The Professor Comet's Report

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(PanSTARRS) C/2011 L4

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Welcome to the comet report which is a monthly article on the observations of comets by the amateur astronomy community and comet hunters from around the world! This article is dedicated to the latest reports of available comets for observations, current state of those comets, future predictions, & projections for observations in comet astronomy!

Late Winter – March 2013

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The Current Status of the Predominant Comets for March 2013!

Comets	Designation (IAU – MPC)	Orbital Status	Magnitude Visual	Trend	Observation (Range in Lat.)	Constellations (Night Sky Location)	Visibility Period Before Sunrise or After Sunset (Alt. ≥ 15˚)
PanSTARRS	C/2011 L4	C	3.0* (24 Feb)	***Brightening Rapidly***	90˚N – 75˚S (80˚N - 25˚S)	***Moving NE to due N from Sculptor to Aquarius, Cetus, Pisces, & finally Andromeda***	***12 March – 8 June***
LEMMON	C/2012 F6	C	5.0* (21 Feb)	***Brightening, but likely plateaued!***	45˚N - 25˚S	***Moving N just E of the 'Great Square' of Pegasus while still in the W edge of Pisces***	***(1 – 31) May***
Pons – Gambart – SWAN	273P/2012 V4 (C/1827 M1)	P	11.2* (17 Feb)	Fading Slowly	85˚N - 15˚S	*Moving northward from Hercules to Ursa Major*	***16 March onward!***
Bressi	C/2012 T5	C	11.4* (6 Feb)	Still Visible, but Extremely Diffuse!	85˚N - 20˚N	*Moving northward from Lacerta to Cepheus well into Summer!*	***10 May onward!***
LINEAR	C/2012 K5	C	11.5* (6 Feb)	Faint & Steady! (Observable in the N hemisphere until April)	50˚N - 15˚S	Moving NNE from Equuleus thru the W region of Pegasus thru Early April!	***7 March onward!***
McNaught – Russell	262P/2012 K7	C	11.6* (11 Jan)	Fading Noticeably	55˚N - 70˚S	***Moving E thru the N region of Eridanus until late March crosses into the Winter Hexagon thru the middle star (Alnilam) of Orion's Belt by 15 April!***	***1 March - 5 April***
McNaught	C/2011 R1	C	11.8* (7 Feb)	Faint & Stable until Summer 2013	65˚N - 65˚S	General Westward direction from Libra to Boötes!	***25 February – 1 October***

*Visual Magnitude determined from last known field observation report!

Comets with visual magnitudes fainter than 12 , more suitable for observing in the Southern hemisphere , or the tropics are not reported on this list!

Ephemeris Data Terminology

Ephemeris Term	*Definition (plus additional comments)*
Date	Month and Year using the standard Gregorian calendar.
TT	Terrestrial Time (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.
M1	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!*
M2	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 Professor Comet's Report

Degree of Condensation (DC)

All observations of comets are broken down into three factors: estimating magnitudes for light curves to predict future brightness, coma observations, and observations that concern with a comet's tail(s). For the coma or a comet's head there two characteristic features that are important for study: Degree of condensation (DC) and coma size measured in arcminutes. The classification system for determining the DC is based on a positive integer system from 0 to 9 as shown below.

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***

A Synopsis of the Predominant Comets for Winter 2013!

This winter season is approaching its' final weeks and the time for 2013 to be a great year for comets is starting to ratchet up with the coming appearance of C/2011 L4 LINEAR which will be a prime location in the night sky for observers in the northern hemisphere as it begins its' trail across the western horizon after dark! Right now the comet is not observable north of Central America as the comet is progressing ever northward towards the North Celestial Hemisphere on a destination to Ursa Minor, home to the 'Little Dipper , Polaris (the north star), and the NCP (Northern Celestial Pole). The comet is currently moving thru Sculptor as of last day of February 2013 and will eventually make a northeast turn grazing past Aquarius between (2 – 4) March, then make a NNE direction thru Cetus between (5 – 8) March, and moving in and out between Cetus and Pisces from 9 March thru 14 March! Expect C/2011 L4 to stay on course with a nearly strict northward pass towards Andromeda by late March moving parallel with NW horizon and continue to remain present in the region of the circumpolar constellations thru the early summer. Currently the comet is lost in the daytime glare with a minimum solar elongation of just 15.1˚ on the day of 11 March as comet C/2011 L4 moves in and out of the constellation boundary between Cetus and Pisces for a couple of days before and after minimum solar elongation. The prior dates of (5 – 6) March will be a time when the comet is expected to reach perigee (minimal distance from the Earth) at 1.097 AU or (164,108,865 km or 101,977,248 mi) about 1.51x the aphelion distance of Venus to the Sun. After that on 10 March the comet will reach perihelion at 0.302 AU (45,178,557 km or 28,073,955 mi); only 98.2% of Mercury's orbital perihelion. Then it will begin its' journey outwards towards the outer solar system around the time the comet reaches prime observing for astronomers in the northern hemisphere for the early half of 2013!

The comet has now developed a prominent 'fan – shaped' tail with the two streams radiating away from the central nucleus; a long, straight tail of ionized, gas particles and a shorter, more spread out dust tail both spreading out away from the rapidly brightening coma is now estimated to have a size of 300,000 km across (~2.1 Jovian diameters). LINEAR's coma will be a naked eye object in the daytime despite its' close proximity to the Sun during daytime, but the 'fan – shaped' tail will be better seen in the evening hours of the coming days of mid to late March with a medium pair of binoculars. As to the orientation of the tails they will certainly be directed away from the Sun, but it is uncertain as to what the future perimeters will be for the tails. Its' last observation was on 24 Feb, DC at a value of 5, Coma a main diameter of 5' (2.5% the size of an average full moon), Tail size is 20' (1/3˚ or ~40.3% of an average full moon) with a P.A. of 173˚ (SSE from the Coma). Depending on the number and analysis of the photometry readings of the comet's brightness the maximum brightness of visual magnitude was originally predicted to be at -0.97 on the day of its' perihelion, however recently the maximum peak of prediction has flatten out to just 3.0! Yet the coma is very much naked eye even in the glow of dawn and certainly dusk, but any pair of 7x50 binoculars can bring out the tail of C/2011 L4 LINEAR! Basic Future facts about the future path of C/2011 LINEAR: maximum declination will be +85˚ 14' 10" on 28 May, maximum solar elongation will be 78.9˚ between (1 – 5) July, secondary minimum solar elongation will be 47.1˚ between (22 – 24) November, and a maximum brightness above 6.0 is very likely thru 1 April ! Where will the Moon be during this period: moving eastward thru Pisces between (11 – 14) March, Aries (15 – 16) March, and Taurus (17 – 19) March; before reaching 1st Qtr. phase and prior to the Full Worm Moon (3rd full moon of 2013)!

A Synopsis of the Predominant Comets for Winter 2013!

The end of Winter season will bring about the coming of Spring and with it the coming of comet C/2012 F6 (LEMMON) which is now already at a current visual magnitude of 5.0 as of 21 Feb as it now moving thru the constellation of Sculptor and away from the skies of the southern celestial hemisphere towards the northern observers. C/2012 L6 as of late February has been reported with a size of 5' – 8' across (between 2.5% - 6.4% average full Moon) with a DC of 5; no such field observations of a tail have been reported so far, but the comet has developed a striking appearance of a nearly, circular coma composed of an outer, fainter envelope with a better, more centralized inner coma! The tail is very thin composed of several braids with dark stripes indicating multiple trails of some dust, but mostly ionized volatiles ejecting along the path of the solar wind away from the central nucleus. The latest images show the tail nearly 30' in length equivalent to the angular diameter of a full apogee Moon. Although previous photometry data gave the long term predictions for maximum brightness of the comet at a visual magnitude of 3.0 it appears that the brightness progression may have flatten out and the comet may only get to 5th magnitude. However, if it stays at that brightness for a very long time since it is past perigee back on (5 – 6) February at 0.985 AU (147,353,903 km or 91,565,715 mi) and perigee on (24 – 25) March at 0.731 AU (109,356,044 km or 67,953,846 mi) it should remain prime for observing for most of May. It will be prime for observers in the northern hemisphere with the comet moving nearly northward from Pisces to Andromeda just east of the 'Great Square' of Pegasus between (8– 27) May 2013 before fading to 9th magnitude prior to penetrating deeper into Andromeda and ever northward! The most interesting fact is that C/2012 L4 will be following nearly the exact same route, but a several degrees further to the east between the dates (17 – 27) March about two months before C/2012 F6 LINEAR's path thru the same area between Pisces, Pegasus, and Andromeda!

One remaining comet is C/2012 S1 ISON of the International Scientific Optical Network (ISON) which is located near Kislovodsk, Russia by two scientists; Vitali Nevski (Belarus) and Artyom Novichonok (Russia) from 21 Sept 2012 at a visual magnitude of 18.8! Currently this comet is still going thru a 'double retrograde' effect while located near the stellar twins of Gemini from now thru the early Summer 2013 while it is continuing on a course that will take will within the domain of the 'inferior planets' (Venus and Mercury). It is right now passing thru the region of Jupiter's orbit and recent images are already showing quite a respectable coma at an estimated 300 000 km across (~78% of average Earth Moon distance). Right now the comet is currently reported by the latest field observations between 15 – 16 visual magnitude and photometry extrapolations give a prediction of visual magnitude reaching a theoretical possibility of -9.61 in comparison Venus will reach a maximum brightness of -4.89 predicted for 8 December 2013! This means that C/2012 S1 could reach a peak brightness of ~78.5x greater than the prediction for Venus on the last month of 2013! Improved analysis and a more updated ephemeris on the orbital elements of comet ISON will not place it anywhere near the proximity of 87,000 mi distance to the Sun's photosphere obtained by C/2011 W3 Lovejoy back on 16 December 2011 or the 1.1 million mi distance originally estimated for ISON back in Nov & Dec 2012! The best this comet will do in terms of it's perihelion will be a distance of 0.0312 AU for 29 Nov 2013 about 4,467,454 km (2,774, 289 mi). This is still a distance of equivalence to ~3.21 solar diameters from the Sun's photosphere, so it will be well immersed in the multimillion degree envelope of the Sun's Corona!

A Synopsis of the Predominant Comets for Autumn 2012!

Predictions forecast comet ISON to reach both maximum apparent brightness, perihelion, and an intermediate apogee of 0.977 AU during the same day of 29 Nov 2013! The solar elongation for this comet is decreasing as it increases in brightness: less than 100˚ by 19/20 March, minimum solar elongation will be 5˚ (11 - 19) July, maximum solar elongation 54˚ (22 – 24) October, 2nd minimum solar elongation of 3˚ on 29 Nov 2013! ISON will not reach solar elongations of 45˚ - 90˚ for possible observations in the morning skies before dawn until (16 – 30) December, but the comet will still be a bright 3rd to 4th apparent magnitude. However, any object brighter than -2.0 magnitude would clearly be a daytime object observable and the first such predominant comet since Ikeya – Seki in 1965. Ikeya – Seki was a member of the Kreutz sungrazers just like C/2011 W3 Lovejoy, but the parabolic path of C/2012 S1 places well outside the plane of the elliptic at an orbital inclination of 62˚ and in the wrong area of the sky from the locations of Ikeya – Seki & Lovejoy so this is not a Kreutz sungrazer, but it could be nearly if not equal in exact brightness of magnitude -10.0 for Ikeya – Seki. For night time observations look to the constellation of Draco for any night time observations past perihelion before that the tail of the comet if reaches that of any of the great McNaught comets or Ikeya – Seki should be in the regions of Hercules and Corona Borealis during the period close to and just after perihelion! Right now these are all predictions and conditions for this comet could change rapidly and be unpredictable to the point where it eithers exceed expectations or becomes the great disappointment of 2013, so cautious optimism should be taken as gospel for the time being until the later half of 2013!

