Discovering Comet Bruenjes

About Me

- Fred Bruenjes
- Electrical Engineer by training, owner of Moonglow Technologies
- Main product is All Sky Cam, see the entire sky in one image

Comet Hunting

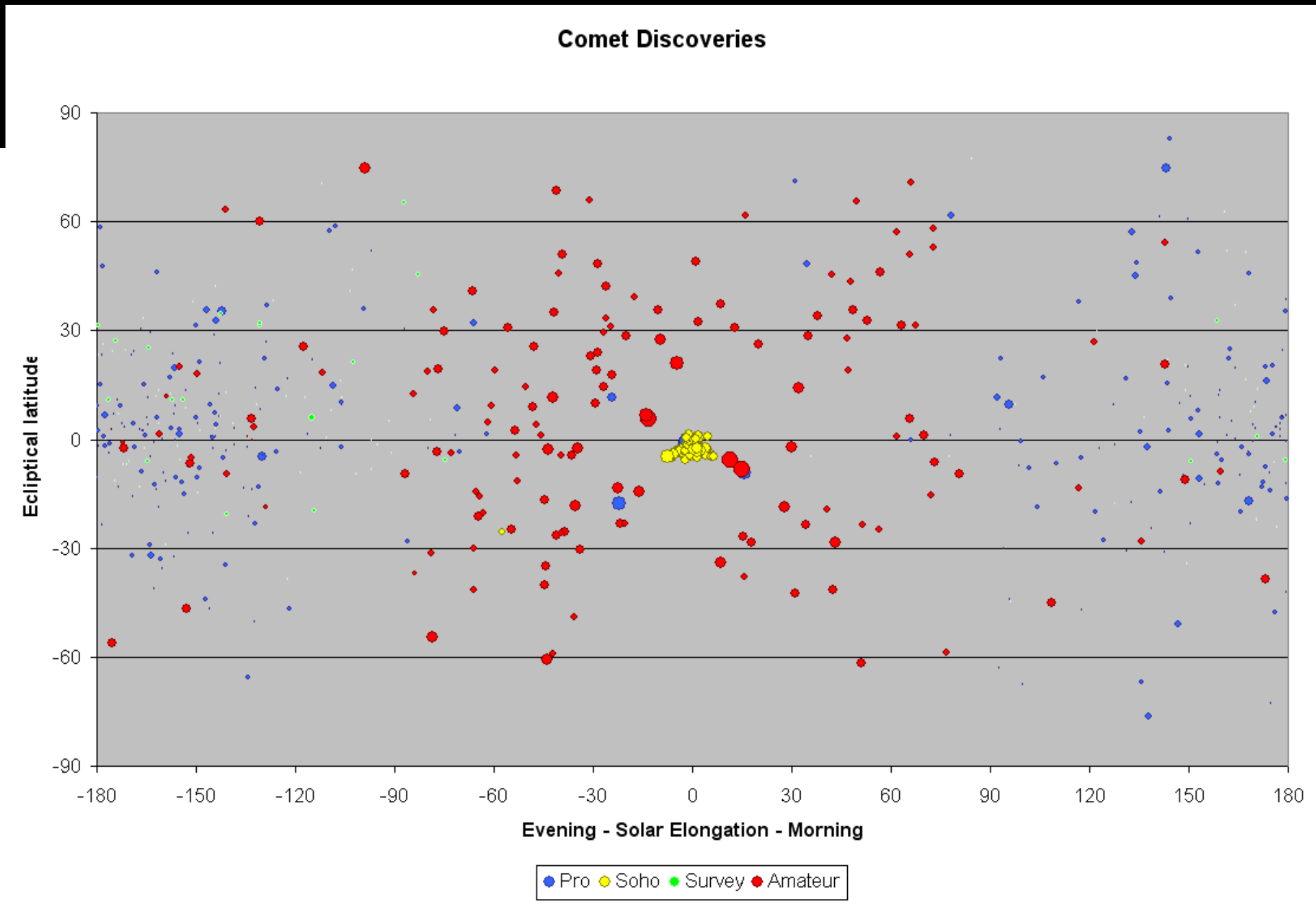
- Halley's Comet 1986 apparition launched my interest in astronomy
- Always wanted to discover one of my own
- Never had quite the right combination of equipment and time

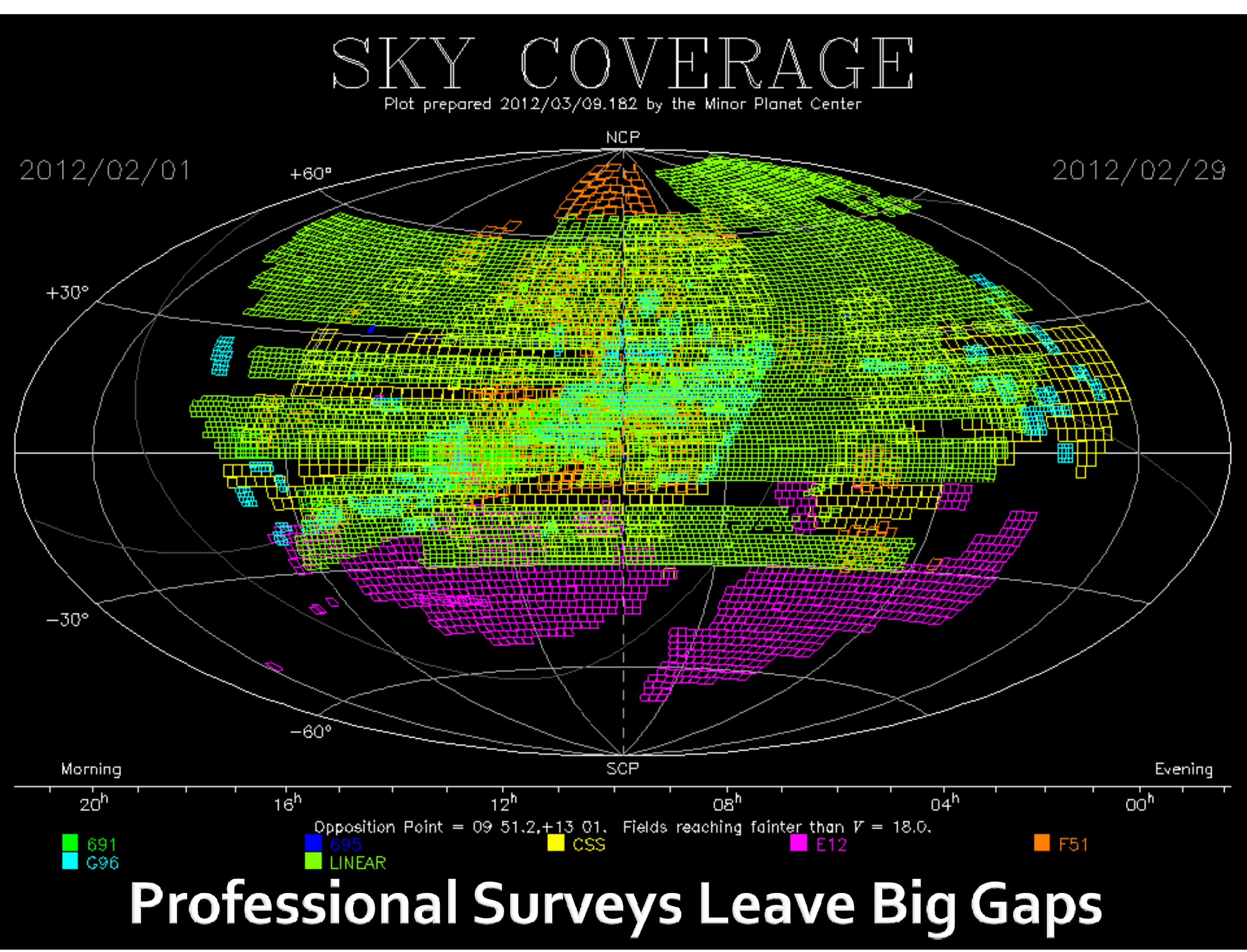
Stargarden Foundation

- Founded by Vic Winter
- Outreach to public, schools, third world countries
- With David Levy's cooperation, Meade donated 14" LX200GPS to Stargarden for purpose of comet hunting in southern sky.
- After Vic passed away, scope went unused.
- Hey, I should get it going!

