The Professor Comet's Report

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Lovejoy emerging from the Corona
Dec 16 2011
Courtesy of SDO/NASA

© Dan Burbank – NASA Astronaut
Mission Commander, ISS Expedition 30
Earth Orbit – ISS, 22 December 2011.

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!

New Year – 11 Jan 2012

The Current Status of the Predominant Comets for Jan 2012!

Comets	Designation (IAU – MPC)	Orbital Status	Magnitude Visual	Trend	Observation (Range in Lat.)	Constellations (Night Sky Location)	Visibility Period
Garradd	2009 P1	C	6.5 - 7.0	Bright	90°N – 5°N	Eastern Region of Hercules *(Moving north, northwest &currently E of the Keystone!)*	Early Evening & Early Morning
Lovejoy	2011 W3	C	9	Fading	5°S – 50°S	***Wide motion across the southern celestial hemisphere: Circinus to Caelum***	All Night
Gibbs	2011 A3	C	*9.7	Steady	N/A	Solar Conjunction	N/A
Gehrels 2	78P	P	*10.1	Steady	70°N – 45°S	***Moving eastwards in the S and E regions of Pisces***	Best Evening
Hill	2010 G2	C	11 – 11.5	Fading	70°N – 50°S	Moving SW thru the E region of Cetus & then SE in the W region of Eridanus	All Evening
Giacobini - Zinner	21P	P	11.5	Bright	N/A	Poor Elongation	N/A
Honda – Mrkos – Pajdusakova	45P	P	12	Fading	55˚N - 40˚S	***Undergoing retrograde motion in Virgo (Expect eastward motion to begin during the evening of Jan 31/Feb 1 2012)***	Morning
Arend - Rigaux	49P	P	12	Fading	70°N – 40°S	*Moving NE from NW region of Virgo thru the western region of Coma Berenices*	Best Morning
SWAN	2011 Q4	C	13	Fading	80°N – 15°S	**Traveling NW from Boötes to Canes Venatici**	Best Morning
Schwassmann Wachmann 1	29P	P	~13	Varying Brightness	45°N – 50°S	Undergoing retrograde motion between Virgo and Corvus	Early Morning

*Visual Magnitude determined from last known field observation report!

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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	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	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!)*
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!)*

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 the New Year 2012!

As the new year of 2012 has now come upon us, so has been those surprises in certain comets and comet discoveries tracing back to the latter months of the 2011; I am referring to 2009 P1 Garradd and 2011 W3 Lovejoy which has come to be known as 'The Great Christmas Comet of 2011'! First one is Comet Garradd which has been reported as maintaining a stable brightness level at a visual magnitude ranging from 6.5 to 7.0, but more often seen at in the mid to lower 6th mag range. The comet is still moving north along the eastern half of the Hercules constellation heading in a general north, northwest direction towards the constellation of Leo gliding along the eastern edge of the keystone. Expect Garradd's coma to have a diameter between 6 – 9 arcminutes as reported in the latest field observation reports which gives it angular surface area about 3.7% - 8.4% to that of an average full Moon. Garradd's tail has also been also been seen in optical instruments as small as a pair of 8x40 binoculars with a length up to 1.1 degrees at a PA of 50˚. It's progression towards the north circumpolar, night sky with an initial rate of 46.2 arcminutes (0.77˚) per hour starting on Jan 1 2012 and will gradually increase to about 105 arcminutes (1.75˚) per hour by month's end! The comet has already passed the Sun at perihelion last month and now comes the successive prediction of reaching perigee with the Earth at a minimum distance of 1.266 AU or 117,611,400 mi (189,236,743 km) during the period of 4 – 5 March 2012. Upon this particular time period C/2009 P1 will have reached the southern region of Ursa Minor 'The Little Dipper' at a northern declination of 68.5˚ - 69˚ N and only several degrees from the stars Kocab (β UMi) and Pherkad (γ UMi) during the first week of March.

New photometry readings still predict that this comet will succeed expectations in brightness with a possible visual magnitude of 6.0 making it a better opportunity for naked eye comet hunting for the early half of 2012. Comet Garradd will eventually reach a maximum northern declination of 70˚ 41′ the evening of March 11 2012 while crossing the boundary between Ursa Minor and the western tail of Draco and then start a SW march back into towards the southern skies while moving thru Ursa Minor thru all of late March and mid April. During the rest of winter and well into the month of March expect comet Garradd to suipass a nightly progression of 2″/min starting Feb 5 to over 3″/min by Feb 24. The night of its closest approach to Earth the comet will swing by at 3.3″/min. It's maximum progression across the northern night sky will peak at 3.33″/min during the evenings of 7 – 9 March and then it will move further from the Earth and it continues its headlong movement out of the inner solar system into the icy regions beyond the outer planets!

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A Synopsis of the Predominant Comets for the New Year 2012!

The remaining comet of recent interest has been the unexpected discovery of Comet C/2011 W3 Lovejoy which is the third comet to be discovered by Australian comet hunter and amateur Astronomer Terry Lovejoy. C/2011 W3 is his third discovery: the other two are named C/2007 E2 and C/2007 K5 discovered on March and May 2007 respectfully. This latest discovery of Terry Lovejoy has obtained using a C8 SCT at f/2.1 with a QHY9 CCD camera on the night of Nov 27 2011 making it the first discovery of a group of cometary bodies called the Kreutz sungrazers in 41 years! The last Kreutz sungrazer to be discovered or reported falling into the Sun was Comet C/1970 K1 White – Ortiz – Bolelli discovered on the evenings of 18, 21 May 1970 also in the southern hemisphere. Comet Lovejoy was initially discovered as a 13th magnitude fuzzy object moving at tremendous speed towards the Sun, but final confirmation came from a team working at the Mt. John University observatory in New Zealand at their 1 meter 'Dall – Kirkham reflector' McLellan telescope on Dec 1 2011. The IAU Minor Planet Center certified it's discovery the following day, Dec 2 and on that day was crowned 'The Great Birthday Comet of 2011' in honor of the 16th anniversary of the launch of SOHO! The comet has been observed by the Stereo twin spacecrafts, SDO, SOHO, and a variety of other observatories and observers since it's pervios voyage inside the solar corona getting to within 140,000 km or 86,940 mi of the Solar photosphere at 00:17 UTC on Dec 16 2011. One fragment of the comet was confirmed by Chinese, amateur astronomer Zhijian Xu and later observed by other space observatories in solar orbit.