C/2012 F6 (LEMMON)

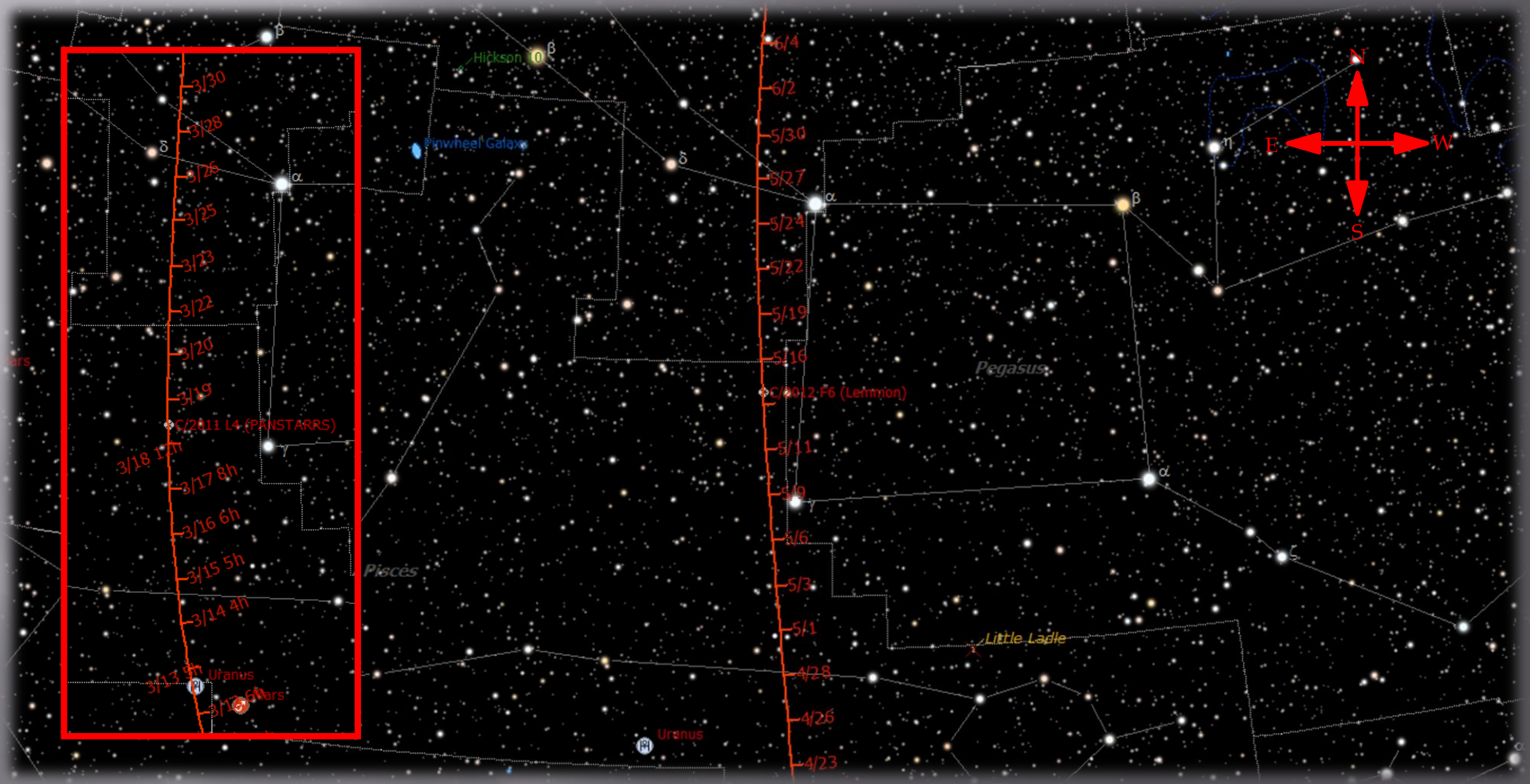
Figure 1: Projected Path of C/2012 F6 (LEMMON) across the celestial skies from 19 July 2012 – 2 May 2013!

Courtesy of SkyTools 3 Profession Ed, 2012.

Late Winter – March 2013

C/2012 F6 (LEMMON)

Figure 2: Future Projection of Comet C/2012 F6 when it is visible again in the N hemisphere (23 Apr – 4 Jun) 2013!



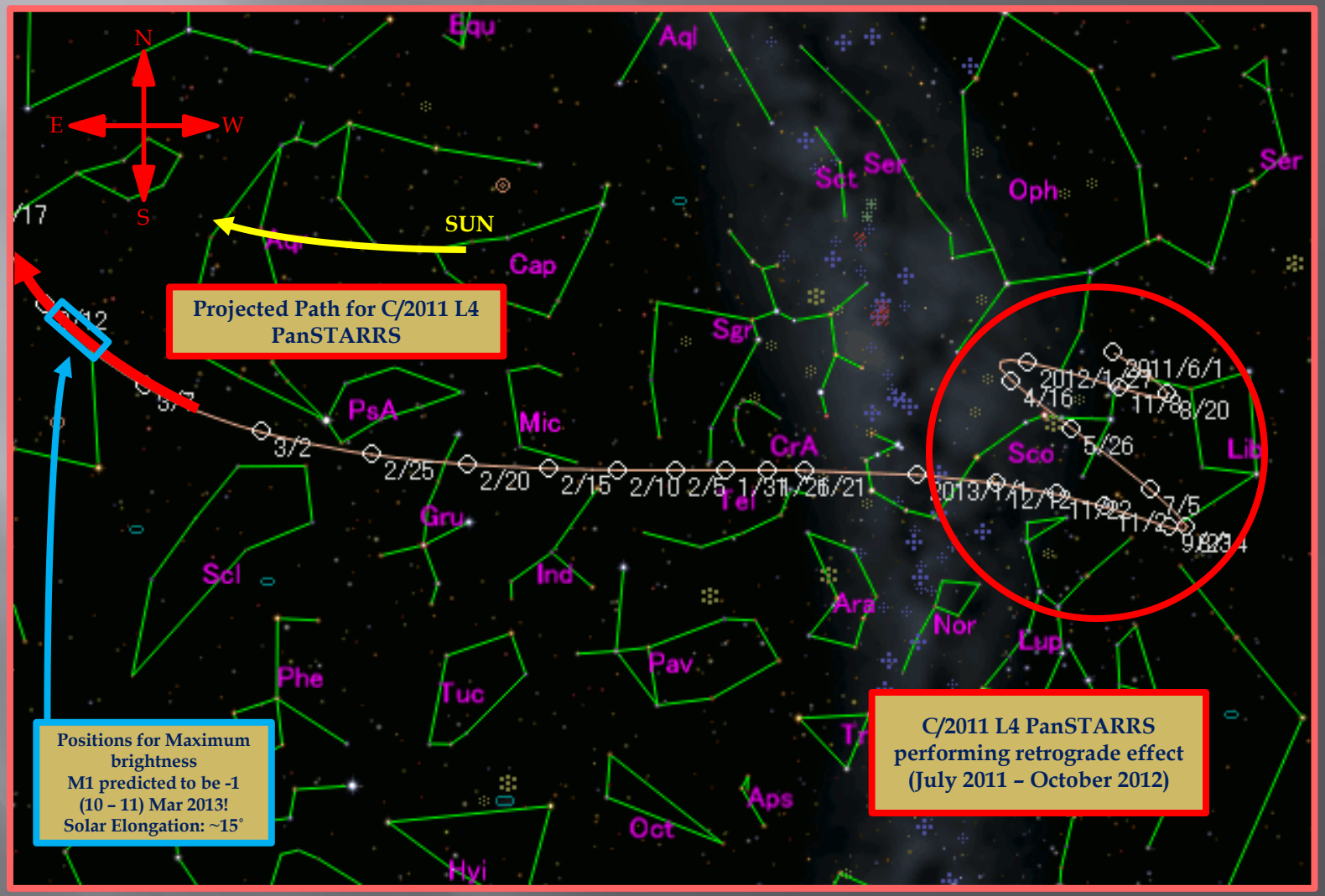
Courtesy of SkyTools 3 Profession Ed, 2012.

Note the side by side comparison and similarities in the projected pathways for both C/2012 F6 LEMMON & C/2011 L4 PanSTARRS!

Note: Comet C/2013 S1 (LEMMON) is expected to be visible again in the N hemisphere by May 2013! Here in Figure 2 we have it's path just to the east of the 'Great Square' of Pegasus moving northward from 8 – 27 May 2013!

C/2011 L4 PanSTARRS

Figure 3: The projected path of the PanSTARRS comet across the Summer Sky (June 2011 – March 2013)!



Courtesy of Seiichi Yoshida's Comet Page, 2012.

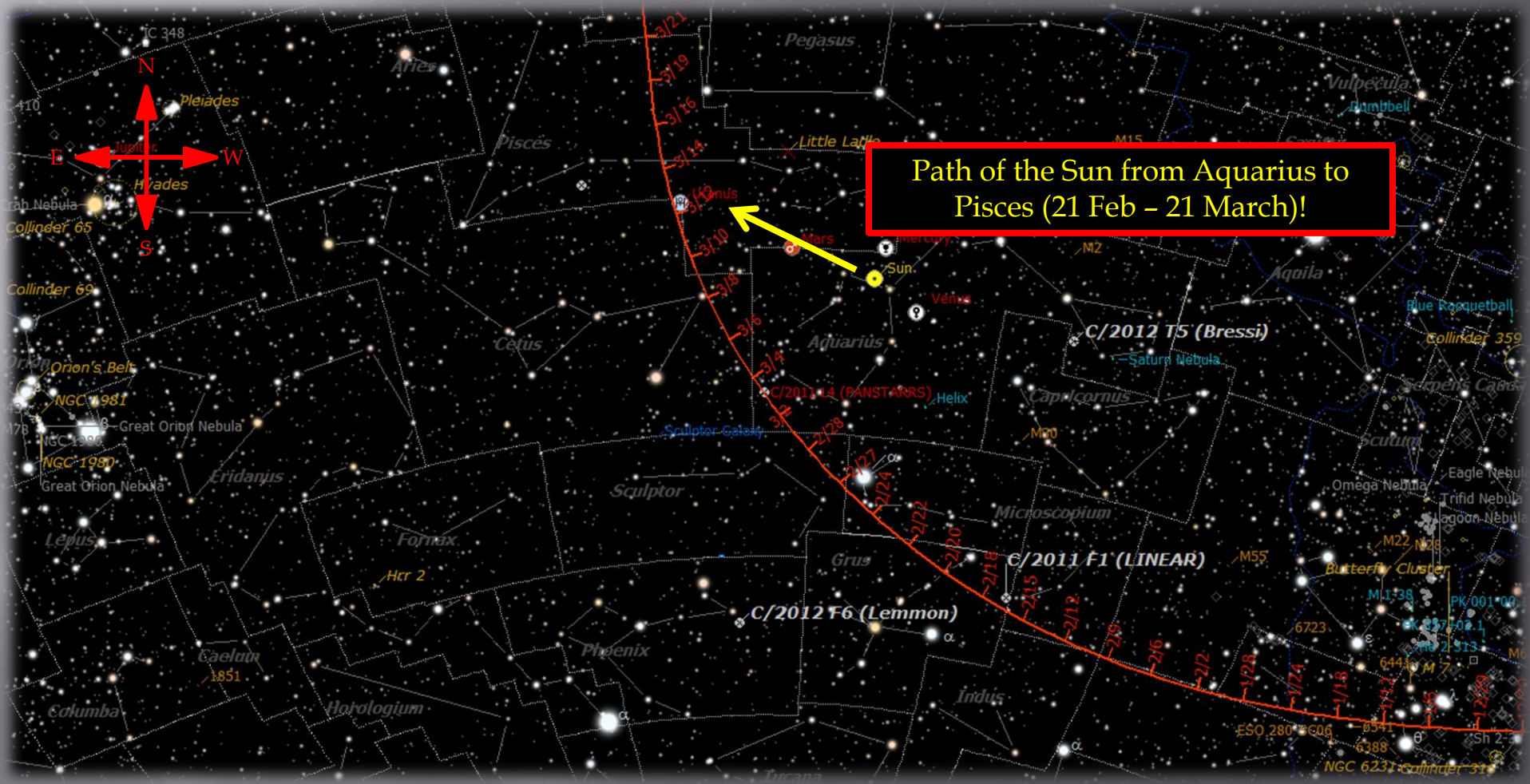
A Special Brief on C/2011 L4 PanSTARRS

Comet C/2011 L4 is another discovery of the PanSTARRS telescope located on the summit of Mt. Haleakala on the island of Maui, Hawaii! PanSTARRS stands for Panoramic Survey Telescope And Rapid Response System is under the administration of the University of Hawaii. The PanSTARRS project is a consortium of several university and science institutions decided to continuously scanning the sky for new and updating the current status of a variety of DSOs including comets and other minor planets. The survey can also looking for new objects recently detected and determine the accurate astrometry and photometry of these objects. The construction of all four telescopes: PS 1 thru PS 4 are funded by the U.S. Air Force with PS 1 going online on 6 December 2008 and beginning full scale science operations 13 May 2010 and PS 2 should begin first light sometime in 2013.