Search Strategy

- Where to look?
- What camera to use?


Comet Discoveries
Ecliptical latitude
90
60
30
0
-30
-60
-90
-180
-150
-120
-90
-60
-30
0
30
60
90
120
150
180
Evening - Solar Elongation - Morning
Pro
Soho
Survey
Amateur



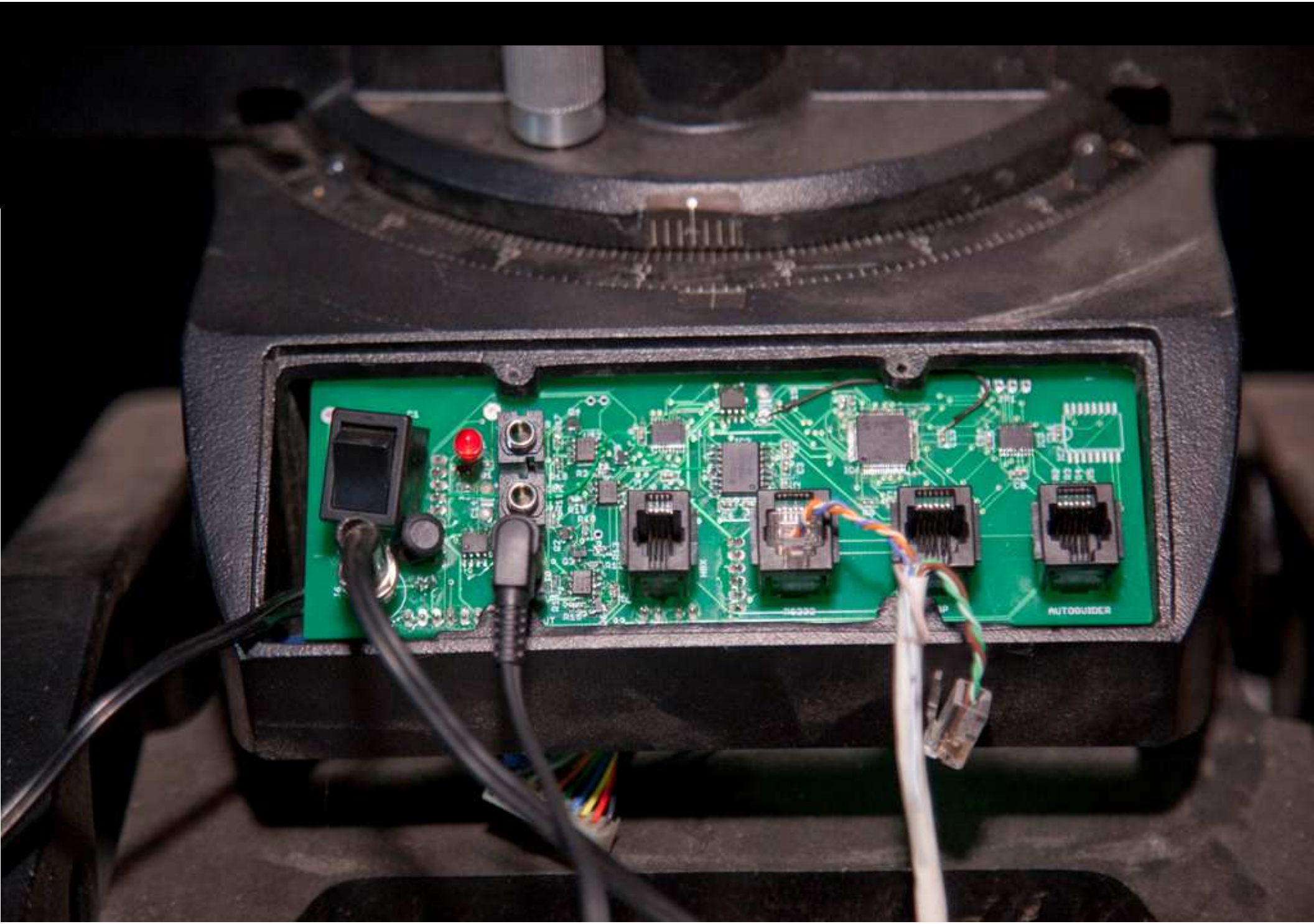
Professional Surveys Leave Big Gaps

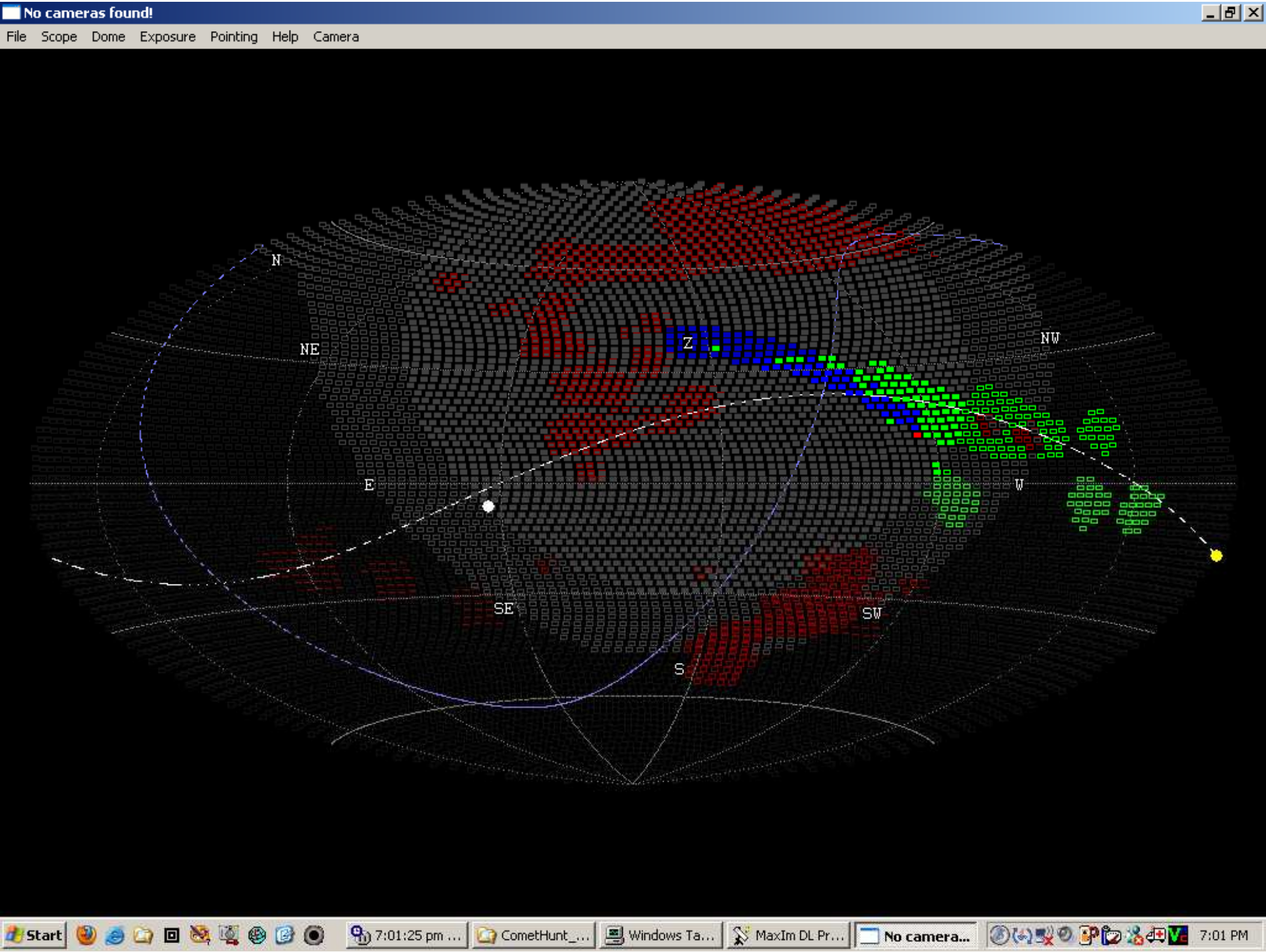
Equipment

- Want a wide field of view
- Want to move from field to field as quickly as possible
- Want as faint a limiting magnitude as possible

My Equipment

- Meade LX200GPS 14" Schmidt-Cass
- Starizona Hyperstar M14 – F/2.0 focal reducer
- Canon 5D DSLR camera, modified by Hutech to remove IR cut filter
- Custom electronics in LX200 to reduce slew time