Comet Lovejoy was a fantastic comet to observe for those living in the southern hemisphere with a maximum brightness that was reported slightly better than -4 visual magnitude. Lovejoy upon its ascending trajectory from the Sun reported the comet as having a bar – shaped central brightness within the nucleus accompanied by a very bright array of a tail. In the weeks prior to its perihelion with the Sun it's tail reached a maximum angular length the varied in reports from 30˚ - 40˚; no reports of the false nucleus were made as it's visual magnitude was dimmer than 19. The comet's survival from successfully passing through the multi-million degree, solar corona has forced a reevaluation of the size of the nucleus to 500m (1600 ft) from original estimates of 100 – 200m across. However, the solar corona has likely burned off most of the nucleus's mass, but not enough to where reported brightness values range from -0.8 to -1.2 by Mr. Lovejoy the following night of 17 Dec 2011. Comet Lovejoy became once again an observable naked eye object on the nights of Dec 21 – 22, 2012 when it had faded to 4th magnitude. It has now faded to magnitude values dimmer than 8.5 and requires a moderate – size telescope for further observations from now and well into February. Since the comet has a very elliptical orbit that takes it well south of the solar plane, it is likely that the comet will return again sometime at a undetermined future date since it is unaffected by any gravitational perturbation from any of the planets in our solar system. However, any future return of this comet towards the Sun may result in its eventual destruction either by complete disintegration due to the horrific conditions that naturally occur within the Solar Corona or by a direct impact with the photosphere!

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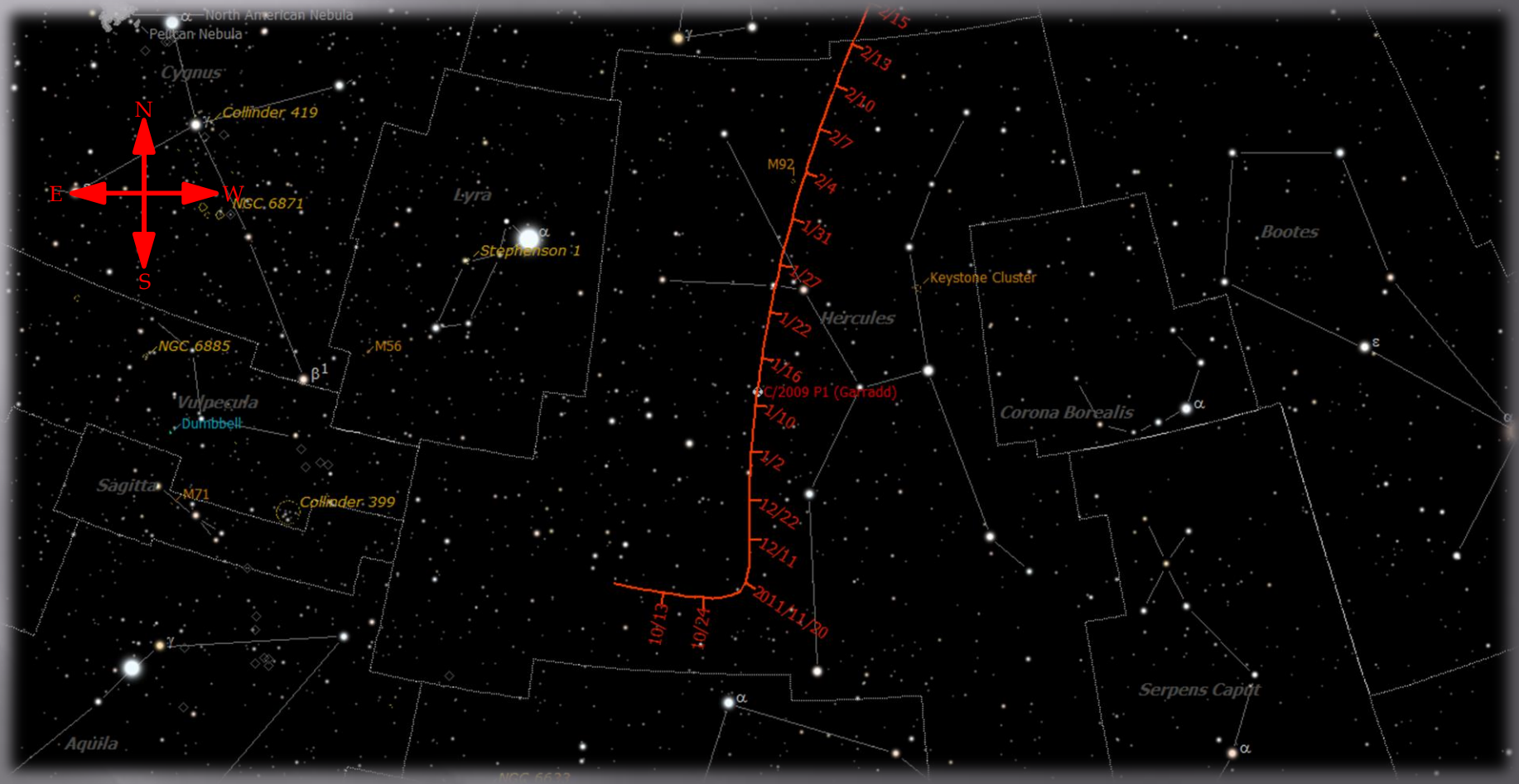
C/2009 P1 Garradd

Figure 1: Garradd P1 projected path across the Summer/Spring Constellations thru mid - Feb 2012!



Courtesy of SkyTools 3 Profession Ed, 2012.