C/2011 L4 was discovered on 6 June 2011 between 09:22 UTC and 10:19 UTC using the PS 1 telescope which is 1.8m RC telescope acquiring four CCD images with a measured photographic magnitude 19.4 – 19.6. The Mt. Lemmon Survey in Arizona, US also acquired several pre-discovery images from their 154 cm refractor and CCD imager during the night of 24 May 2011 between 7:26 UTC and 7:55 UTC with a measured magnitude between 18.9 – 19.2! The passed rather close to 174P/Echeclus the night of 30 May and reached a maximum solar elongation of 176˚ on 27 May 2011. It was later determined that the comet was discovered at a distance of 7.9 AU (between the orbits of Jupiter and Saturn). This comet likely originated from the Oort Cloud spending million of years in the regions beyond the heliopause before returning to the Sun. Upon leaving the planetary region of the solar system astrometry data predicts a 'post – perihelion' orbital distance with a duration of ~110 000 years based on the future J2050 .0 epoch. Comet PanSTARRS has an orbit inclination of 84.2080˚ taking it well above the plane of the ecliptic into the northern celestial hemispherical domain of the solar system. A central nucleus resides within its' already large coma which maybe only several kilometers across in size emitting dust particles composed of various metals, carbon and silicate – based minerals along with a variety of volatiles; water, ammonia, methane, and carbon dioxide being the main components!

C/2011 L4 PanSTARRS

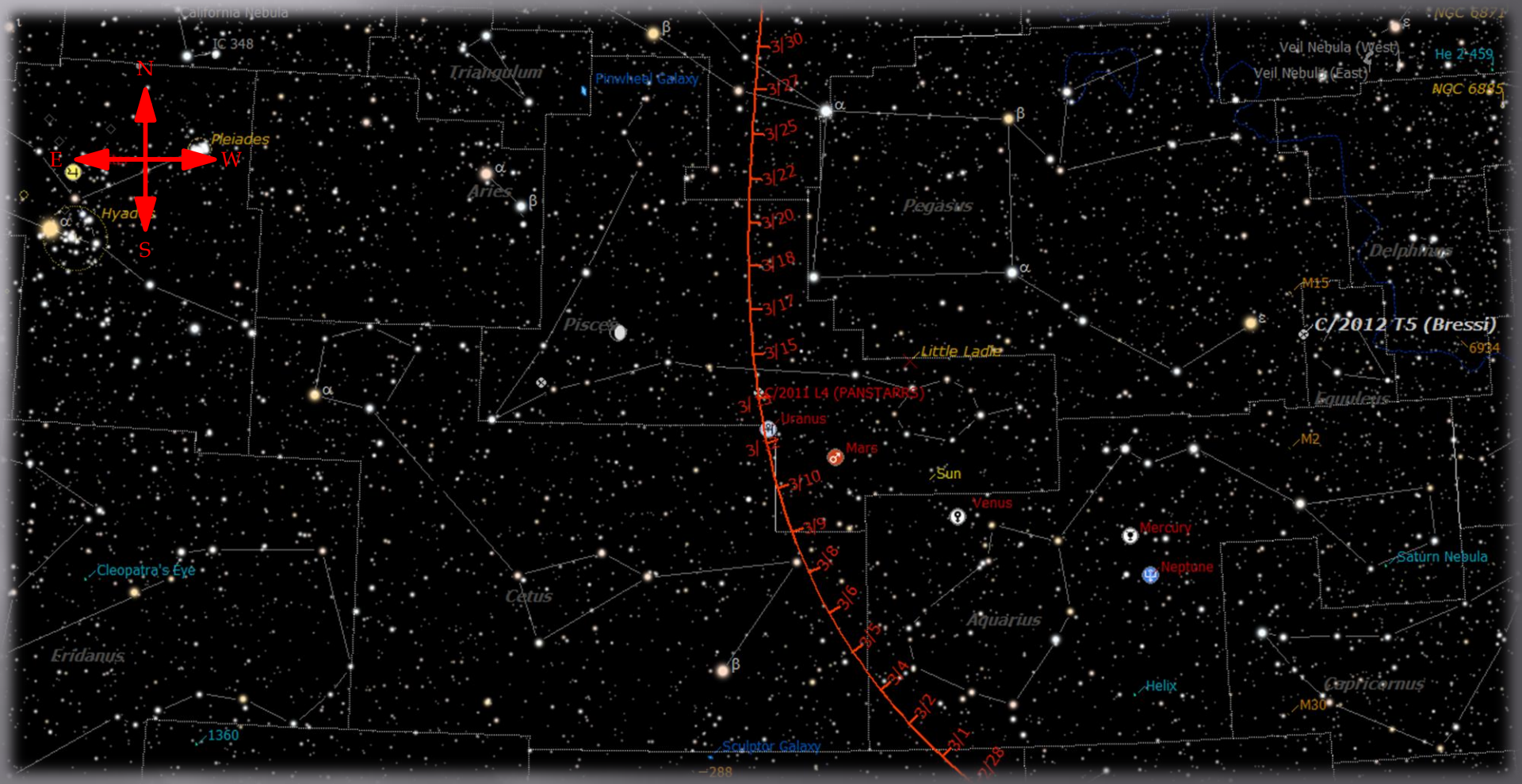
Figure 4: The projected path of the PanSTARRS comet during predicted peak brightness (29 Dec 2012 – 21 Mar 2013)!



Courtesy of SkyTools 3 Profession Ed, 2012.

C/2011 L4 PanSTARRS

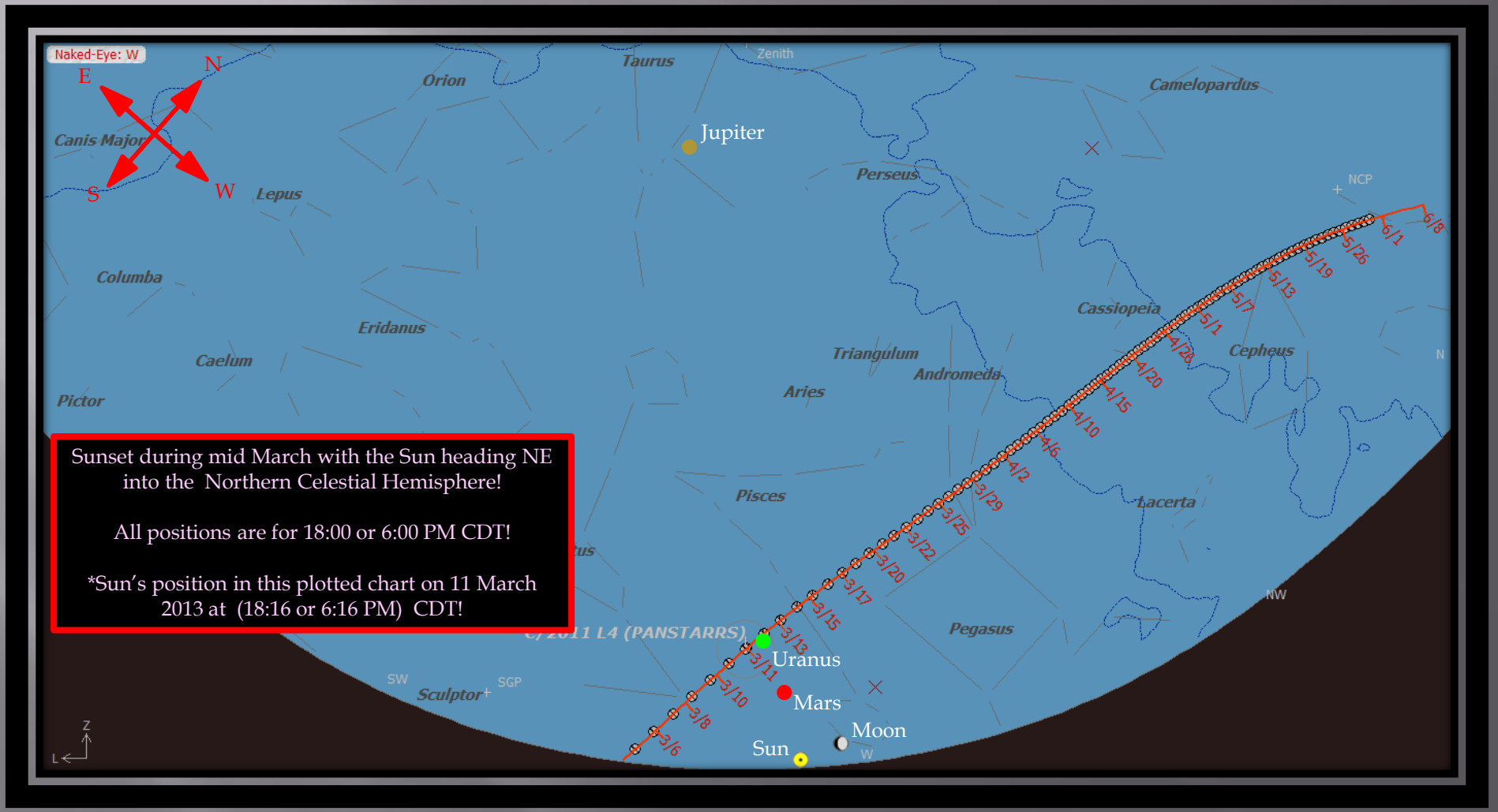
Figure 5: The projected path in the celestial Spring sky for March 2013 at the peak of prime viewing!



Courtesy of SkyTools 3 Profession Ed, 2012.

C/2011 L4 PanSTARRS

Figure 6.1: Watch the comet move across the W horizon towards Polaris (9 March – 8 June) 2013!



Courtesy of SkyTools 3 Profession Ed, 2012.

C/2011 L4 PanSTARRS

Figure 6.2: Watch the comet move across the W horizon towards Polaris (9 March – 8 June) 2013!

Courtesy of SkyTools 3 Profession Ed, 2012.

C/2011 L4 PanSTARRS & LUNAR PHASES FOR MARCH 2013

Figure 6.3: The position & phases of the Moon during the prime time period for observing C/2011 L4!

Courtesy of SkyTools 3 Profession Ed, 2012.

C/2011 L4 PanSTARRS & LUNAR PHASES

Figure 6.4: General progression of the paths of the Moon & PanSTARRS thru early June 2013!

Courtesy of SkyTools 3 Profession Ed, 2012.