- Custom software to choose search fields & download while slewing


AUTOGUIDER


No cameras found!
File Scope Dome Exposure Pointing Help Camera
N
NE
Z
NW
E
W
SE
SW
S
Start
7:01:25 pm ...
CometHunt_...
Windows Ta...
MaxIm DL Pr...
No camera...
7:01 PM

Square Degrees Per Hour

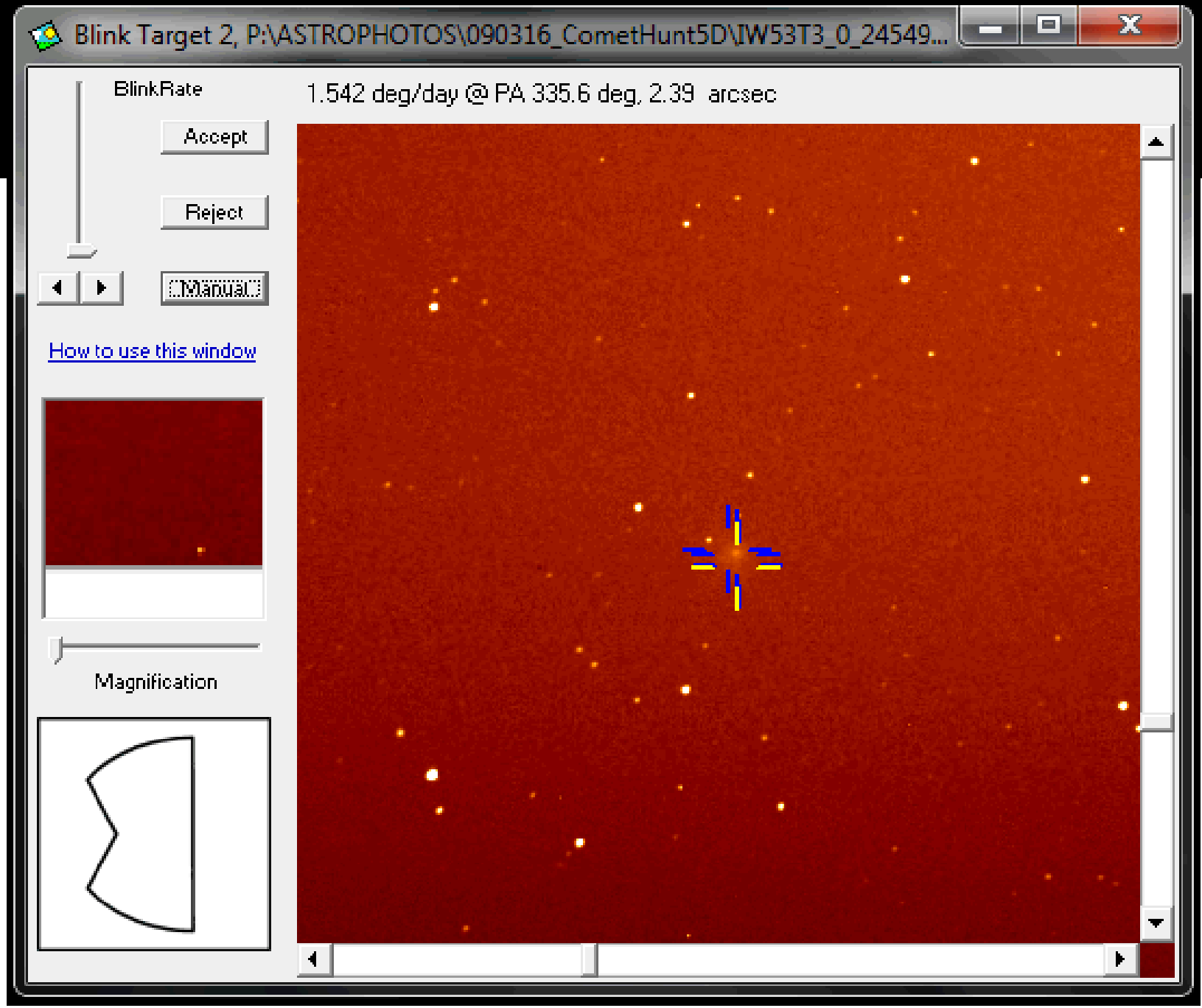
- Linear: 60 Deg²/hr to magnitude 22
- NEAT: 50 Deg²/hr to magnitude 20
- Catalina: 80 Deg²/hr to magnitude 20
- Levy: 78 Deg²/hr to magnitude 17

- Me: 270 Deg²/hr to magnitude 16

How to Report a Comet Find

- Verify it's real, it moves, it's not already known
- If you have an MPC observatory code, submit measurements to the MPC, it will be put on the NEOCP and hammered
- Otherwise contact the Central Bureau for Astronomical Telegrams

