO THEY ORIGINATE?

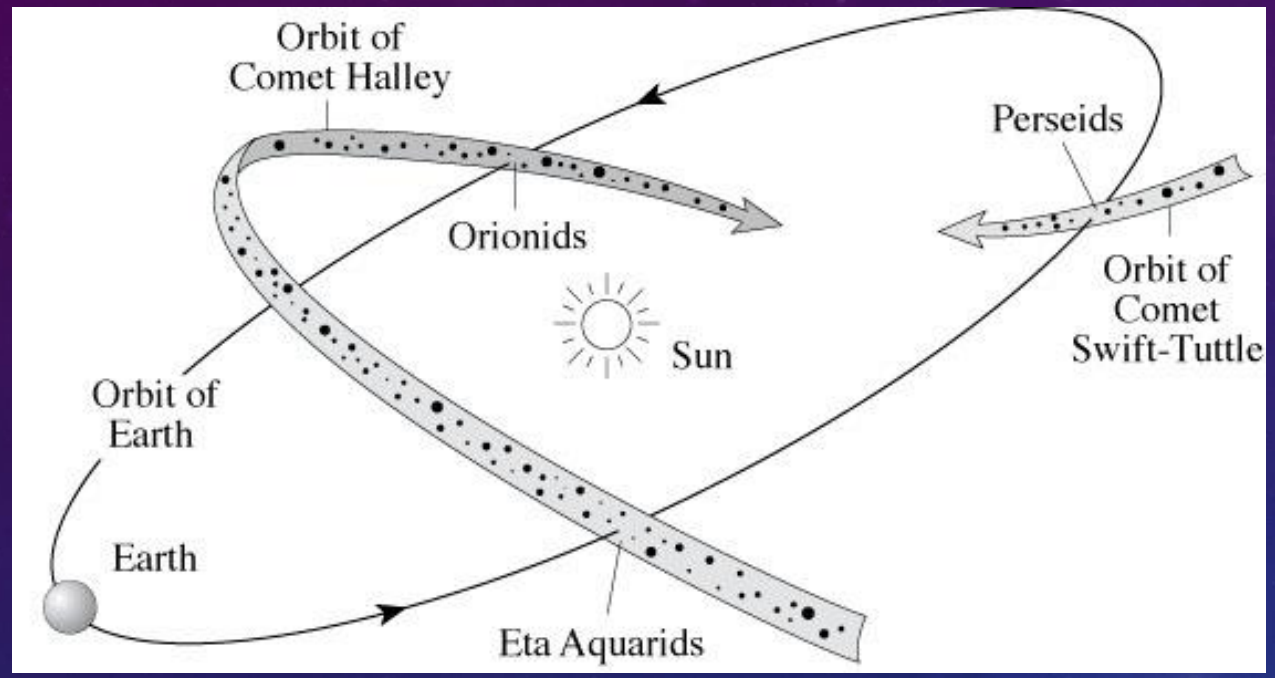


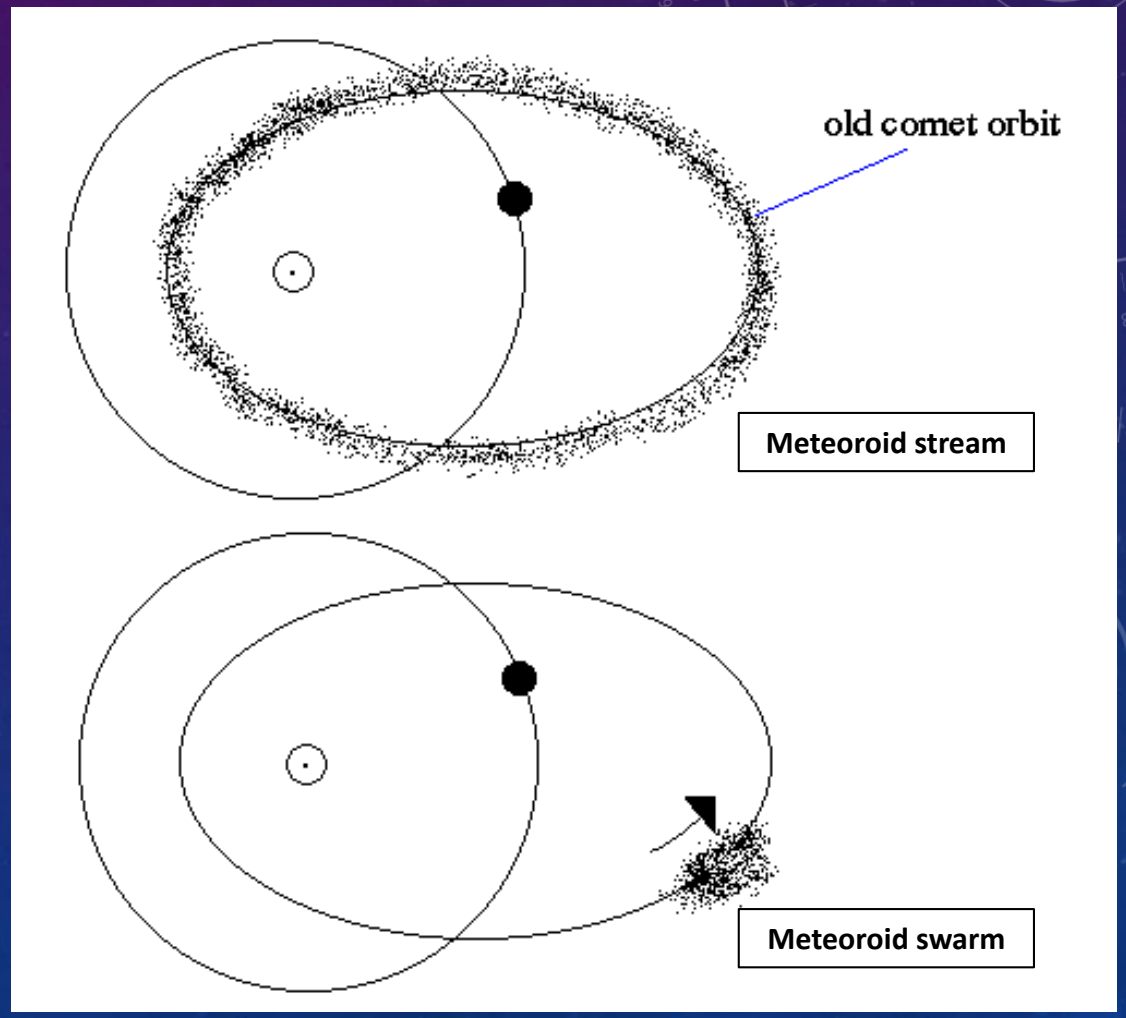


Meteor showers are composed of small fragmentations of rock and metal referred to as meteoroids in space and meteorites if such fragments survive entry into the Earth's Atmosphere!

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?