IAU MPC Ephemeris data for C/2011 L4 (PanSTARRS): (1 – 31) Mar 2013

	CDT/CST	Epoch (J2000.0)		Basic Ephemeris						Sky Motion		Moon Phase	Moon Mag.
Date	hh:mm:ss	R.A.	Dec	Delta	R	El. (˚)	Ph.	M_{pred}	% Fore.	"/min	P.A.	(0.00 - 1.00)	(Visual)
3/1/2013	0:00:00	23 27 03.2	26 53 37 S	1.110	0.407	21.4	62.6	0.310	11	6.89	43.2	0.87	-12.07
3/2/2013	0:00:00	23 35 16.6	24 49 32 S	1.104	0.388	20.4	63.1	0.092	11	7.02	40.7	0.79	-11.88
3/3/2013	0:00:00	23 43 05.4	22 38 27 S	1.100	0.370	19.5	63.4	-0.123	11	7.13	38.1	0.69	-11.64
3/4/2013	0:00:00	23 50 26.8	20 20 43 S	1.098	0.353	18.6	63.4	-0.319	11	7.22	35.5	0.58	-11.33
3/5/2013	0:00:00	23 57 18.1	17 56 53 S	1.097	0.339	17.8	63.3	-0.510	11	7.28	32.8	0.47	-10.95
3/6/2013	0:00:00	00 03 36.4	15 27 39 S	1.097	0.326	17.0	62.9	-0.680	11	7.30	30.0	0.35	-10.47
3/7/2013	0:00:00	00 09 19.5	12 53 59 S	1.099	0.315	16.3	62.3	-0.812	11	7.29	27.1	0.25	-9.87
3/8/2013	0:00:00	00 14 25.2	10 16 59 S	1.102	0.308	15.8	61.5	-0.918	12	7.23	24.2	0.16	-9.10
3/9/2013	0:00:00	00 18 52.5	07 38 02 S	1.106	0.303	15.4	60.7	-0.967	13	7.13	21.2	0.08	-8.06
3/10/2013	0:00:00	00 22 41.3	04 58 34 S	1.110	0.302	15.2	59.8	-0.971	14	6.99	18.4	0.03	-6.50
3/11/2013	0:00:00	00 26 00.0	02 13 32 S	1.116	0.303	15.1	58.8	-0.947	14	6.81	15.5	0.00	-3.89
3/12/2013	0:00:00	00 28 34.8	00 22 25 N	1.122	0.308	15.3	58.0	-0.865	15	6.60	12.9	0.00	-2.25
3/13/2013	0:00:00	00 30 37.8	02 54 47 N	1.128	0.316	15.5	57.4	-0.742	16	6.36	10.4	0.02	-5.75
3/14/2013	0:00:00	00 32 12.7	05 22 39 N	1.135	0.327	16.0	56.8	-0.580	16	6.12	8.3	0.06	-7.45
3/15/2013	0:00:00	00 33 23.6	07 45 27 N	1.142	0.340	16.5	56.3	-0.397	17	5.87	6.3	0.12	-8.52
3/16/2013	0:00:00	00 34 14.3	10 02 53 N	1.149	0.355	17.2	55.9	-0.196	17	5.63	4.7	0.19	-9.28
3/17/2013	0:00:00	00 34 48.5	12 14 50 N	1.157	0.372	17.9	55.6	0.022	18	5.39	3.2	0.27	-9.87
3/18/2013	0:00:00	00 35 09.2	14 21 23 N	1.164	0.390	18.8	55.3	0.240	18	5.16	2.0	0.36	-10.34
3/19/2013	0:00:00	00 35 19.0	16 22 45 N	1.172	0.409	19.6	55.0	0.462	18	4.95	0.9	0.46	-10.74
3/20/2013	0:00:00	00 35 20.3	18 19 09 N	1.180	0.429	20.6	54.7	0.684	18	4.75	0.0	0.55	-11.08
3/21/2013	0:00:00	00 35 14.7	20 10 54 N	1.188	0.449	21.5	54.5	0.897	19	4.56	359.3	0.64	-11.37
3/22/2013	0:00:00	00 34 48.5	21 58 18 N	1.196	0.470	22.5	54.2	1.11	19	4.39	358.7	0.73	-11.62
3/23/2013	0:00:00	00 34 30.1	23 41 39 N	1.204	0.492	23.5	53.9	1.32	19	4.23	358.2	0.82	-11.84
3/24/2013	0:00:00	00 34 09.2	25 21 15 N	1.212	0.513	24.5	53.6	1.52	19	4.08	357.8	0.89	-12.03
3/25/2013	0:00:00	00 33 46.4	26 57 22 N	1.220	0.535	25.5	53.3	1.72	20	3.94	357.4	0.95	-12.18
3/26/2013	0:00:00	00 33 22.2	28 30 17 N	1.228	0.557	26.5	53.0	1.90	20	3.81	357.2	0.98	-12.28
3/27/2013	0:00:00	00 32 56.9	30 00 14 N	1.236	0.579	27.5	52.7	2.09	20	3.69	356.9	1.00	-12.34
3/28/2013	0:00:00	00 32 30.9	31 27 26 N	1.245	0.601	28.5	52.4	2.26	21	3.58	356.8	0.99	-12.34
3/29/2013	0:00:00	00 32 04.3	32 52 05 N	1.253	0.624	29.5	52.0	2.44	21	3.48	356.6	0.96	-12.27
3/30/2013	0:00:00	00 31 37.3	34 14 23 N	1.261	0.646	30.5	51.7	2.61	22	3.39	356.5	0.90	-12.15
3/31/2013	0:00:00	00 31 10.1	35 34 31 N	1.269	0.668	31.5	51.3	2.77	22	3.30	356.5	0.82	-11.97

All ephemeris data is calculated based on the Geographical location of the George Observatory, SE Texas, United States.

29˚22'30" N, 95˚35'37" W

$M_{pred} = 4.0 + 5 \log d + 10.0 \log r$

Note: Dark Green cells are for times calculated for Daylight Savings Time (DST)

The Professor Comet's Report

Calculated Ephemeris data for C/2011 L4 (PanSTARRS) for W horizon observation: (1 – 31) March 2013

	CDT/CST	Epoch (J2000.0)		Calculated Ephemeris					Sky Position (19:00 CST)			Constellation
Date	hh:mm:ss	R.A.	Dec	Delta	R	El. (°)	M_{pred}	$*M_1$	Alt. (° ′ ″)	Azi. (° ′ ″)	Card. Pos.	
3/1/2013	19:00:00	23 32 35.2	25 37 48 S	1.11	0.40	21	0.310	3.38	-08 35 30	245 57 45	WSW	Sculptor
3/2/2013	19:00:00	23 40 34.3	23 29 34 S	1.10	0.38	20	0.092	3.24	-06 45 38	247 26 27	WSW	Aquarius
3/3/2013	19:00:00	23 48 07.2	21 14 32 S	1.10	0.36	19	-0.123	3.11	-04 56 18	249 02 17	WSW	Aquarius
3/4/2013	19:00:00	23 55 11.2	18 53 09 S	1.10	0.34	18	-0.319	2.99	-03 08 36	250 45 31	WSW	Aquarius
3/5/2013	19:00:00	00 01 43.4	16 26 04 S	1.10	0.33	17	-0.510	2.87	-01 23 45	252 36 22	WSW	Cetus
3/6/2013	19:00:00	00 07 41.4	13 54 06 S	1.10	0.32	17	-0.680	2.77	+00 16 53	254 34 49	WSW	Cetus
3/7/2013	19:00:00	00 13 02.8	11 18 20 S	1.10	0.31	16	-0.812	2.69	+01 51 56	256 40 34	WSW	Cetus
3/8/2013	19:00:00	00 17 46.2	08 40 01 S	1.10	0.30	16	-0.918	2.63	+03 19 58	258 53 05	WSW	Cetus
3/9/2013	19:00:00	00 21 51.1	06 00 34 S	1.11	0.30	15	-0.967	2.607	+04 39 59	261 11 24	W	Pisces
3/10/2013	19:00:00	00 25 17.9	03 21 31 S	1.11	0.30	15	-0.971	2.609	+18 38 52	255 33 57	WSW	Pisces
3/11/2013	19:00:00	00 28 08.5	00 44 16 S	1.12	0.31	15	-0.947	2.63	+19 46 10	258 05 02	WSW	Cetus
3/12/2013	19:00:00	00 30 25.7	01 49 52 N	1.13	0.31	15	-0.865	2.68	+20 42 37	260 39 37	W	Cetus
3/13/2013	19:00:00	00 32 13.0	04 19 54 N	1.13	0.32	16	-0.742	2.76	+21 28 26	263 15 52	W	Pisces
3/14/2013	19:00:00	00 33 34.6	06 45 05 N	1.14	0.33	16	-0.580	2.86	+22 04 12	265 52 10	W	Pisces
3/15/2013	19:00:00	00 34 34.2	09 05 00 N	1.15	0.35	17	-0.397	2.98	+22 30 48	268 27 08	W	Pisces
3/16/2013	19:00:00	00 35 15.7	11 19 28 N	1.15	0.36	18	-0.196	3.10	+22 49 11	270 59 41	W	Pisces
3/17/2013	19:00:00	00 35 42.3	13 28 29 N	1.16	0.38	18	0.022	3.24	+23 00 26	273 29 01	W	Pisces
3/18/2013	19:00:00	00 35 56.9	15 32 12 N	1.17	0.40	19	0.240	3.38	+23 05 31	275 54 36	W	Pisces
3/19/2013	19:00:00	00 36 01.9	17 30 50 N	1.18	0.42	20	0.462	3.51	+23 05 23	278 16 07	W	Pisces
3/20/2013	19:00:00	00 35 59.4	19 24 41 N	1.18	0.44	21	0.684	3.65	+23 00 53	280 33 24	W	Pisces
3/21/2013	19:00:00	00 35 50.8	21 14 03 N	1.19	0.46	22	0.897	3.79	+22 52 46	282 46 28	WNW	Pisces
3/22/2013	19:00:00	00 35 37.5	22 59 13 N	1.20	0.48	23	1.11	3.92	+22 41 41	284 55 20	WNW	Andromeda
3/23/2013	19:00:00	00 35 20.5	24 40 31 N	1.21	0.50	24	1.32	4.05	+22 28 14	287 00 09	WNW	Andromeda
3/24/2013	19:00:00	00 35 00.8	26 18 12 N	1.22	0.53	25	1.52	4.18	+22 12 52	289 01 04	WNW	Andromeda
3/25/2013	19:00:00	00 34 38.8	27 52 34 N	1.22	0.55	26	1.72	4.30	+21 56 02	290 58 16	WNW	Andromeda
3/26/2013	19:00:00	00 34 15.3	29 23 50 N	1.23	0.57	27	1.90	4.42	+21 38 07	292 51 56	WNW	Andromeda
3/27/2013	19:00:00	00 33 50.5	30 52 16 N	1.24	0.59	28	2.09	4.54	+21 19 22	294 42 19	WNW	Andromeda
3/28/2013	19:00:00	00 33 24.8	32 18 04 N	1.25	0.61	29	2.26	4.65	+21 00 07	296 29 33	WNW	Andromeda
3/29/2013	19:00:00	00 32 58.5	33 41 26 N	1.26	0.64	30	2.44	4.76	+20 40 34	298 13 53	WNW	Andromeda
3/30/2013	19:00:00	00 32 31.7	35 02 32 N	1.27	0.66	31	2.61	4.86	+20 20 55	299 55 28	WNW	Andromeda
3/31/2013	19:00:00	00 32 04.7	36 21 33 N	1.27	0.68	32	2.77	4.97	+20 01 21	301 34 30	WNW	Andromeda

All ephemeris data is reconfigured for observation towards the western horizon for 19:00 or 7:00 PM CST as observed from the George Observatory, Needville, Texas, USA!

$M_{pred} = 4.0 + 5 \log d + 10.0 \log r$

$*M_1 = 5.5 + 5 \log r + 6.0 \log r$

Note: Dark Green cells are for times calculated for Daylight Savings Time (DST)

Late Winter – March 2013

The Professor Comet's Report

Table of Various DSOs within range of C/2011 L4 during the period of prime observing (12 – 27) March 2013!

Date	Constellation	Nearby DSOs	Classification	Orientation	Visual Mag.	Dist. from Earth (A.U. or lys)	Special Features
3/12/2013	Cetus	Uranus	Planet	0.48° E of planet	5.93	21.0	Icy Giant
3/13/2013	Pisces	HD 2842	Variable Star	Comet transits Star	7.99	350 ± 38.0	F0
3/14/2013	Pisces	51 Piscium	Multiple Star System	0.28° NE of the system	5.69 (Primary)	260 ± 17.0	B9 Suspected Variable
3/15/2013	Pisces	Hickson 2	Compact Galaxy Group	1.23° NE of the group	12.90	200 million	4 galaxies
3/16/2013	Pisces	HD 2792	Star	0.81° ENE of Star	7.18	240 ± 15.0	A5
3/17/2013	Pisces	HD 3166	Star	0.47° due N of Star	6.39	400 ± 42.0	K0
3/18/2013	Pisces	NGC 100	Galaxy (4.3′ x 0.5′)	2.88° ESE of galaxy	13.80	38 million	Edge On Spiral
3/19/2013	Pisces	47 Piscium	Variable Star	1.82° E of the variable	5.04	490 ± 58.0	F6 Semi Regular
3/20/2013	Pisces	52 Piscium	Multiple Star System	0.88° SE of the star	5.38 (Primary)	260 ± 15.0	K0III Orange Giant
3/21/2013	Pisces	54 Piscium	Multiple Star System	1.1° WNW of the star	5.86 (Primary)	36 ± 0.3	K2 Suspected Variable
3/22/2013	Andromeda	HD 2925	Multiple Star System	0.56° ENE of the star	6.84 (Primary)	450 ± 55.0	G8III Yellow Giant
3/23/1013	Andromeda	*About halfway between Zeta (ζ) Andromedae & Hickson 1*			ζ star (3.92) & HCG 1 (13.8)		Hybrid Variable K0
3/24/2013	Andromeda	PY And	Variable Star	0.87° SW of the star	6.50	700 ± 110.0	α^2 CVn type K5
3/25/2013	Andromeda	HD 2942	Multiple Star System	0.305° SE of the star	6.33 (Primary)	470 ± 68.0	G8II Yellow Supergiant
3/26/2013	Andromeda	*About halfway between Epsilon (ε) & 28 And – Multi. Star System*			*(ε) 4.38 & 28 And (5.20 – Primary)*		28 And - A7III
3/27/2013	Andromeda	Delta (δ) And	Multiple Star System	1.59° WNW of the star	3.28 (Primary)	100 ± 2.1	K3III Suspected (Orange Giant) Variable

All positions of prominent DSOs listed on this table are calculated for 18:00 CDT while the comet is bright enough to be seen either by naked eye or with medium binoculars (7x50 or 10x50 as the standard)!