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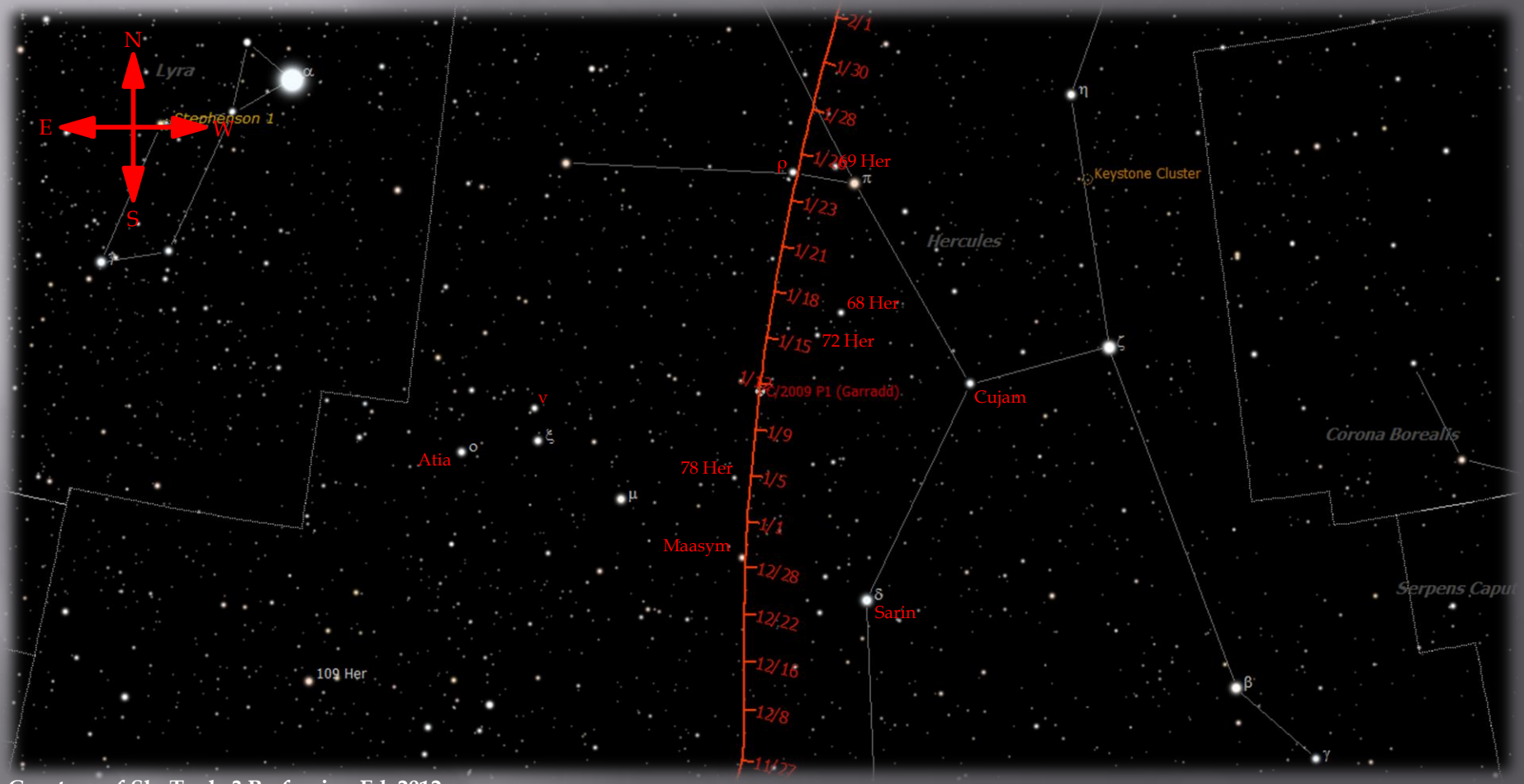
C/2009 P1 Garradd

Figure 2: Close up of Garradd P1 projected path from 11 Nov 2011 – 2 Feb 2012!



Courtesy of SkyTools 3 Profession Ed, 2012.

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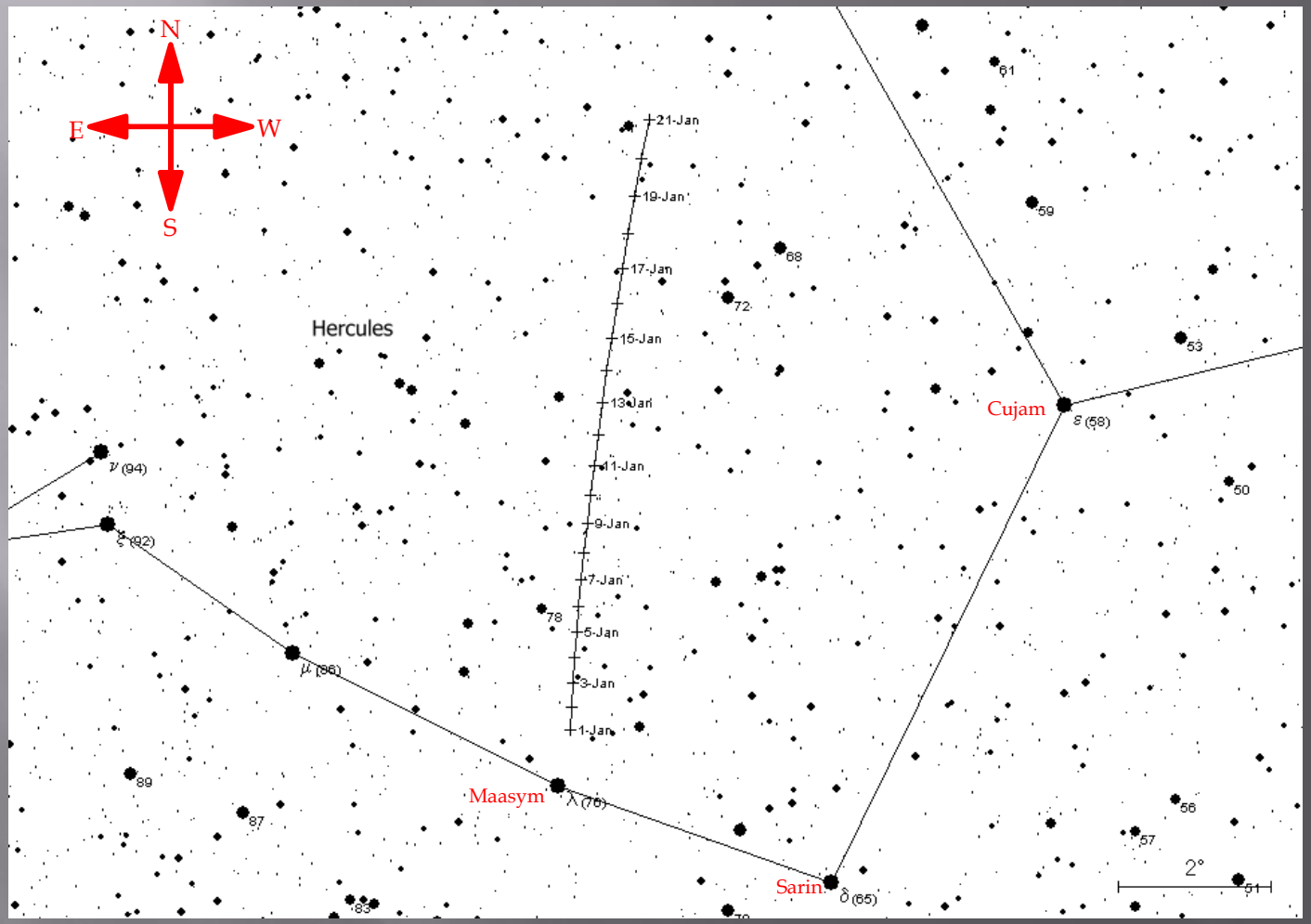
C/2009 P1 Garradd