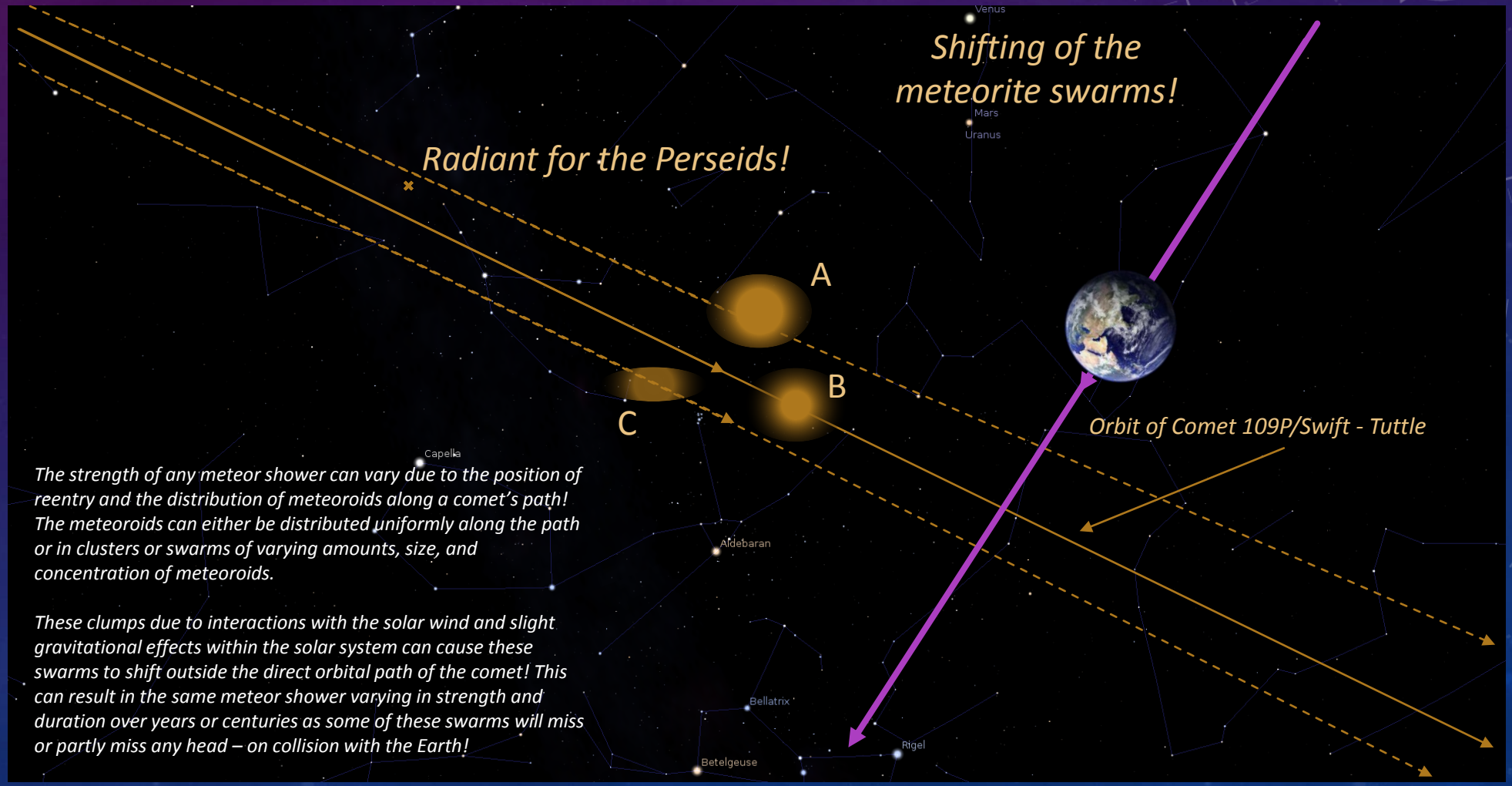




Every swarm or grouping of meteoroids that enter the Earth's atmosphere as a meteor comes from a known comet and travels in paths radiating from a position known as the radiant. All radiant positions are located in constellations for which the meteor is named!
(Example: Eta Aquarids – Source: 1P/Comet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

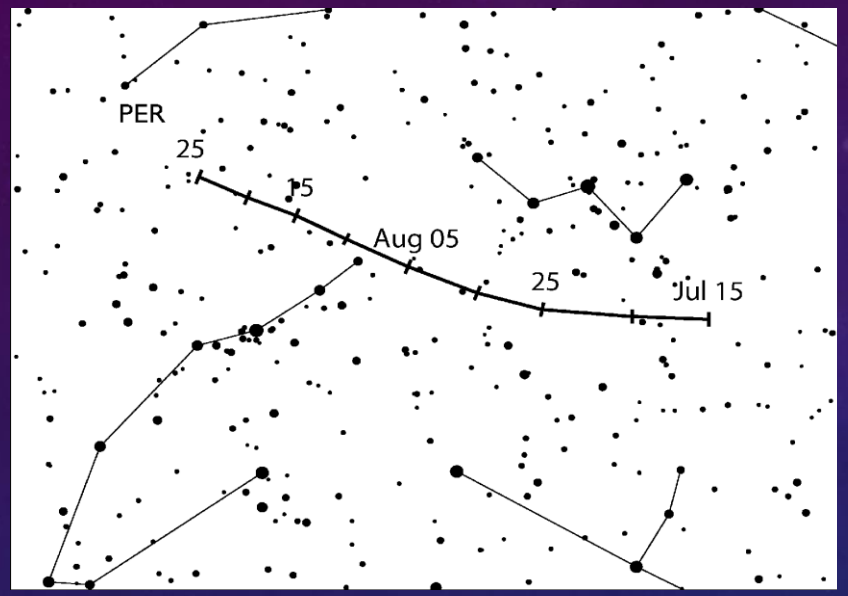
METEOR SHOWERS? WHERE DO THEY ORIGINATE?