General Layout of Events for C/2011 L4 parabolic trajectory (1)!

Date of Event (2013)	Basic Event
3 – 4 March	Maximum Phase @ 63.4˚
5 – 6 March	Perigee @ 1.097 AU
9 March	Recalculated Max. Brightness (2.607 Vis. Mag.)
10 March	Perihelion @ 0.302 AU
10 March	Original Est. Max Brightness (-0.971 Vis. Mag.)
11 March	Min. Solar Elongation @ 15.1˚
12 March	Earliest Date for Evening Viewing at Dusk (WSW with Alt. = 18˚ 38′ 52″ at 19:00 CST)
7 May	Earliest Date of Fading to 8th Vis. Mag. Predicted by the MPC!
13 – 14 May	Crosses the orbit of Mars (Mean Dist. = 1.524 AU)
21 - 22 May	Max. Mars – Sun Dist. from Earth (Delta = 1.666 AU)
28 May	Max. Dec. @ 85˚ 14′ 10″ (~4˚ of Polaris)

General Layout of Events for C/2011 L4 parabolic trajectory (1)!

Date of Event (2013)	Basic Event
15 Jun e	Enters the Asteroid Belt at 4:1 Kirkwood Gap (R = 2.06 AU)
1 – 5 July	Max. Solar Elongation @ 78.9˚
10 August	C/2011 L4 now 3.0 AU from Earth!
1 October	C/2011 L4 now 4.0 AU from Earth!
13 – 14 October	Leaves the Asteroid Belt at 5:3 Kirkwood Gap (R = 3.70 AU)
19 – 21 November	Secondary Min. Solar Elongation @ 47.1˚
1 – 16 December	Minimum Phase @ 9.8˚
25 February 2014	Crosses the Orbit of Jupiter (Mean Dist. = 5.204 AU)

Ephemeris & Orbital Elements for C/2011 L4 PanSTARRS

Supplement Epoch 2012 Sept. 30.0 TT = JDT 2456200.5
T 2013 Mar.10.1668 TT
IAU MPC

q 0.301569	(2000.0)	P	Q
z -0.000180	Peri. 333.6479	+0.4100486	+0.1005077
+/-0.000001	Node 65.6662	+0.9078330	+0.0506433
e 1.000054	Incl. 84.2080	-0.0877462	+0.9936465

From 1309 observations 2011 May 21-2013 Jan. 4, mean residual 0".4.

Epoch
The epoch of osculation of the orbital elements.

M
Mean anomaly at the epoch.

T
Date of perihelion passage.

n
Mean daily motion (in degrees/day).

a
Semimajor axis (in AU).

z
Reciprocal semimajor axis (in 1/AU).

q
Perihelion distance (in AU).

e
Orbital eccentricity.

P
Orbital period (in years).

Peri.
The J2000.0 argument of perihelion (in degrees).

Node
The J2000.0 longitude of the ascending node (in degrees).

Incl.
The J2000.0 inclination (in degrees).

P and Q vectors
The vectors P and Q are an alternate form of representing the angular elements Peri., Node and Incl. For an explanation of how to convert between the two sets of quantities you are referred to standard celestial mechanics textbooks.

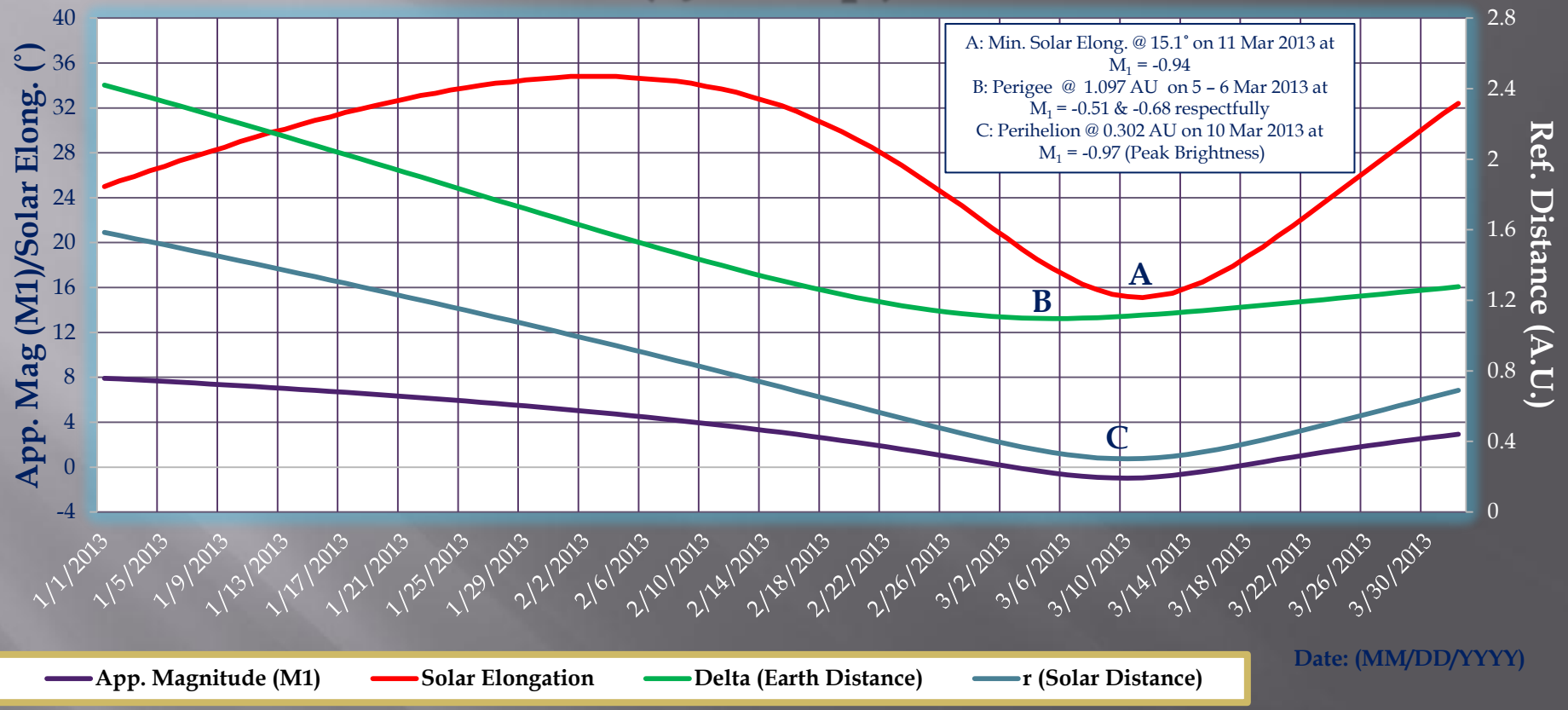
U
Uncertainty parameter.

Not all of these quantities will be given with every orbit, but enough information will always be given to describe an orbit completely.
The following two quantities are not orbital elements but are generally given with them.

H
Absolute visual magnitude. A table converting H to a diameter is available.

G
Slope parameter. For an explanation of the H,G magnitude system refer to *Application of Photometric Models to Asteroids*, Bowell et al., in *Asteroids II*, 524-556 (published by the University of Arizona Press, ISBN 0-8165-1123-3) and the references therein.

Prediction Graph on the Brightness, Solar Elongation, and Distances for C/2011 L4 (PanSTARRS) (1 Jan - 1 Apr) 2013

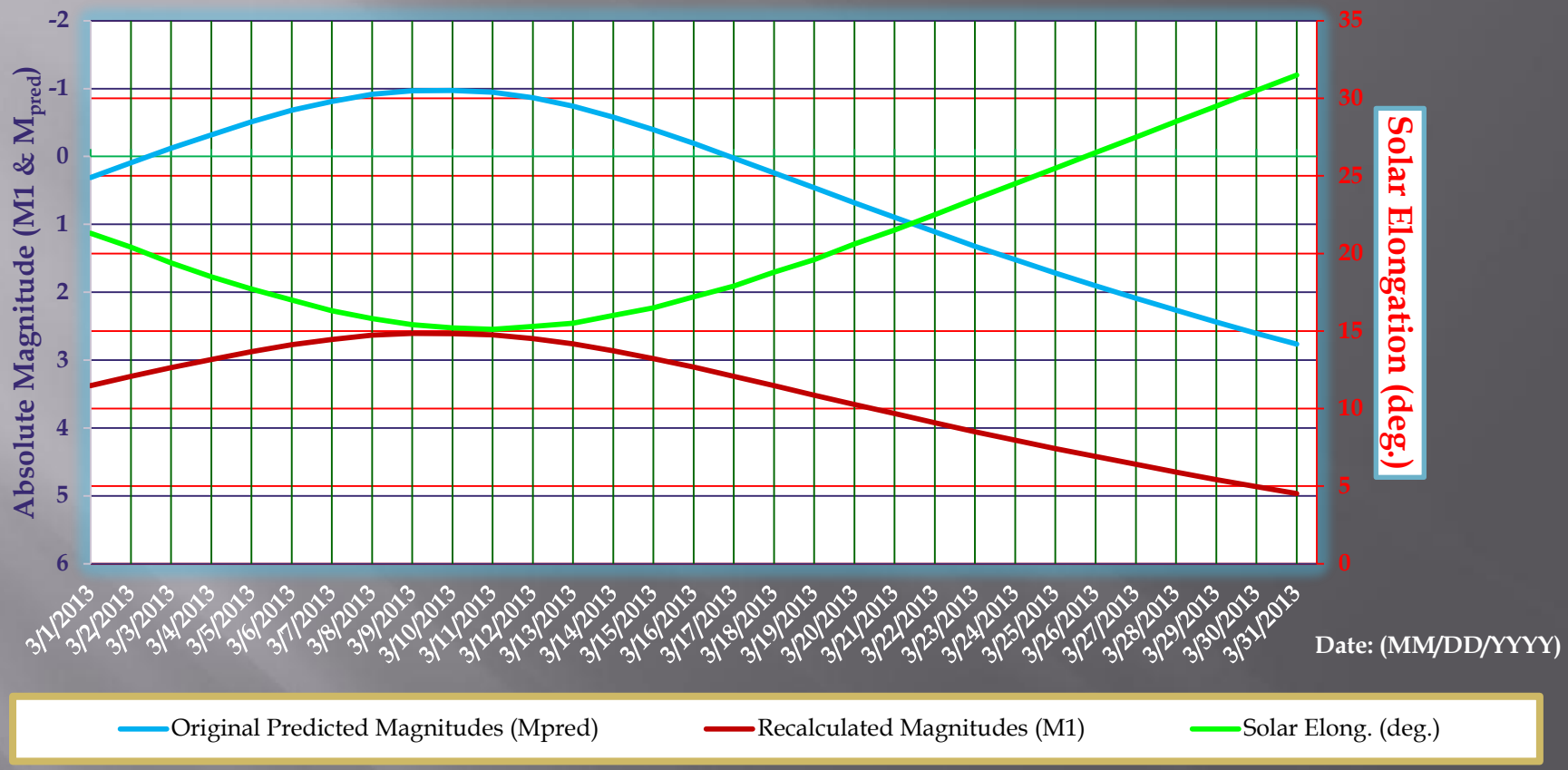


This chart indicates projections & predictions for perigee, perihelion, and maximum apparent brightness in conjunction with solar elongation based on the comet elements calculated for C/2011 L4 (PanSTARRS) during a time period spanning the first 3 months of 2013!
The ref. distance shows the change in distance of the comet with respect to both the Earth & the Sun in A.Us!