Figure 3: Close up of Garradd P1 projected path from 1 - 21 Jan 2012!



Courtesy of Winnie's Comet Pages, 2012.

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Bright Stars in Hercules along the Winter path of Comet Garradd

Star	Common Designations	Vis. Mag	Classification	Stellar Attributes	R.A. (2000)	Dec (2000)	Distance (lys)
Cubitum Sinistrum Ingeniculi	Mu (μ) Her 86 Her, HR 6623, HD 161797	3.42	G5 IV	None	17h 46m 27.3s	+27˚43′05″	27
Xi (ξ) Her	92 Her, HR 6703, HD 163993	3.87	G8 III	Variable Type: SRD	17h 57m 46.0s	+29˚14′52″	140
Atia	Omicron (ο) Her, 103 Her, HR 6779, HD 166014	3.85	B9.5 V	Variable Type: GCAS	18h 7m 32.6	+28˚45′45″	350
Sarin	Delta (δ) Her, 65 Her, HR 6410, HD 156164	4.96/5.18	A3 IV/F0 V	Double Star System	17h 15m 1.9s	+24˚50′21″	75
Cujam	Epsilon (ε) Her, 58 Her, HR 6324, HD 153808	3.92	A0 V	None	17h 0m 17.3s	+30˚55′35″	160
Pi (π) Her	67 Her, HR 6418, HD 156283	3.18	K3 II	Suspected Variable	17h 15m 2.8s	+36˚48′33″	370
Rho (ρ) Her	75 Her, STF 2161, HR 6484, HD 157778	5.40	B9.5 III/A0 V/K0 V	Triple Star System	17h 23m 40.7s	+37˚08′49″	401
68 Her	u Her, HR 6431, HD 156633	4.69	B1.5 Vp	Variable Type: EA+SD	17h 17m 19.6s	+33˚06′00″	860
72 Her	HR 6458, HD 157214, SAO 65963	5.39	G1 V	Suspected Variable	17h 20m 39.7s	+32˚27′51″	47
Nu (ν) Her	94 Her, HR 6707, HD 164136	4.43	G8 III	Variable Type: SRD	17h 58m 30.1s	+30˚11′21″	800
69 Her	HR 6436, HD 156729, SAO 65921	4.66	A2V	Suspected Variable	17h 17m 40.3s	+37˚17′30″	180
78 Her	HR 6533, HD 159139, SAO 85182	5.66	B9 V	None	17h 31m 49.6s	+28˚24′27″	270
Maasym	λ Her, HR 6526, HD 158899	4.41	K3.5 III	Suspected Variable	17h 30m 44.3s	+26˚06′39″	370

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IAU MPC Ephemeris data for C/2009 P1 Garradd (December 2011):