And the Search Begins…
January 2009

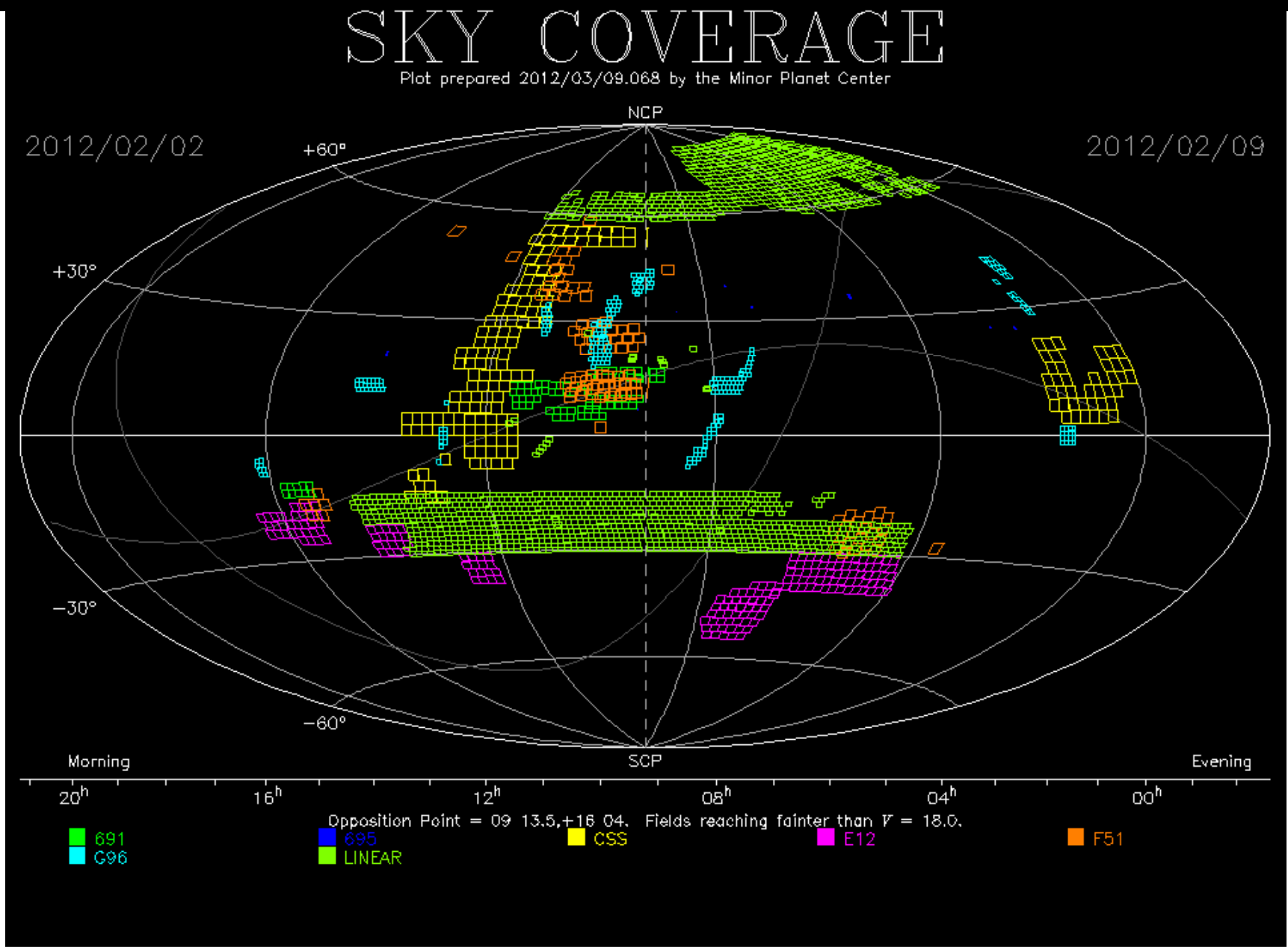

Blink Target 2, P:\ASTROPHOTOS\090316_CometHunt5D\IW53T3_0_24549...
BlinkRate
1.542 deg/day @ PA 335.6 deg, 2.39 arcsec
Accept
Reject
Manual
How to use this window
Magnification

Comet C/2009 E1 (Itagaki)

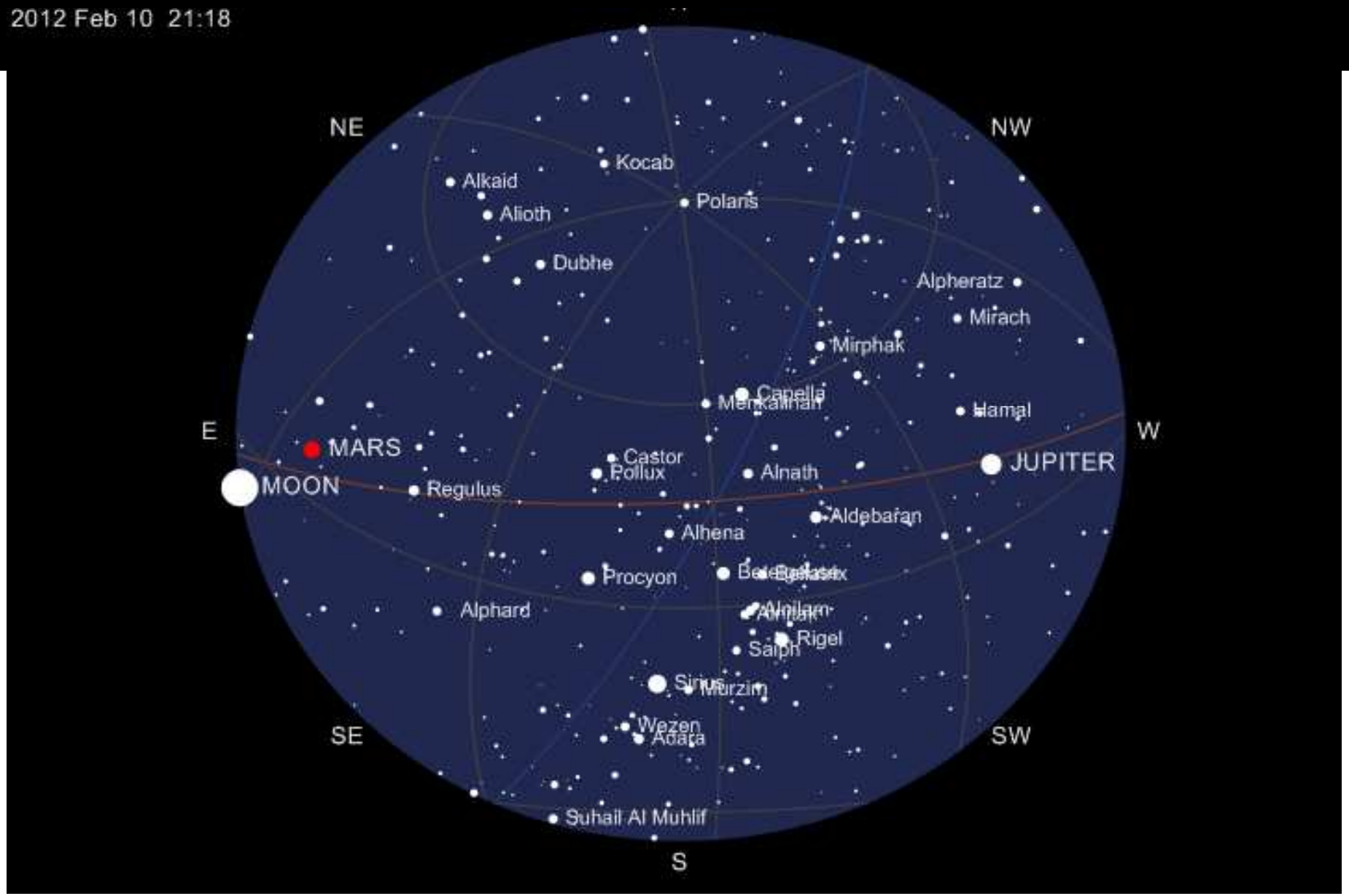
- Discovered March 14th, 2009
- TWO DAYS EARLIER!!!!!!