Basic Definitions:
Perigee – Closest Distance to Earth
Apogee – Furthest Distance from Earth
Perihelion – Closest Distance to the Sun

Late Winter – March 2013

Predicted and Recalculated Abs. Magnitudes and Solar Elongation values for Comet C/2011 L4 (PanSTARRS) during the period (1 - 31) March 2013



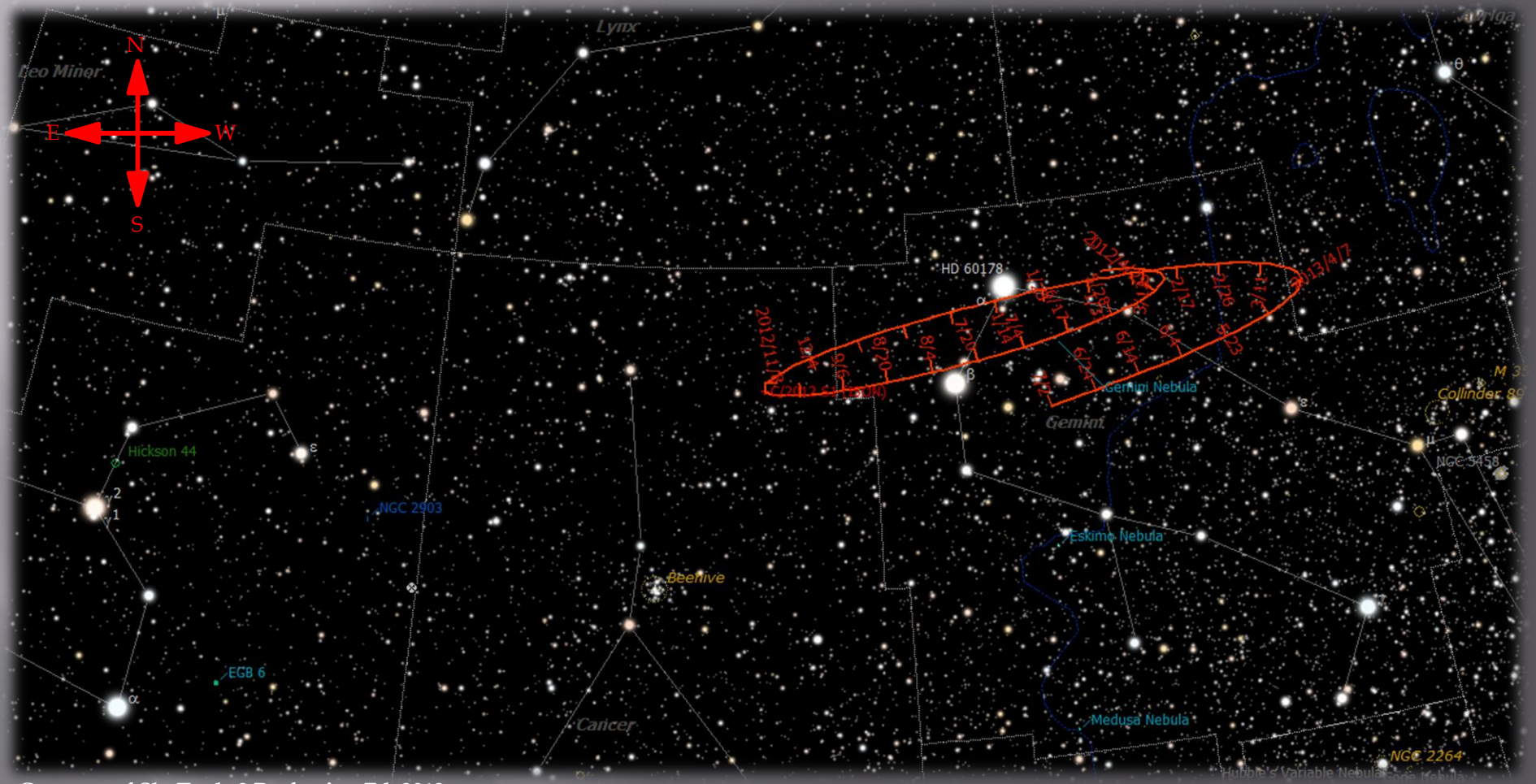
This chart indicates projections & predictions for perigee, perihelion, and maximum apparent brightness in conjunction with solar elongation based on the comet elements calculated for C/2011 L4 (PanSTARRS) during a time period spanning the first 3 months of 2013!
The ref. distance shows the change in distance of the comet with respect to both the Earth & the Sun in A.Us!

Basic Definitions:
Perigee – Closest Distance to Earth
Apogee – Furthest Distance from Earth
Perihelion – Closest Distance to the Sun

Late Winter – March 2013

C/2012 S1 (ISON)

Figure 7: Projected path of C/2012 S1 (ISON) with an expected retrograde repeat: (1 March 2012 – 1 July 2013)!

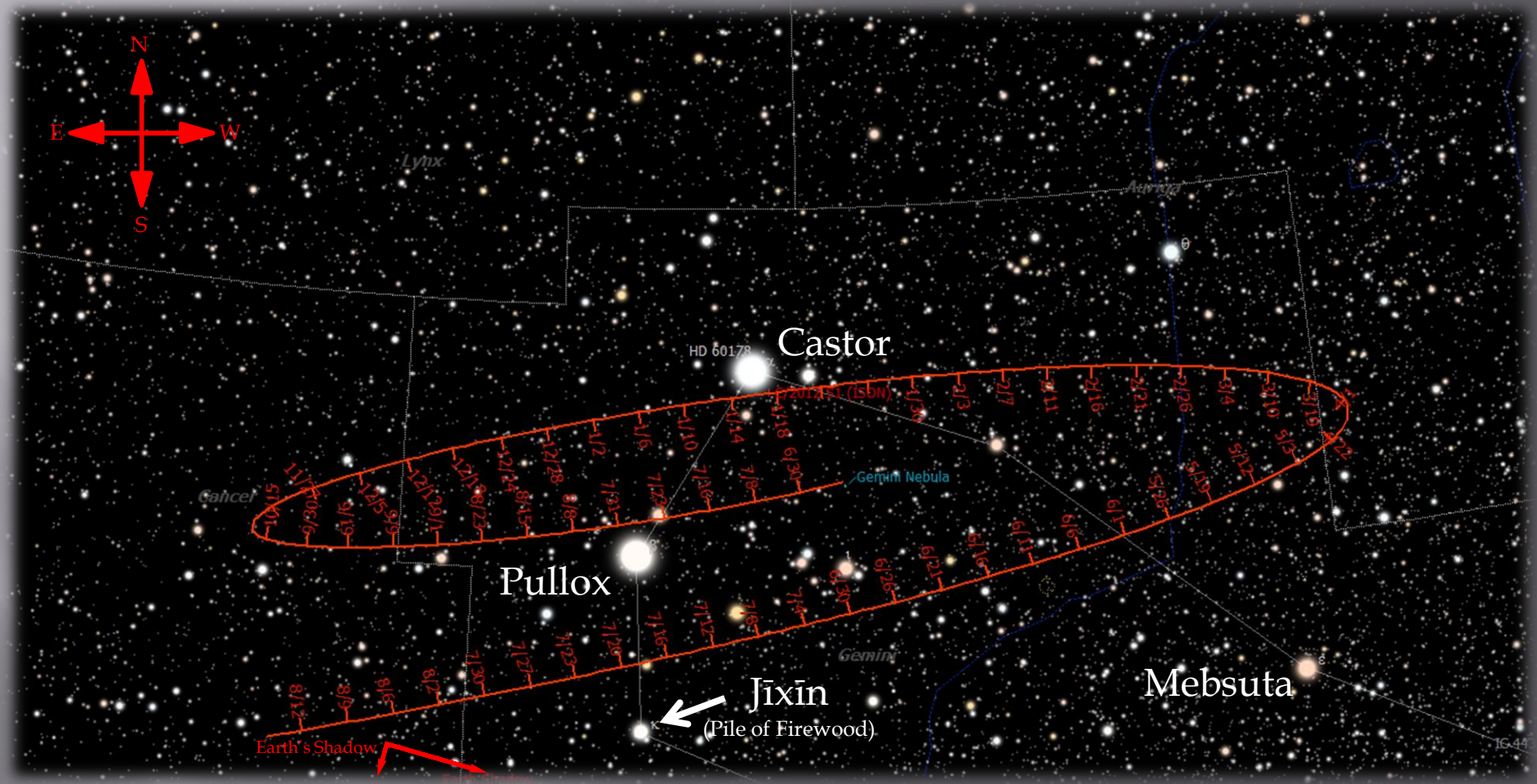


Courtesy of SkyTools 3 Profession Ed, 2012.

Late Winter – March 2013

C/2012 S1 (ISON)

Figure 8: 'Up Close' retrograde path of C/2012 S1 (ISON) (30 June 2012 – 15 Aug 2013)!



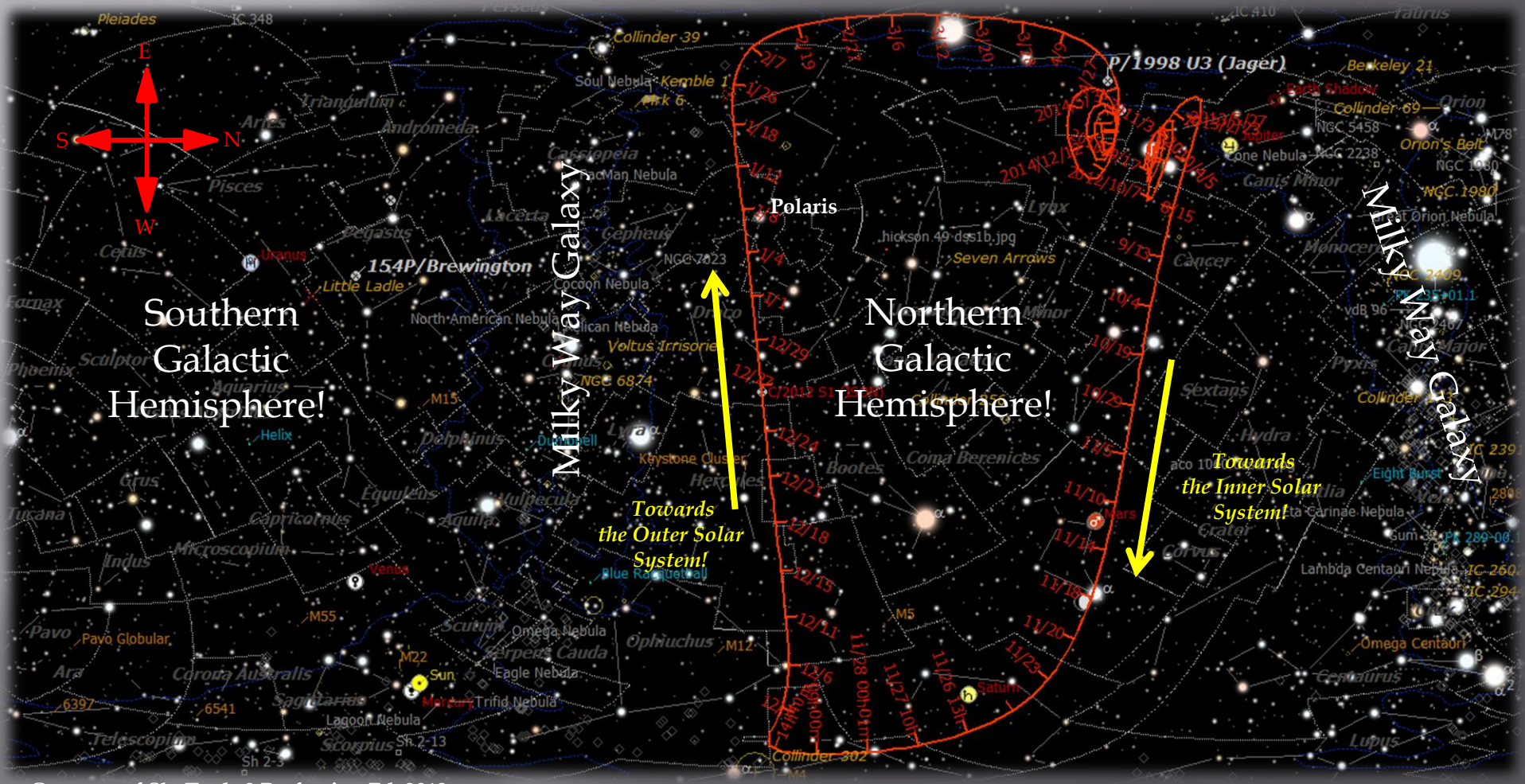
Courtesy of SkyTools 3 Profession Ed, 2012.

The project path of ISON during this retrograde sequence occurs during the time period from Nov 2012 thru Early August 2013!
It is during this period that C/2012 S1 ISON will cross the orbit of Jupiter move thru the asteroid belt and move thru the inner solar system!

Late Winter – March 2013

C/2012 S1 (ISON)

Figure 9: Projected path of the comet across the Northern Celestial Skies from 2010 - 2020!