Date	CDT/CST	R.A. (J2000)	Decl.	Delta	r	El.	Ph.	M1	% Fore.	Sky Motion		Moon Phase	Moon Mag.
	h m s									"/min	P.A.	(0.00 – 1.00)	(Visual)
2012 01 01	180000	17 30 03.6	+27 03 51	1.928	1.556	53.3	30.5	7.3	49	0.77	355.8	0.55	-11.21
2012 01 02	180000	17 29 59.0	+27 22 30	1.918	1.557	53.9	30.7	7.3	49	0.79	355.4	0.64	-11.46
2012 01 03	180000	17 29 53.7	+27 41 39	1.907	1.558	54.5	30.9	7.3	49	0.81	355.1	0.73	-11.68
2012 01 04	180000	17 29 47.7	+28 01 20	1.896	1.559	55.2	31.2	7.3	48	0.83	354.8	0.81	-11.87
2012 01 05	180000	17 29 40.9	+28 21 33	1.885	1.561	55.8	31.4	7.3	48	0.86	354.4	0.88	-12.02
2012 01 06	180000	17 29 33.3	+28 42 19	1.874	1.563	56.4	31.6	7.3	47	0.88	354.1	0.93	-12.14
2012 01 07	180000	17 29 24.8	+29 03 38	1.863	1.564	57.1	31.9	7.3	47	0.90	353.7	0.97	-12.23
2012 01 08	180000	17 29 15.3	+29 25 33	1.851	1.566	57.8	32.1	7.3	47	0.93	353.4	1.00	-12.28
2012 01 09	180000	17 29 04.9	+29 48 02	1.839	1.568	58.5	32.3	7.3	46	0.95	353.0	1.00	-12.28
2012 01 10	180000	17 28 53.3	+30 11 09	1.827	1.570	59.2	32.5	7.3	46	0.98	352.6	0.98	-12.23
2012 01 11	180000	17 28 40.6	+30 34 52	1.815	1.573	59.9	32.8	7.3	46	1.01	352.2	0.93	-12.14
2012 01 12	180000	17 28 26.6	+30 59 14	1.803	1.575	60.7	33.0	7.3	45	1.04	351.8	0.87	-11.99
2012 01 13	180000	17 28 11.4	+31 24 16	1.790	1.578	61.4	33.2	7.2	45	1.06	351.4	0.78	-11.80
2012 01 14	180000	17 27 54.7	+31 49 58	1.778	1.580	62.2	33.4	7.2	45	1.09	351.0	0.68	-11.55
2012 01 15	180000	17 27 36.6	+32 16 21	1.765	1.583	63.0	33.6	7.2	45	1.12	350.6	0.57	-11.24
2012 01 16	180000	17 27 16.8	+32 43 27	1.752	1.586	63.8	33.8	7.2	44	1.16	350.2	0.46	-10.85
2012 01 17	180000	17 26 55.4	+33 11 17	1.739	1.589	64.6	34.0	7.2	44	1.19	349.8	0.35	-10.37
2012 01 18	180000	17 26 32.2	+33 39 51	1.726	1.592	65.4	34.2	7.2	44	1.22	349.3	0.24	-9.75
2012 01 19	180000	17 26 07.0	+34 09 12	1.713	1.595	66.2	34.4	7.2	43	1.26	348.9	0.15	-8.94
2012 01 20	180000	17 25 39.8	+34 39 19	1.700	1.598	67.1	34.5	7.2	43	1.29	348.4	0.08	-7.82
2012 01 21	180000	17 25 10.4	+35 10 14	1.686	1.601	67.9	34.7	7.2	43	1.33	348.0	0.03	-6.08
2012 01 22	180000	17 24 38.6	+35 41 59	1.673	1.605	68.8	34.9	7.2	43	1.37	347.5	0.00	-2.52
2012 01 23	180000	17 24 04.3	+36 14 33	1.659	1.609	69.7	35.0	7.2	43	1.40	347.0	0.00	-3.69
2012 01 24	180000	17 23 27.3	+36 47 59	1.646	1.612	70.6	35.2	7.2	42	1.44	346.5	0.02	-6.47
2012 01 25	180000	17 22 47.5	+37 22 17	1.632	1.616	71.5	35.3	7.1	42	1.48	346.0	0.07	-7.92
2012 01 26	180000	17 22 04.6	+37 57 29	1.619	1.620	72.4	35.4	7.1	42	1.53	345.5	0.12	-8.88
2012 01 27	180000	17 21 18.4	+38 33 34	1.605	1.624	73.3	35.5	7.1	42	1.57	345.0	0.20	-9.58
2012 01 28	180000	17 20 28.7	+39 10 35	1.592	1.628	74.2	35.6	7.1	42	1.61	344.5	0.28	-10.12
2012 01 29	180000	17 19 35.2	+39 48 32	1.578	1.632	75.2	35.7	7.1	42	1.66	343.9	0.37	-10.56
2012 01 30	180000	17 18 37.8	+40 27 26	1.565	1.637	76.1	35.8	7.1	42	1.70	343.4	0.46	-10.92
2012 01 31	180000	17 17 36.1	+41 07 17	1.551	1.641	77.1	35.8	7.1	41	1.75	342.8	0.55	-11.24

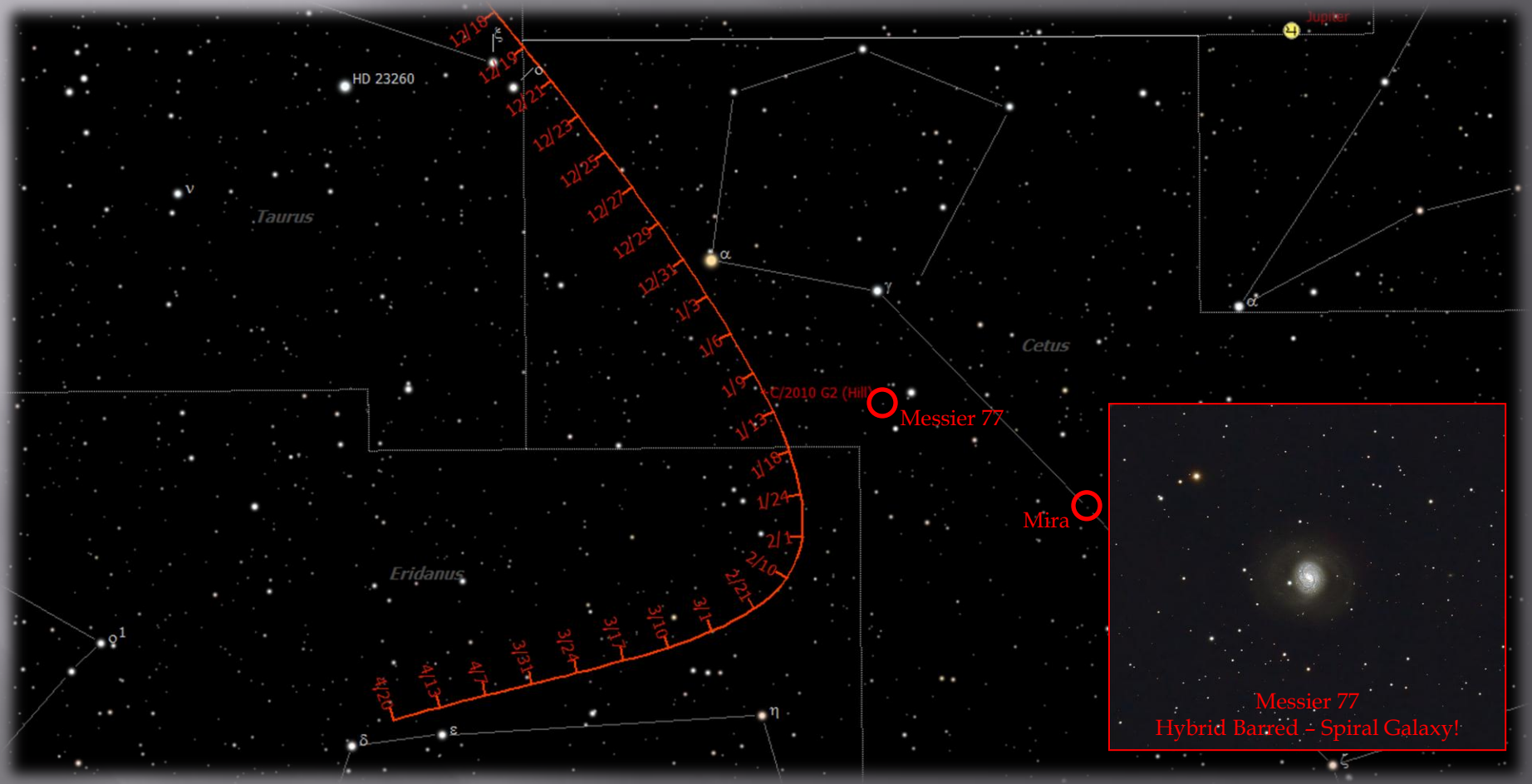
All ephemeris data is calculated based on the Geographical location of the George Observatory, SE Texas, United States.