February 10th, 2012

Sky barely searched due to full moon

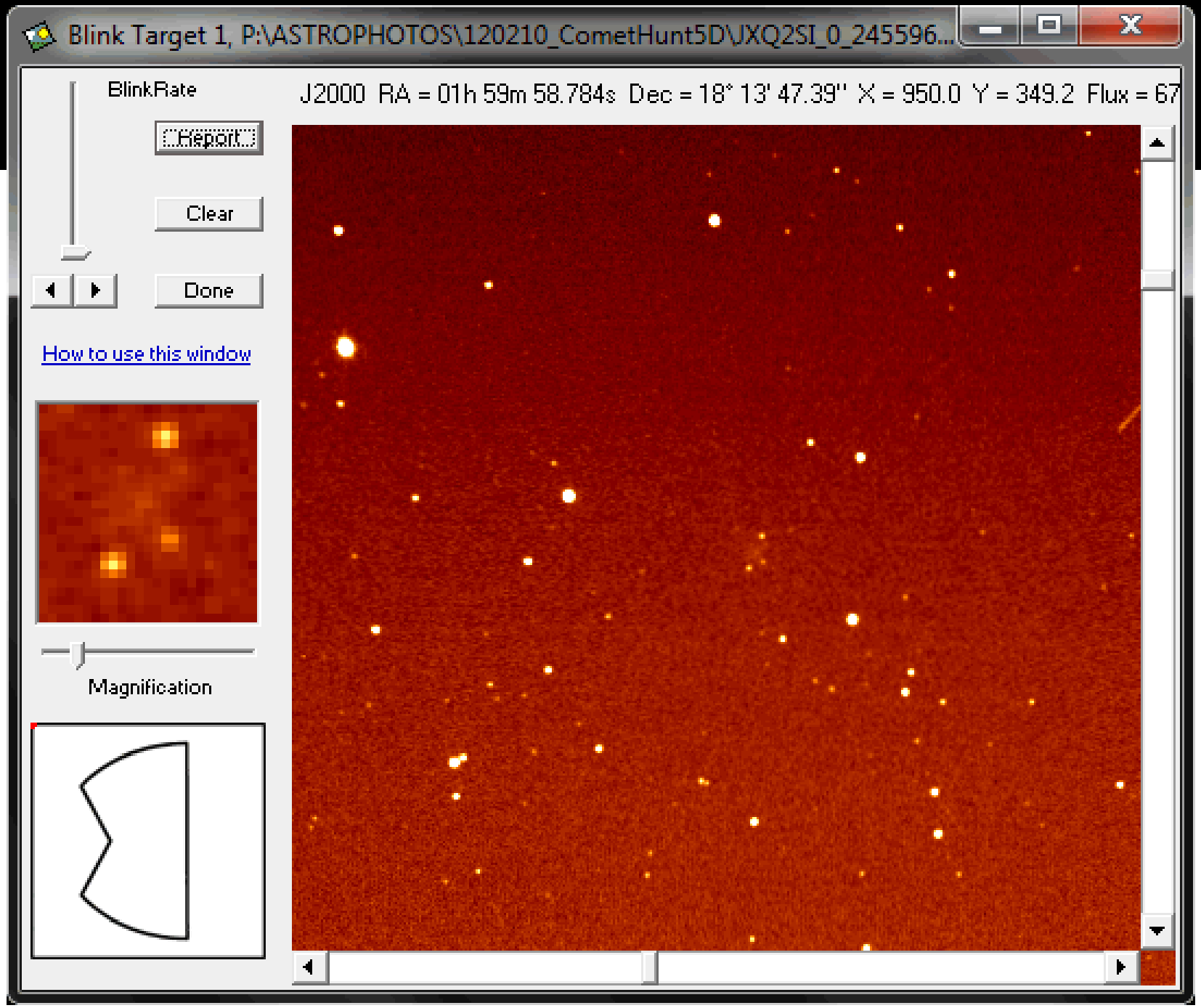


Cold, beautiful night


2012 Feb 10 21:18
NE
NW
E
W
SE
SW
S
Kocab
Alkaid
Alioth
Polaris
Dubhe
Alpheratz
Mirach
Mirphak
Capella
Menkalinan
Hamal
MARS
MOON
Castor
Pollux
Alnath
JUPITER
Regulus
Aldebaran
Alhena
Procyon
Alphard
Rigel
Saiph
Wezen
Adara
Suhail Al Muhlif

- I got the system running
- Came back an hour later and camera had locked up
- First set of images was wasted!
- Really wanted to quit now, but “you can’t find if you don’t look”.

- Let it run for 2 hours until moonlight was just too much
- Started processing images and blinking them in Pinpoint


Blink Target 1, P:\ASTROPHOTOS\120210_CometHunt5D\JXQ2SI_0_245596...
BlinkRate
Report
Clear
Done
How to use this window
Magnification
J2000 RA = 01h 59m 58.784s Dec = 18° 13' 47.39" X = 950.0 Y = 349.2 Flux = 67

What could it be?

- Already known comet? Nope, nothing known at that location.
- Residual bulk image? Nope, not located at same x/y position.
- Distant manmade satellite? Nope.
- Asteroid now showing cometary activity? Nope, all asteroids in this region moving eastward. Rocks don't make U-turns.
- Internal reflection of Jupiter? Could be.

FastMover.xlsx - Microsoft Excel non-com

Home | Insert | Page Layout | Formulas | Data | Review | View

Cut | Copy | Format Painter | Paste | Clipboard

Calibri | 11 | Font

Wrap Text | Merge & Center | Alignment

General | Number

Conditional Formatting | Format as Table

Normal | Bad | Check Cell | Explana

O30

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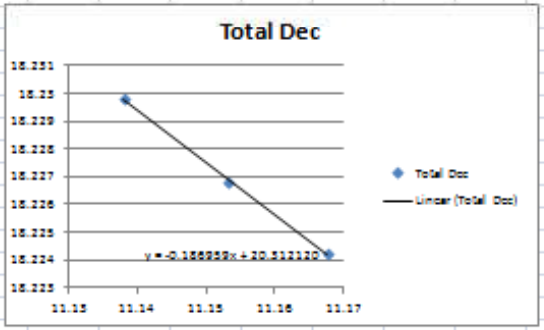
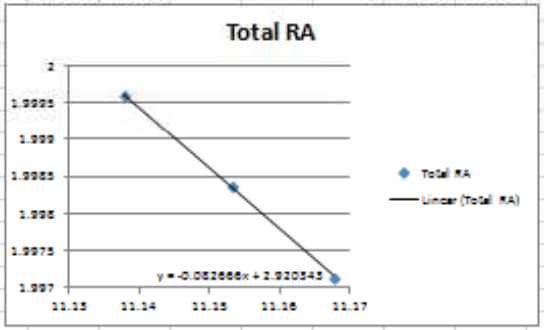
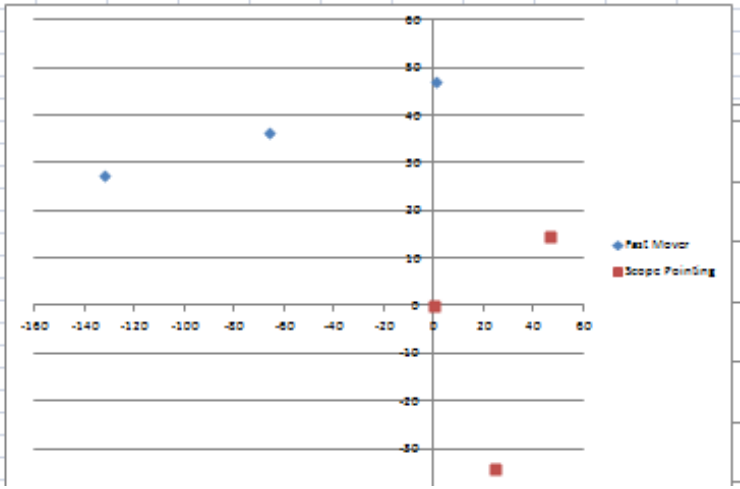
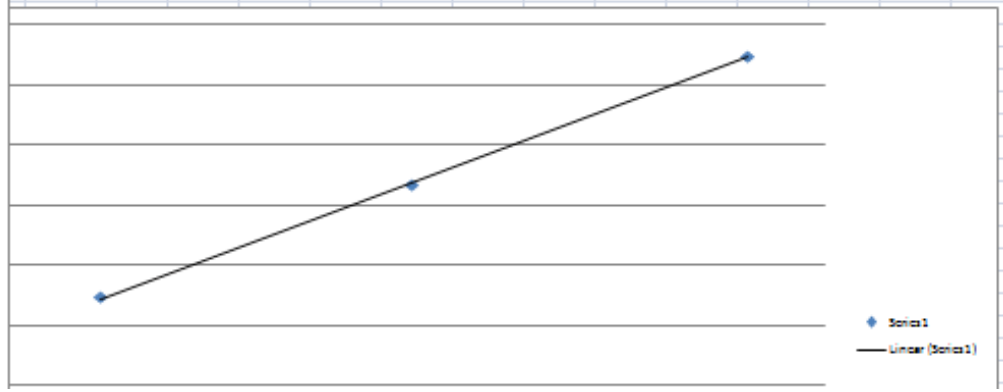
2	JXQ2SI																												
3					Date										Total RA	Total Dec				star x	star y	star raish	star decish				ra	dec	
4		T0003C	C2012	2	11.138	1	59	58.59	18	13	47.4	15.3	R	H27	1.9936	18.23	0.85	47.4		1883	708	0	0				arcsec/m	arcsec/minute	
5		T0003C	C2012	2	11.153	1	59	54.16	18	13	36.6	15.1	R	H27	1.9984	18.227	-65.6	36.6		1902	714	46.36	14.64		-0.001	-0.003	-3.323	-0.54	
6		T0003C	C2012	2	11.168	1	59	49.74	18	13	27.4	15.7	R	H27	1.9972	18.224	-131.9	27.4		1912	700	24.4	-34.16		-0.001	-0.003	-3.315	-0.46	
7															1.9286	18.217													
8																	ra resid "	dec resid "											
9					11.138										1.9936	18.23	0.5766	-0.145											
10					11.153										1.9984	18.227	-1.272	0.3574											
11					11.168										1.9972	18.224	0.613	-0.155											
12				7pm	12.04									pred loc	1.925	18.061			1	55.503	30.16	1h 55' 30"		3.668	40.081		+18d 3' 40"		
13				9:30pm	12.14										1.9168	18.042			1	55.007	0.3999	1h 55' 0.4"		2.5463	32.776		+18d 2' 33"		
14																													
15	58.89	47.4																											
16	54.16	36.6																											
17	49.74	27.4																											