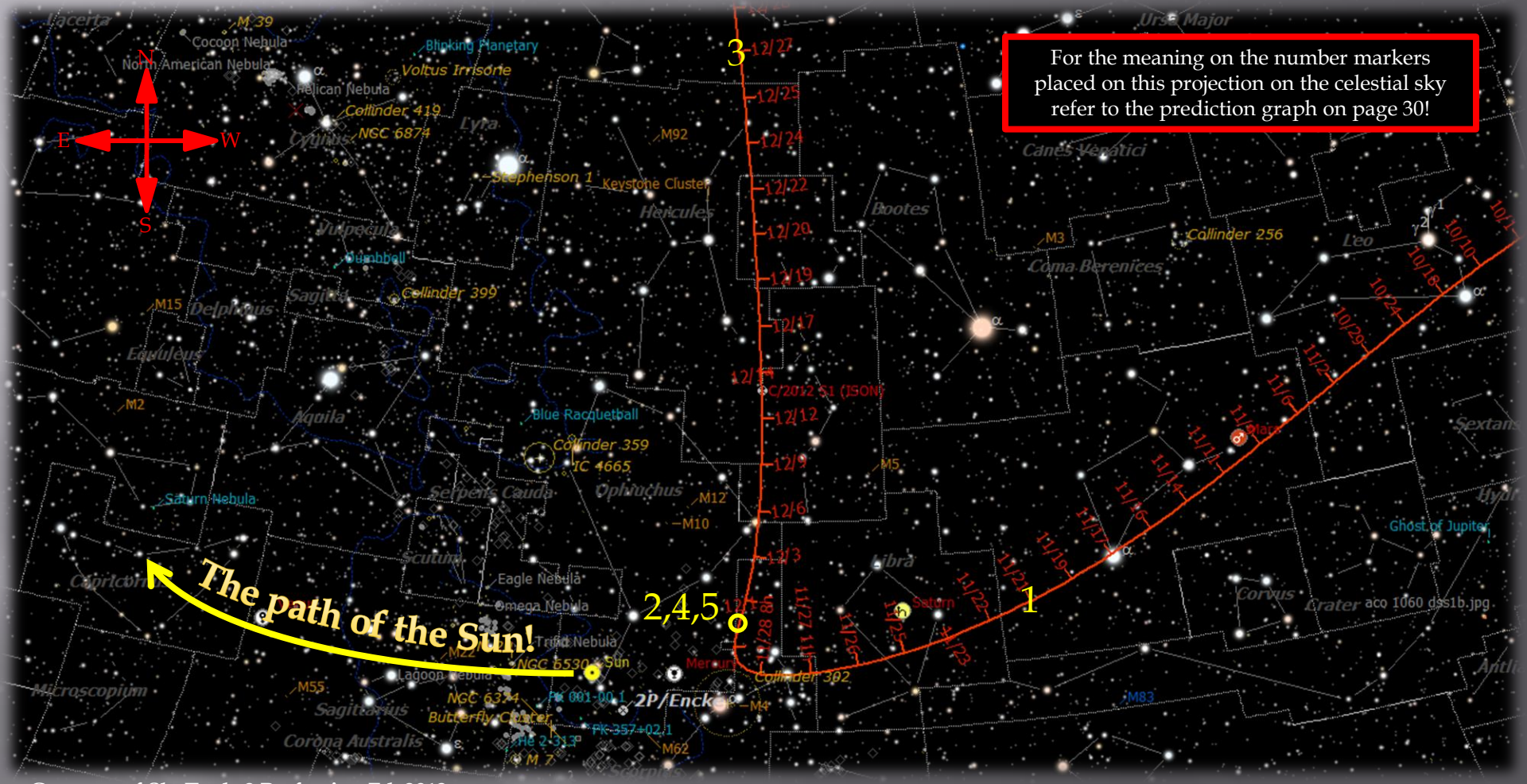
Courtesy of SkyTools 3 Profession Ed, 2012.

This is a Mercator projection map of most of the night sky for both celestial hemispheres! It shows the past and future path of comet C/2012 S1 ISON along with associated retrograde loops as it moves into and out of the inner Solar System through the 2nd decade of the 21st Century!

Late Winter – March 2013

C/2012 S1 (ISON)

Figure 10: Projected path of the comet between the Summer & Spring Skies (1Oct – 27 Dec) 2013!



Courtesy of SkyTools 3 Profession Ed, 2012.

The number indicators show celestial positions when the Comet reaches both perigees, intermediate apogee, perihelion, and maximum apparent brightness (See the Prediction graph on page 16)!

Late Winter – March 2013

Ephemeris & Orbital Elements for C/2012 S1 ISON

Supplement Epoch 2012 Sept. 30.0 TT = JDT 2456200.5
T 2013 Nov. 28.8394 TT
IAU MPC

q 0.012521	(2000.0)	P	Q
z -0.000142	Peri. 345.4975	+0.3139615	+0.5214934
+/-0.000006	Node 295.7567	-0.7595010	-0.3634939
e 1.000002	Incl. 61.7529	-0.5697249	+0.7719565

From 1418 observations 2011 Dec. 28-2013 Jan. 12, mean residual 0".4.

Epoch
The epoch of osculation of the orbital elements.

M
Mean anomaly at the epoch.

T
Date of perihelion passage.

n
Mean daily motion (in degrees/day).

a
Semimajor axis (in AU).

z
Reciprocal semimajor axis (in 1/AU).

q
Perihelion distance (in AU).

e
Orbital eccentricity.

P
Orbital period (in years).

Peri.
The J2000.0 argument of perihelion (in degrees).

Node
The J2000.0 longitude of the ascending node (in degrees).

Incl.
The J2000.0 inclination (in degrees).

P and Q vectors
The vectors P and Q are an alternate form of representing the angular elements Peri., Node and Incl. For an explanation of how to convert between the two sets of quantities you are referred to standard celestial mechanics textbooks.

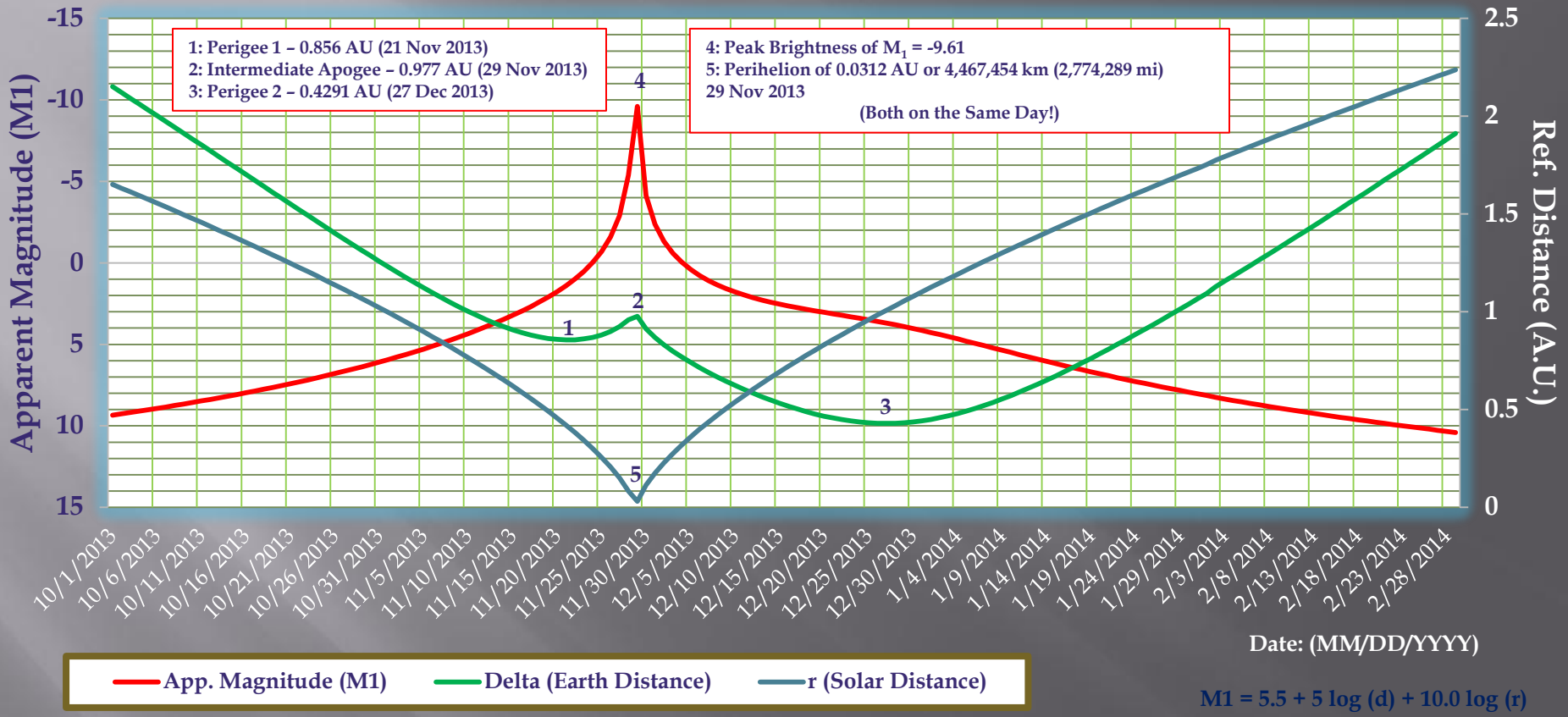
U
Uncertainty parameter.

Not all of these quantities will be given with every orbit, but enough information will always be given to describe an orbit completely.
The following two quantities are not orbital elements but are generally given with them.

H
Absolute visual magnitude. A table converting H to a diameter is available.

G
Slope parameter. For an explanation of the H,G magnitude system refer to *Application of Photometric Models to Asteroids*, Bowell et al., in *Asteroids II*, 524-556 (published by the University of Arizona Press, ISBN 0-8165-1123-3) and the references therein.

Prediction Chart of Brightness & Distance for C/2012 S1 ISON (1 October 2013 - 1 March 2014)



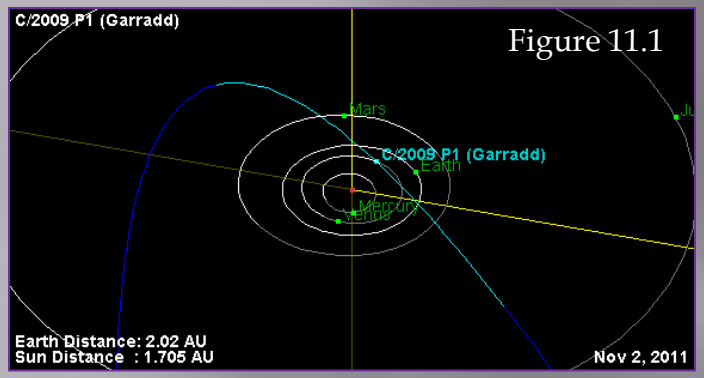
$M1 = 5.5 + 5 \log (d) + 10.0 \log (r)$

This chart indicates projections & predictions for apogee, perigee, perihelion, and maximum apparent brightness based on the comet elements calculated for C/2012 S1 during the period between Autumn 2013 & Early Spring 2014 over a period lasting 5 months!
The ref. distance shows the change in distance of the comet with respect to both the Earth & the Sun in A.Us!

Basic Definitions:
Perigee – Closest Distance to Earth
Apogee – Furthest Distance from Earth
Perihelion – Closest Distance to the Sun

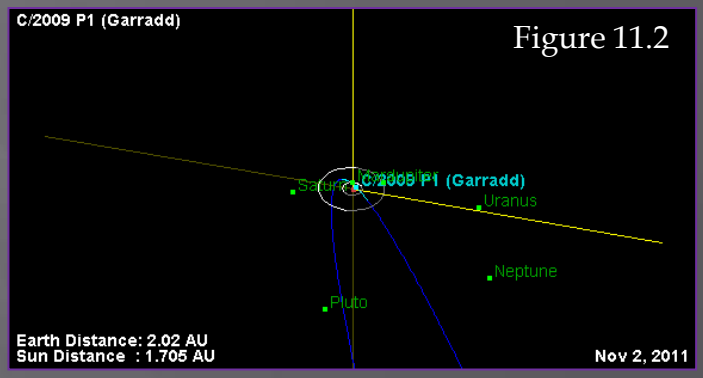
Late Winter – March 2013

Overview of the Orbital Differences for Comets!