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	

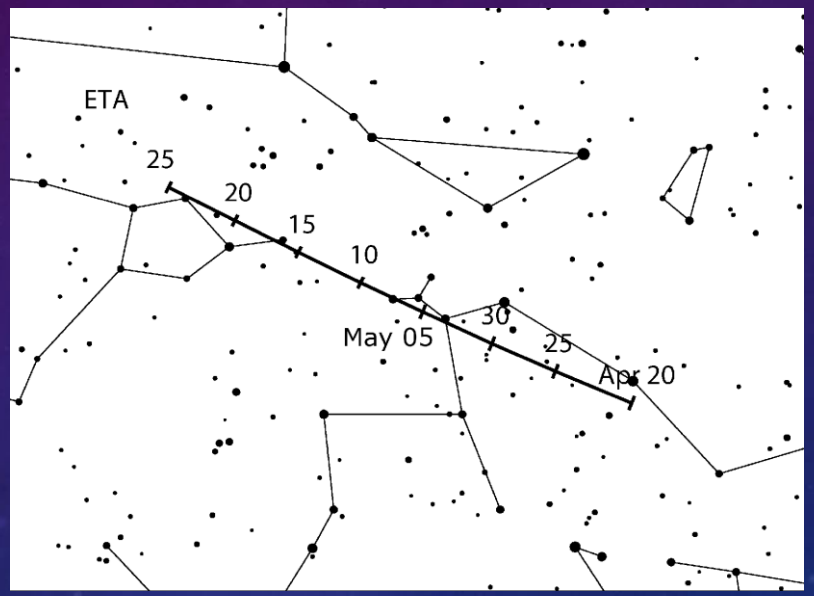
Any changes in the ZHR value when the radiant is at its maximum altitude above the horizon facing due south is in part due to the drifting of the meteoroid swarms or streams from a comet's pathway! Note the 2006 event where the ZHR value was very low indicate that the swarms or streams where far from 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.*