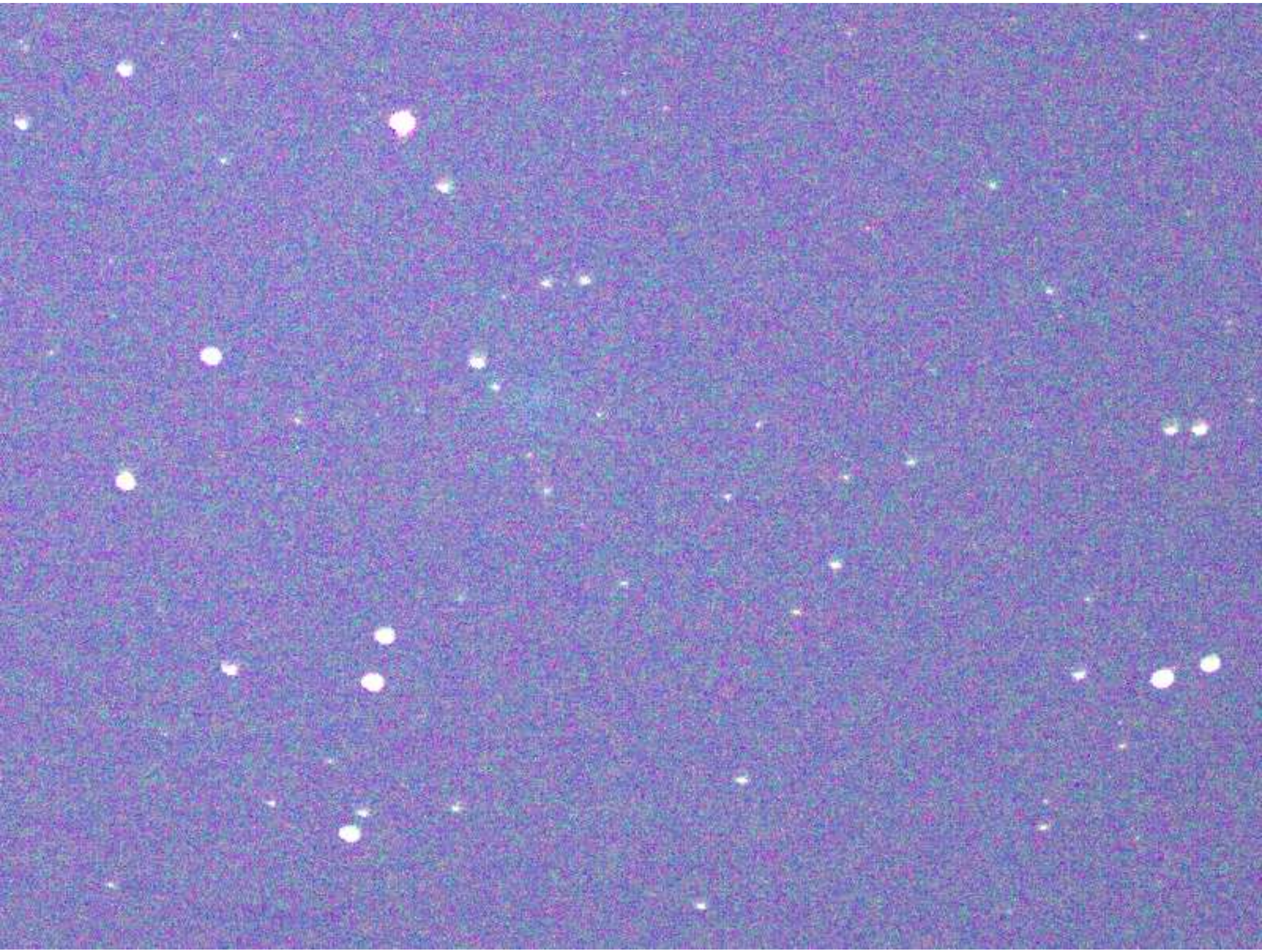






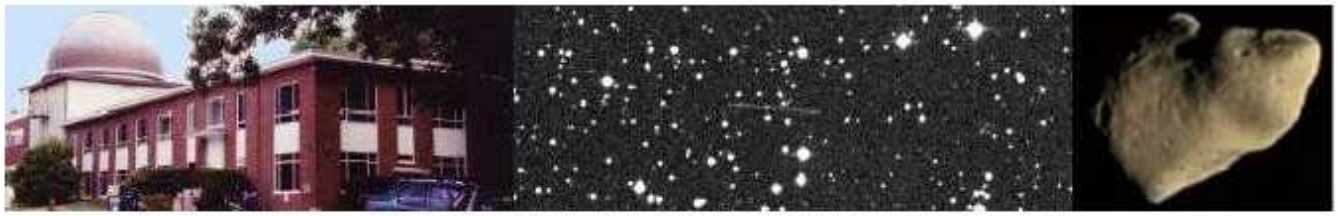
February 11, 2012

- 7pm: 1h 55m 30s +18d 3' 40"
- 9:30pm: 1h 55m 0s +18d 2' 33"



IAU Minor Planet Center

Search MPC



The NEO Confirmation Page

Please ensure you are familiar with the notes at the bottom of this page.

Problems? Comments?