P – Periodic Comets

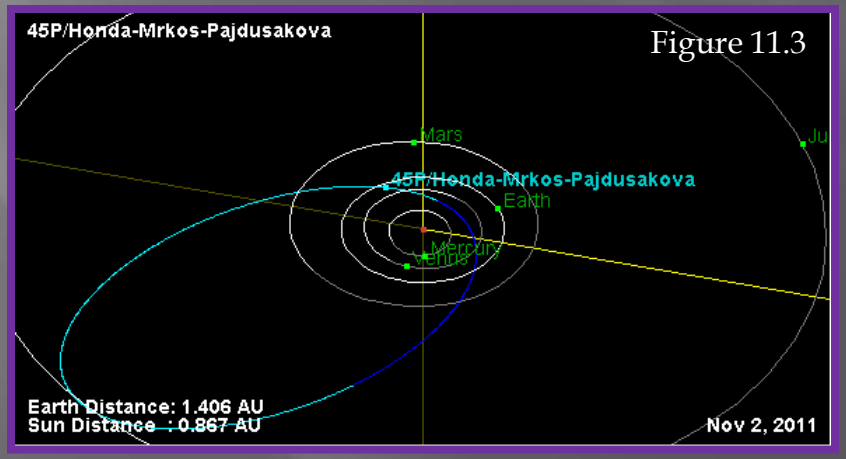
C – Non Periodic Comets



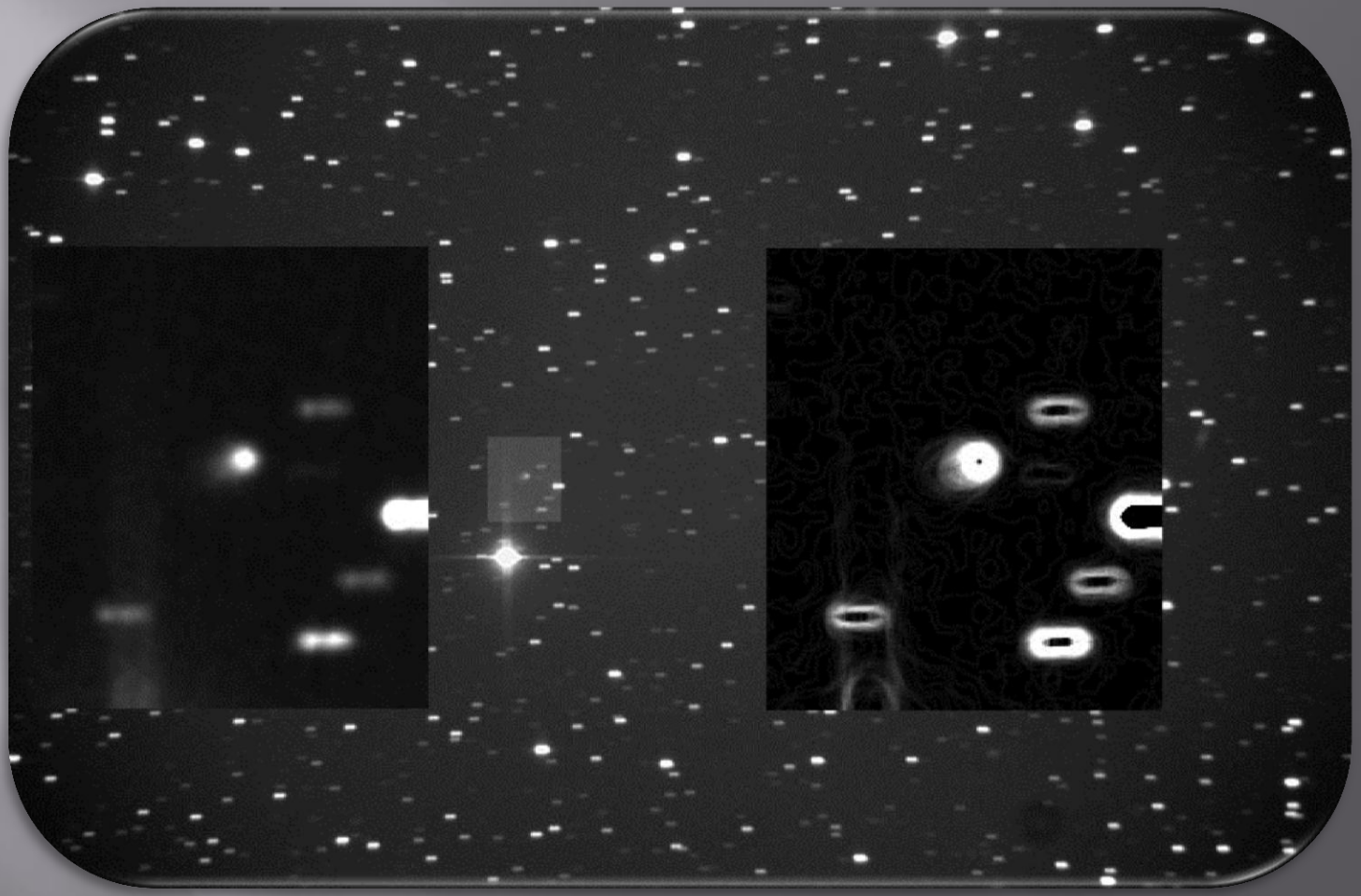
Comet Garradd is the perfect example of a non – periodic comet! The path is hyperbolic in nature. Comet 45P/Honda – Mrkos – Pajdusakova however is the perfect example of a periodic comet which is elliptical in nature.

Figures 11.1 & 11.2 are of Comet C/Garradd 2009 P1 and Figure 11.3 below shows the orbit of 45P.

All images were obtained from the JPL Solar System Dynamics/Small Body Database Browser . Courtesy of NASA/JPL/CalTech



Late Winter
March 2013



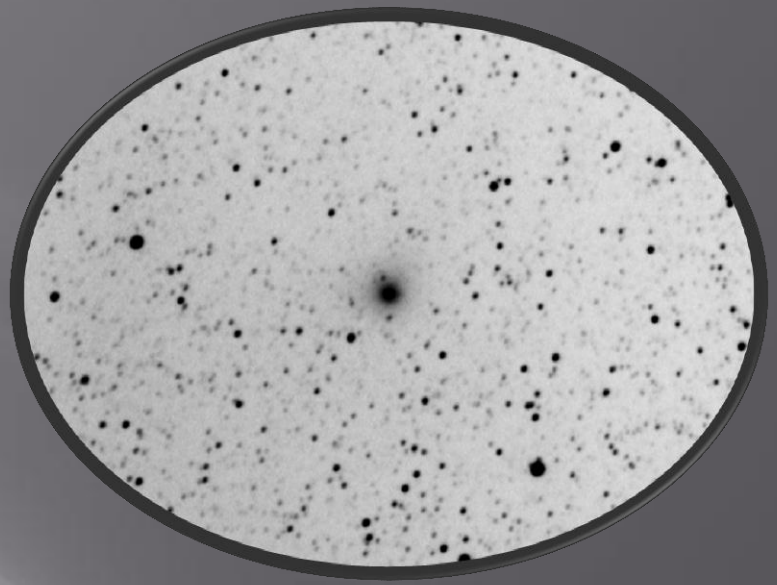
C/2012 S1 (ISON)
(16 December 2012)

Possibly 'The Great Comet of 2013' ???

Late Winter – March 2013

The Predominant Comets for Late Winter 2013 Continued

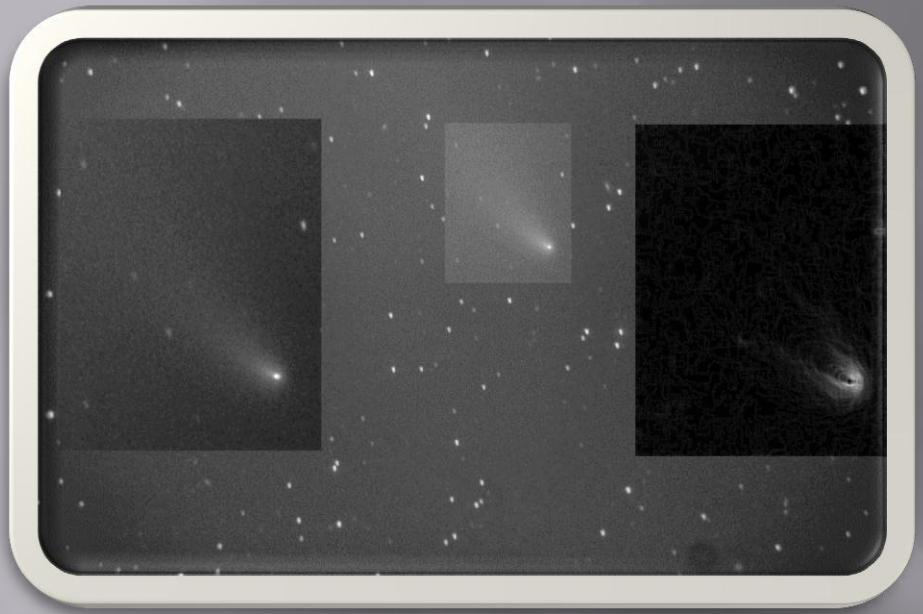
C/2012 F6 (LEMMON)
(2 February 2012)
© John Drummond



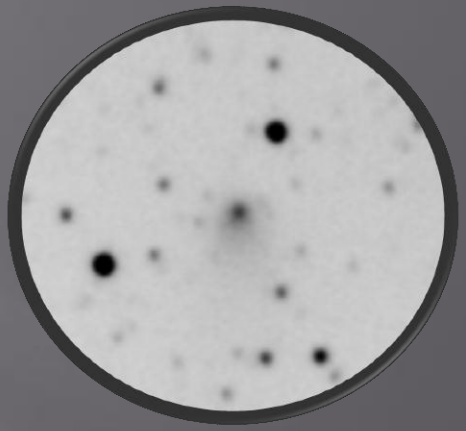
Pons – Gambart
273P/2012 V4
(17 January 2013)
© Hidetaka Sato

C/2012 T5 (Bressi)
(31 January 2013)
© Jose Francisco Hernandez

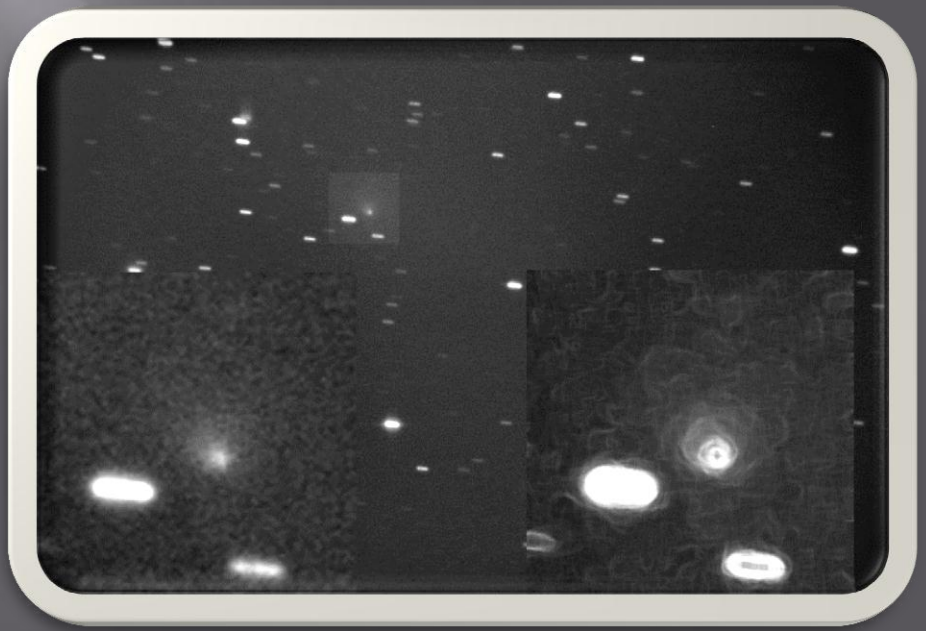
The Predominant Comets for Late Winter 2013 Continued



C/2012 K5 (LINEAR)
(31 January 2013)
© Jose Francisco Hernandez



C/2011 R1 (McNaught)
(17 January 2013)
© Hidetaka Sato



McNaught - Russell
262P/2012 K7
(31 January 2013)
© Jose Francisco Hernandez

C/2011 L4 PanSTARRS
12 February 2013
©Louis Argerich, Buenos Aires

Note: The comet is the 'fan – shaped' object to the upper left with an Iridium flare striking across the sky (upper right)!

C/2011 L4 PanSTARRS
12 February 2013
©Louis Argerich, Buenos Aires

Note: Toggle back and forth between pages 35 & 36 to see the on and off appearance of the constellations in the morning sky!

Late Winter – March 2013

C/2011 L4 PanSTARRS (1 April 2013)
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Late Winter – March 2013