29°22'30" N, 95°35'37" W

New Year – 11 Jan 2012

C/2010 G2 Hill

Figure 4: The projected path for comet Hill through Cetus &Eridanus for Winter/Spring 2012!



Courtesy of SkyTools 3 Profession Ed, 2012.

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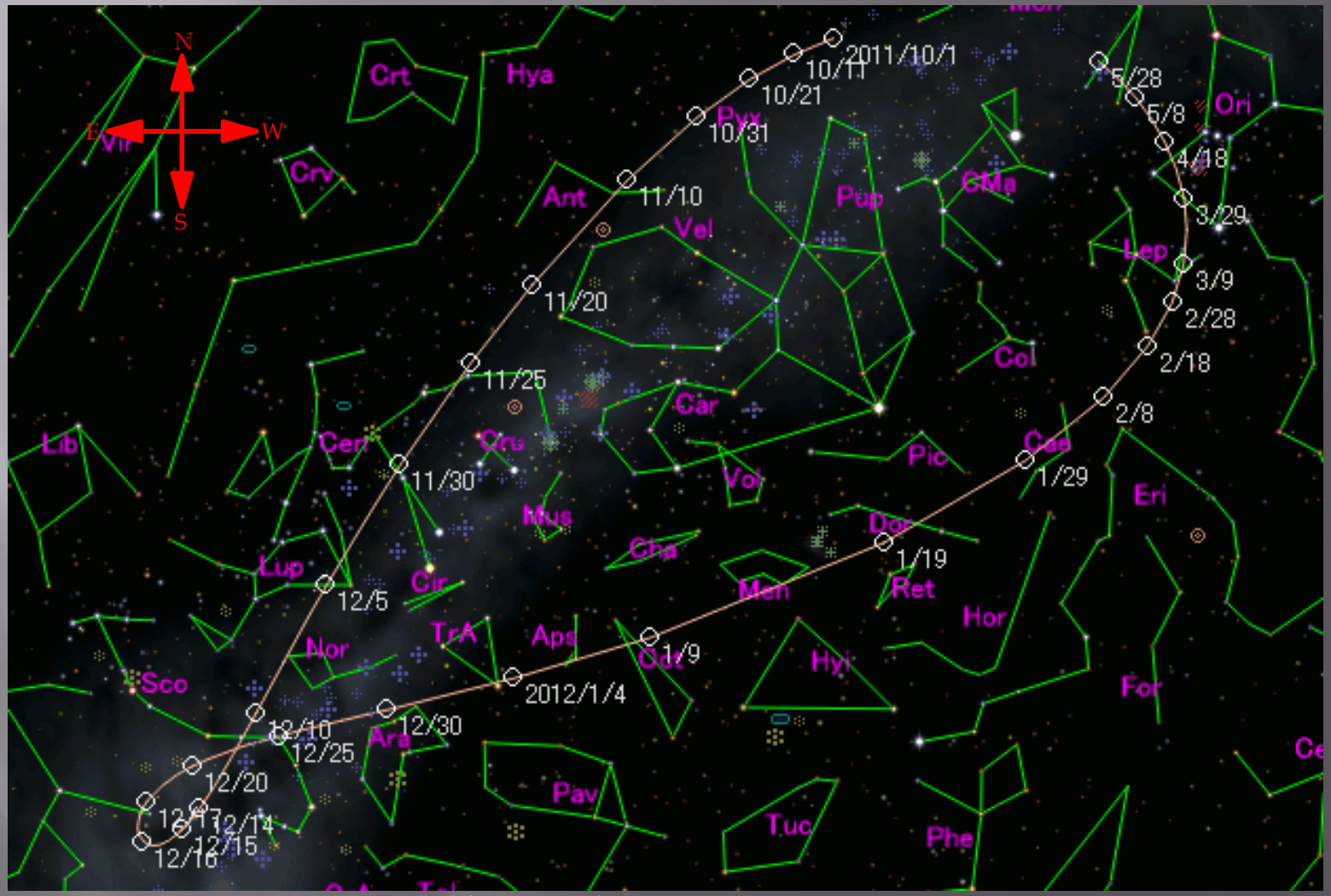
Comet Lovejoy (C/2011 W3)

Figure 5: Comet Lovejoy's retrograde path across the Southern Celestial Heavens!



Courtesy of www.aerith.net, **Seiichi** Yoshida's Comet Website 2012.