Get ephemerides | Reset form

See this list in R.A. order

Select object(s) from the current list of objects needing confirmation (NEO prob, class, discovery date, rough current position and magnitude given):

All objects with *V* = -30 to 30 , with Decl. between -90 ° and +90 °, with an NEO probability of 0 % to 100 %

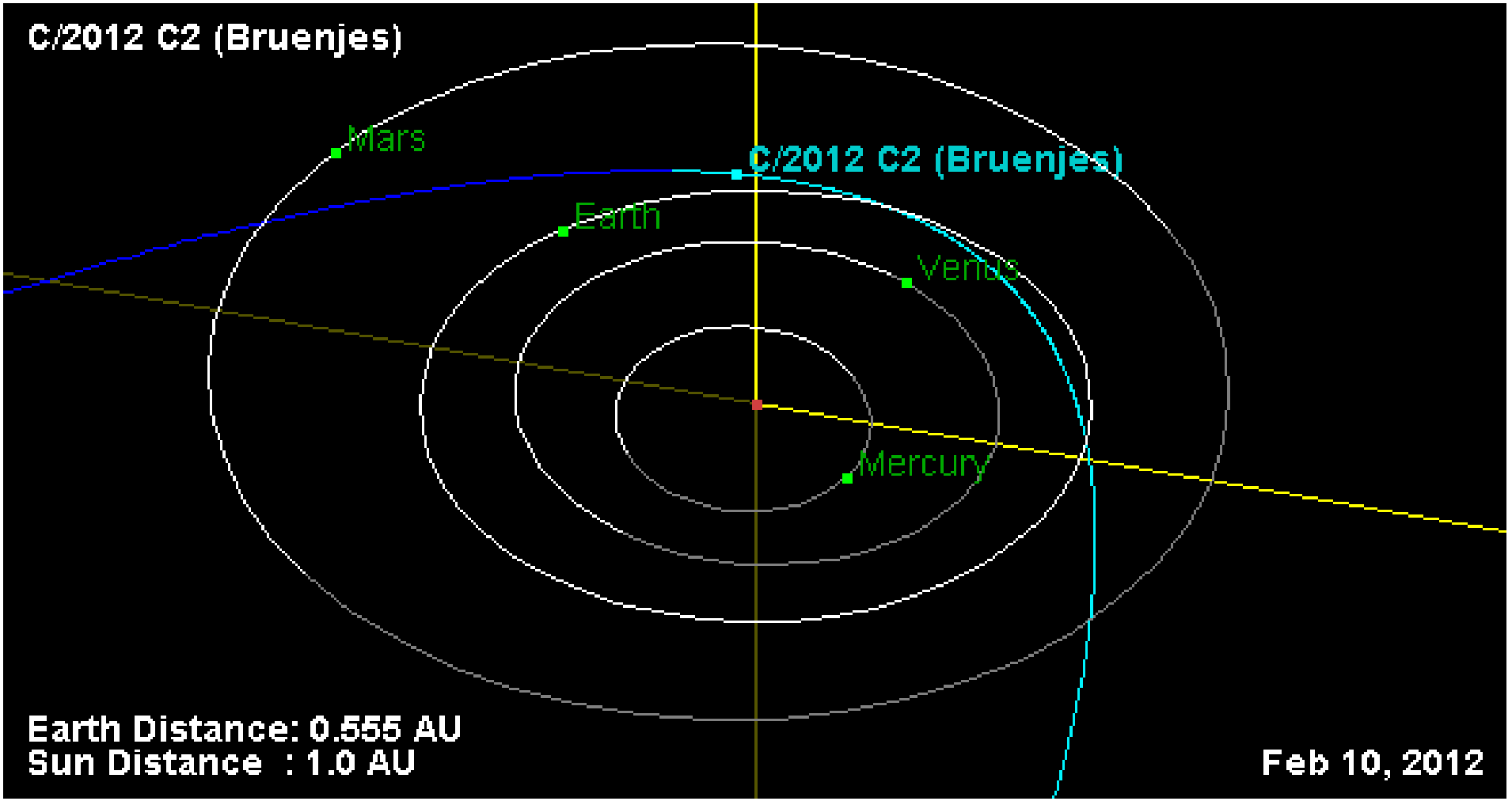
or just the objects selected below: Deselect All | Select All

- T0003C 100 1 [2012 Feb. 11.1 UT. R.A. = 01 55.5, Decl. = +18 04, V = 15.4] Added Feb. 12.11 UT
- TC02DE9 100 1 [2012 Feb. 11.3 UT. R.A. = 10 02.2, Decl. = +30 24, V = 18.5] Updated Feb. 11.99 UT *
- TCA53C7 98 1 [2012 Feb. 11.3 UT. R.A. = 09 52.8, Decl. = +12 21, V = 21.5] Added Feb. 11.41 UT * [1 nighter]
- TCA4F61 100 1 [2012 Feb. 11.3 UT. R.A. = 09 36.2, Decl. = +13 07, V = 20.7] Updated Feb. 11.42 UT * [1 nighter]
- TCA3862 100 1 [2012 Feb. 11.1 UT. R.A. = 05 03.9, Decl. = +23 53, V = 20.4] Updated Feb. 12.07 UT

Electronic Telegram No. 3019
Central Bureau for Astronomical Telegrams
INTERNATIONAL ASTRONOMICAL UNION
CBAT Director: Daniel W. E. Green; Hoffman Lab 209; Harvard University;
20 Oxford St.; Cambridge, MA 02138; U.S.A.
e-mail: cbatiau@eps.harvard.edu (alternate cbat@iau.org)
URL http://www.cbat.eps.harvard.edu/index.html
Prepared using the Tamkin Foundation Computer Network

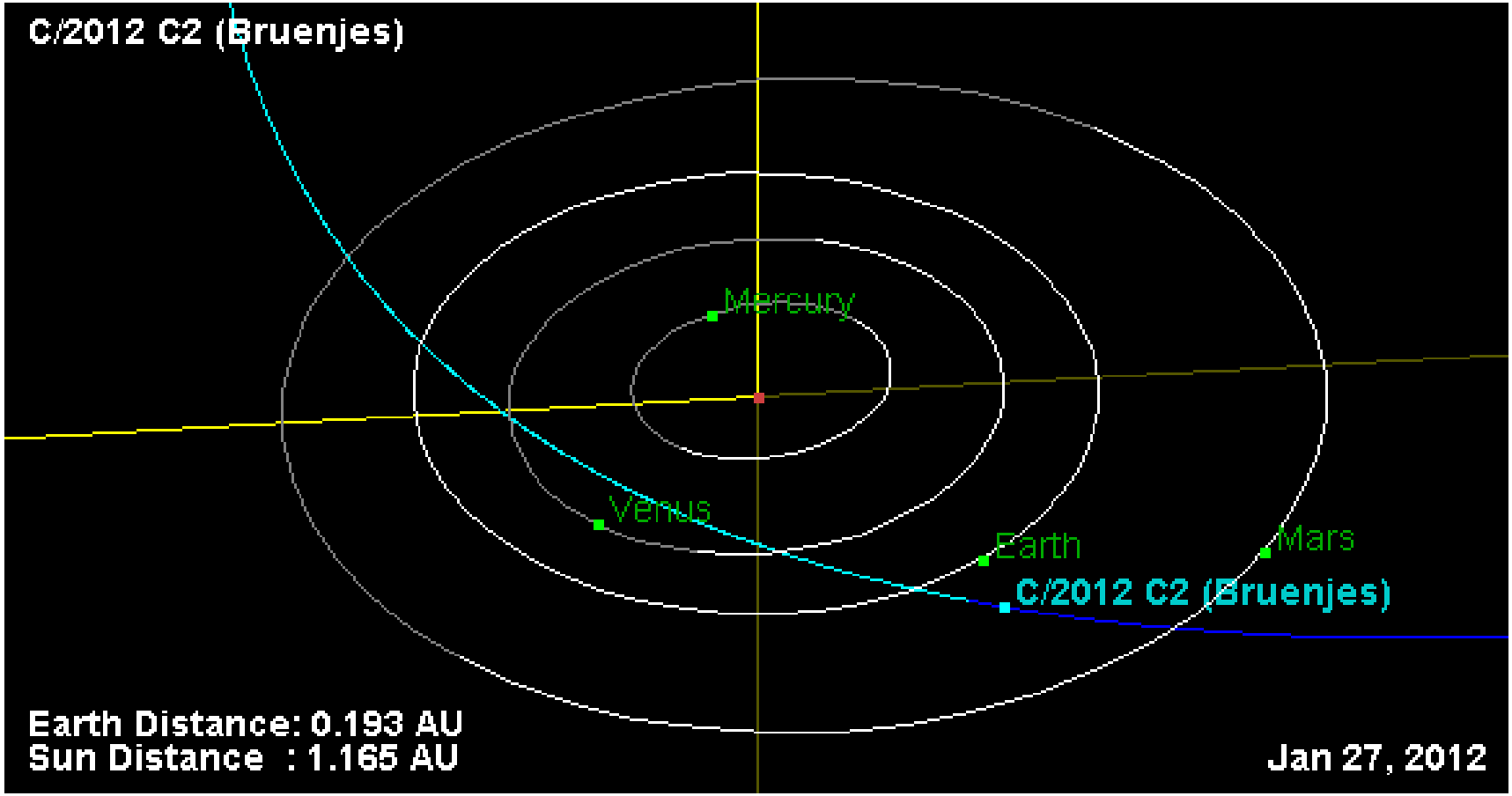
COMET C/2012 C2 (BRUENJES)