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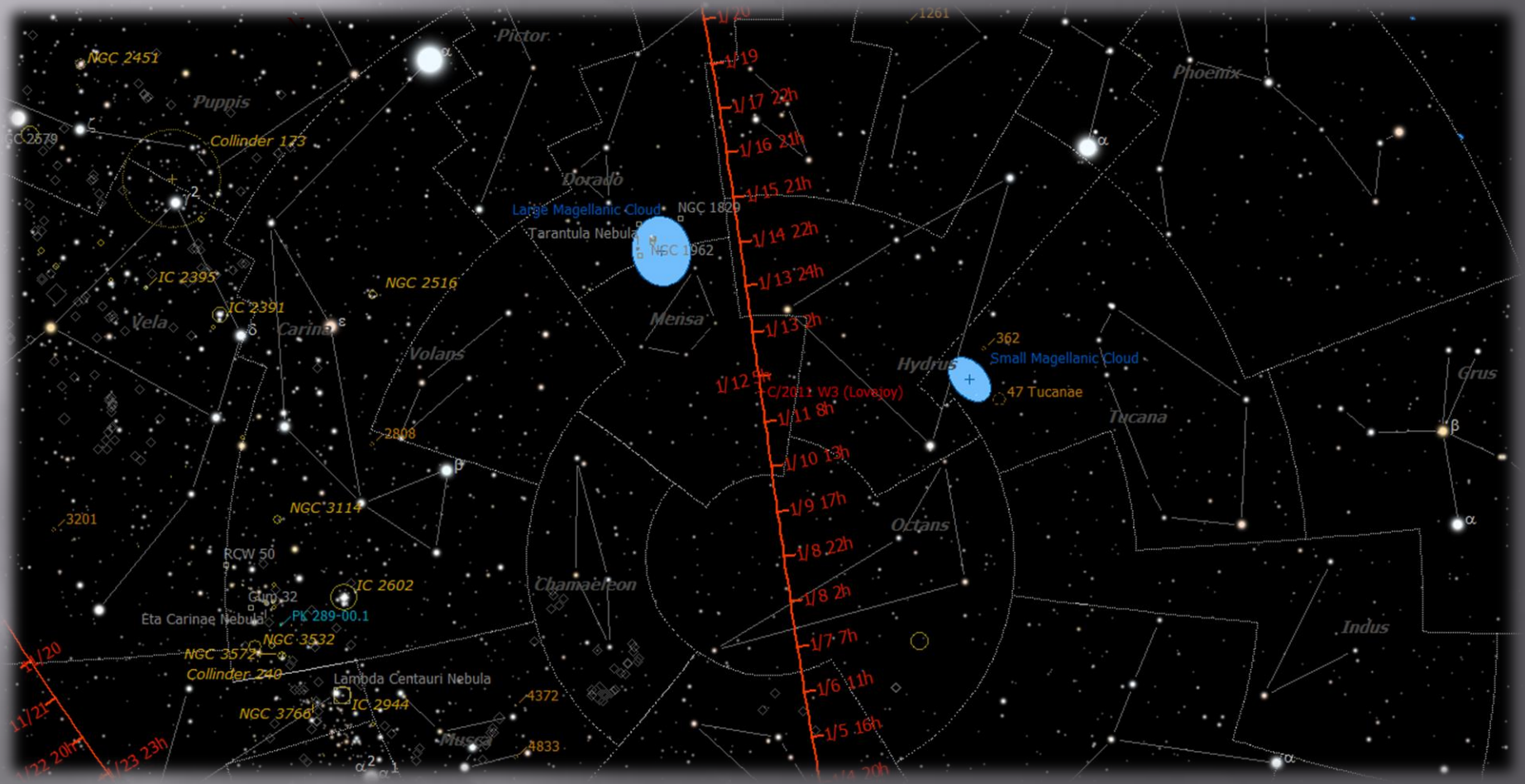
Comet Lovejoy (C/2011 W3)

Figure 6: Comet Lovejoy's path near the Magellanic Clouds from 4 – 20 Jan 2012!



Courtesy of SkyTools 3 Profession Ed, 2012.

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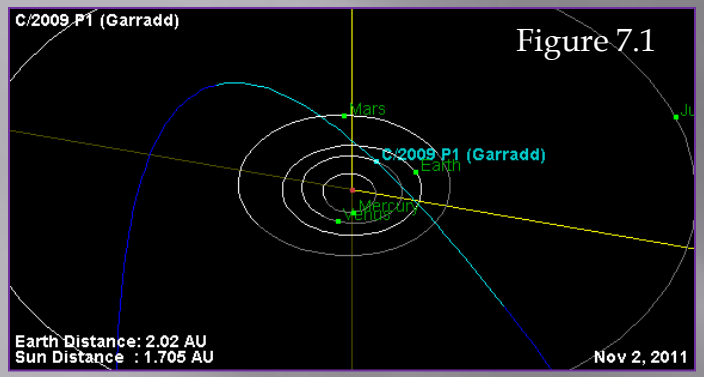
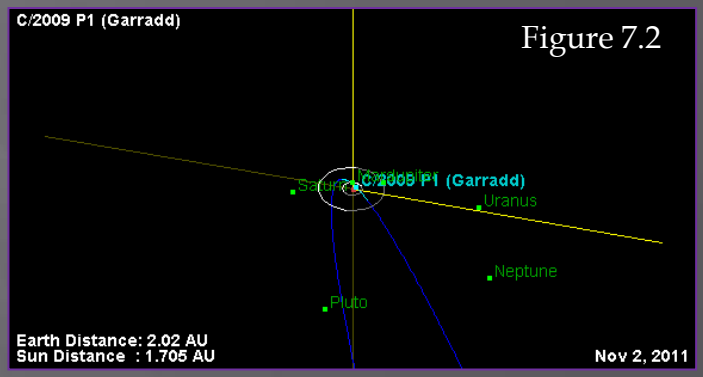
Overview of the Orbital Differences for Comets!



P – Periodic Comets

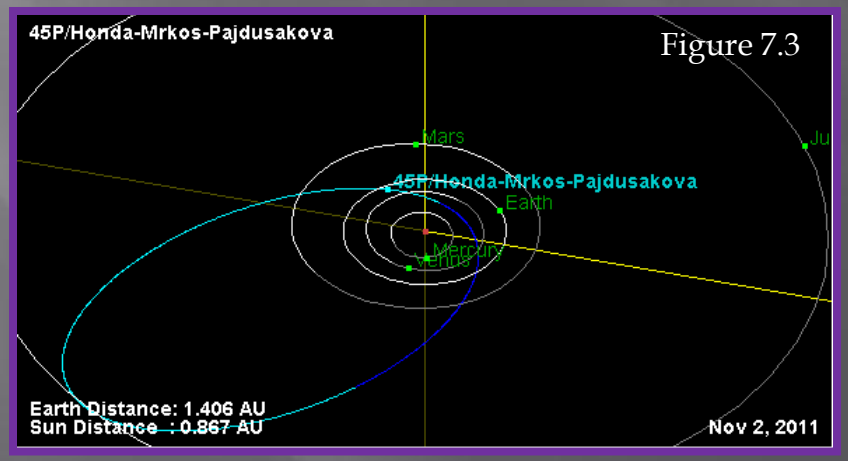
C – Non Periodic Comets



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 7.1 & 7.2 are of Comet C/Garradd 2009 P1 and Figure 7.3 below is off 45P.

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



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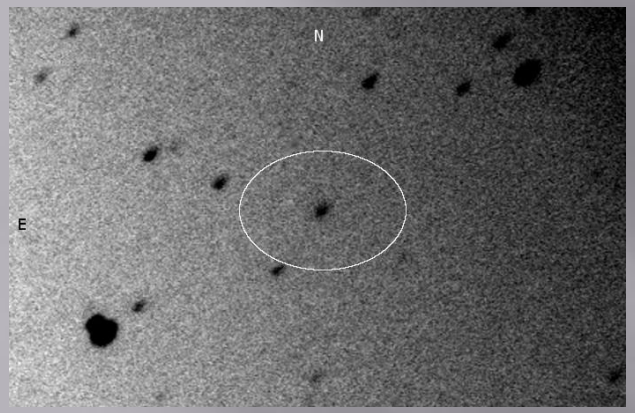
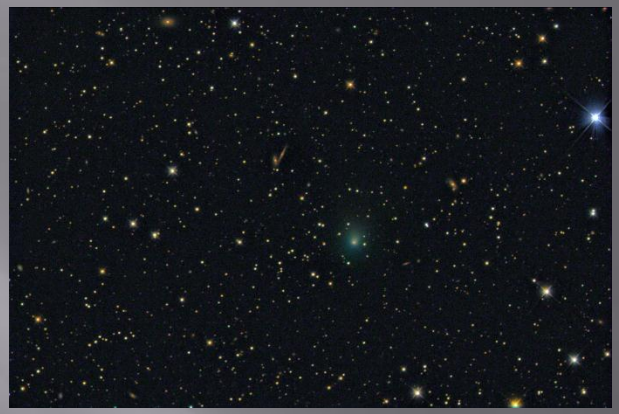


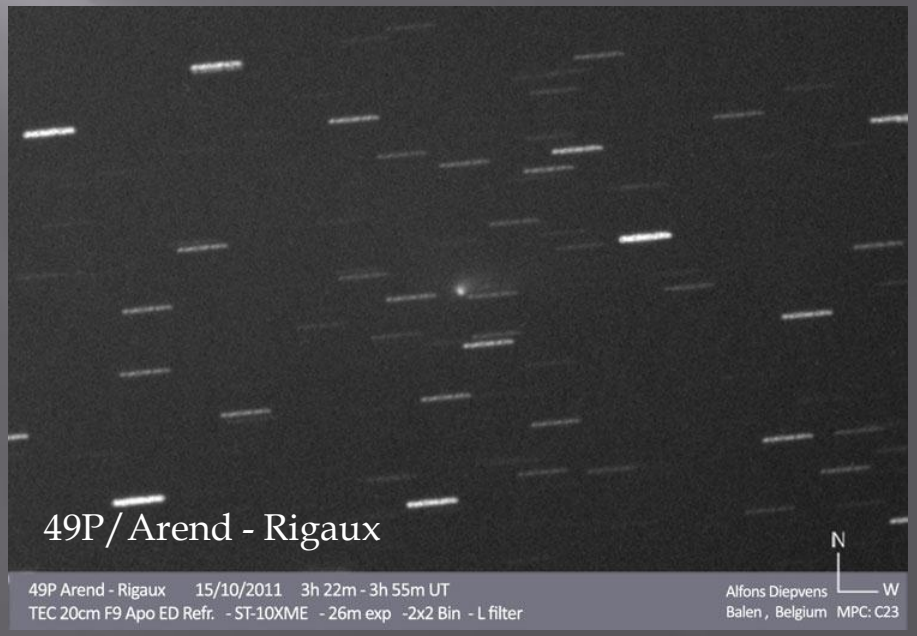
29P/Schwassmann – Wachmann 1



C/2010 G2 Hill

78P/Gehrels 2

C/2009 P1 Garradd



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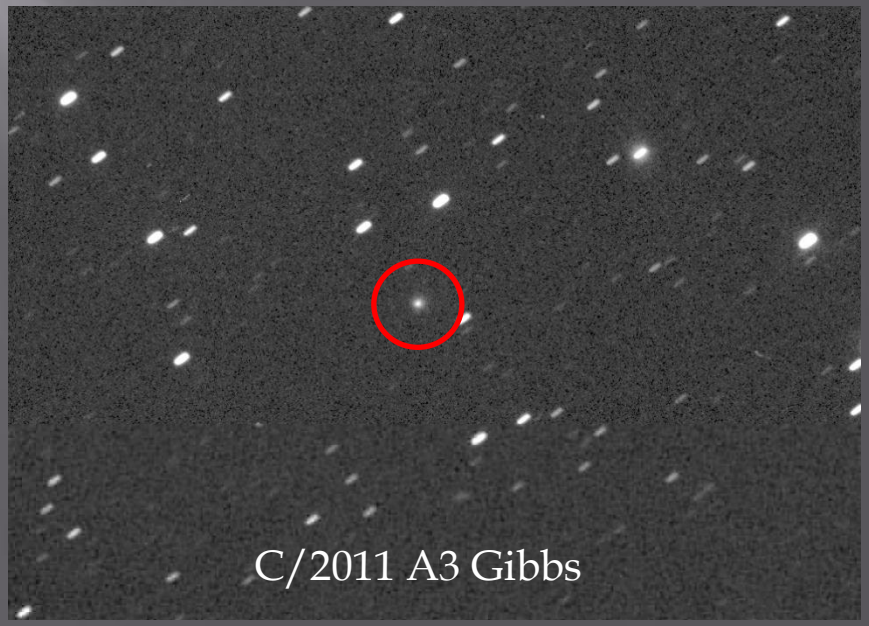
The Professor Comet's Report

Fainter Predominant Comets for Summer 2011 (Continued)!



New Year – 11 Jan 2012