Manfred Bruenjes, Warrensburg, MO, USA, reports his discovery of an apparent comet with a coma diameter of 60" and no discernible tail on 30-s CCD exposures taken on two nights with a 0.36-m f/2.0 Schmidt-Cassegrain reflector (discovery observations tabulated below). After posting on the Minor Planet Center's NEOCP, numerous other CCD astrometrists have also commented on the object's cometary appearance. Y. Ikari (Moriyama, Shiga-Ken, Japan; 0.26-m f/7 reflector; Feb. 12.4 UT) reports total red mag 12.9-13.1 and coma diameter 1'.5-1'.7. S. Nakano, Sumoto, Japan, reports that H. Abe (Matsue-shi, Shimane-ken, Japan; 0.26-m f/6 reflector) measured total mag 12.3 and coma diameter 2'.5 on Feb. 12.45. Nakano also reports the presence of a faint tail 10" long toward the east on images taken by S. Urakawa and N. Hashimoto with the Bisei Spaceguard Center's 1.0-m f/3 reflector on Feb. 12.5. A. Novichonok (Kondopoga, Russia) writes that six stacked 120-s images taken remotely by V. Gerke (Moscow, Russia) with the 0.4-m f/8 "Jigit" reflector at the TAU station of Ka-Dar Observatory (near Nizhniy Arkhyz, Russia) on Feb. 12.7 show a large, 7'-diameter, very diffuse, round coma of total mag 10.6. Vitali Nevski (Vitebsk, Belarus) notes that ten stacked 120-s CCD exposures taken with a 0.3-m f/5 reflector on Feb. 12.71 show a 3' coma; visually on Feb. 12.72, Nevski found a 5' coma of total mag 11.5. R. Ligustri (Talmassons, Udine, Italy) measured a large, diffuse coma of diameter 150" on twelve stacked 60-s images taken on Feb. 12.8 with a 0.43-m f/6.8 reflector at the RAS Observatory near Nerpio, Spain.

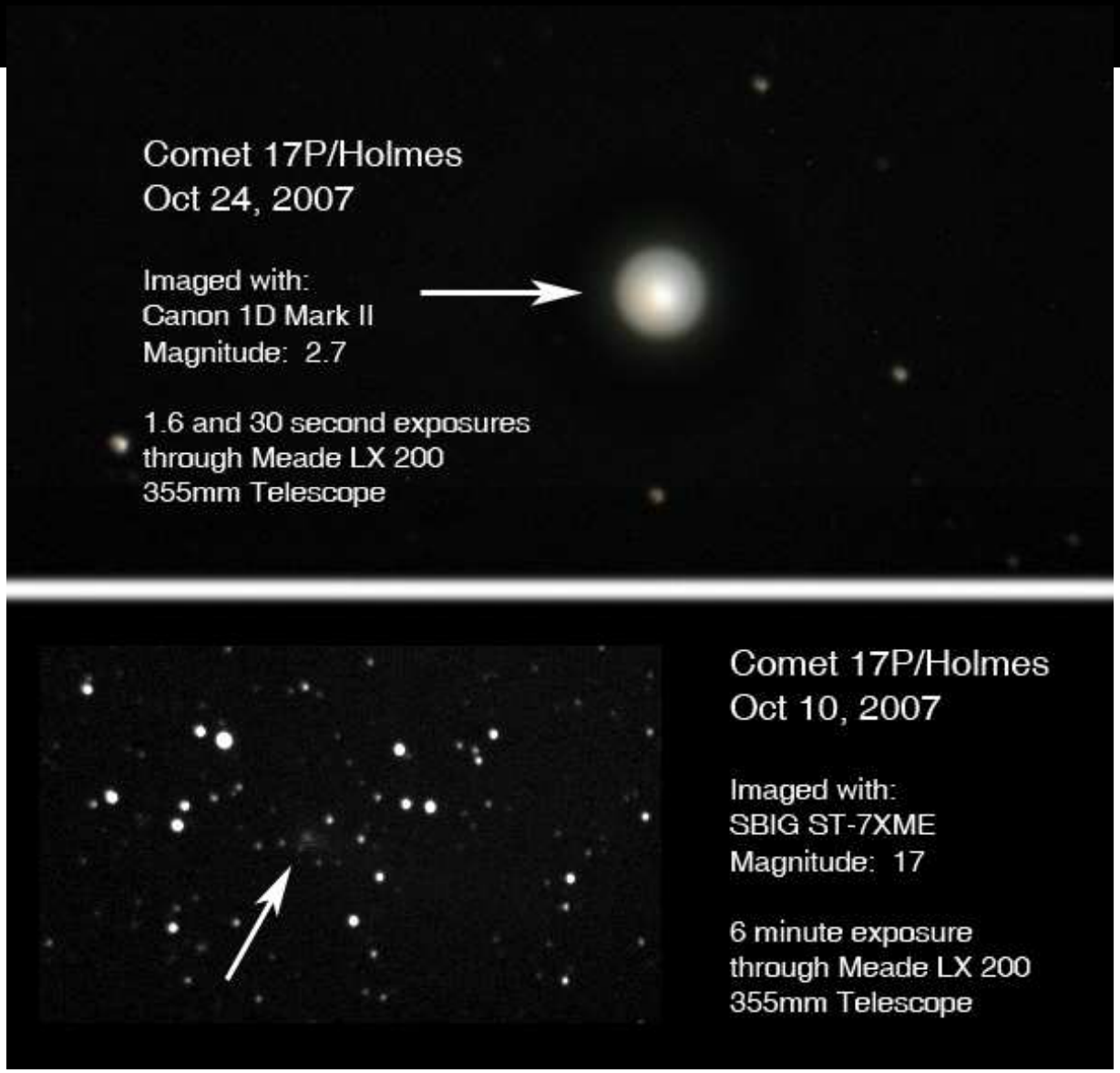

C/2012 C2 (Bruenjes)
Mars
C/2012 C2 (Bruenjes)
Earth
Venus
Mercury
Earth Distance: 0.555 AU
Sun Distance : 1.0 AU
Feb 10, 2012

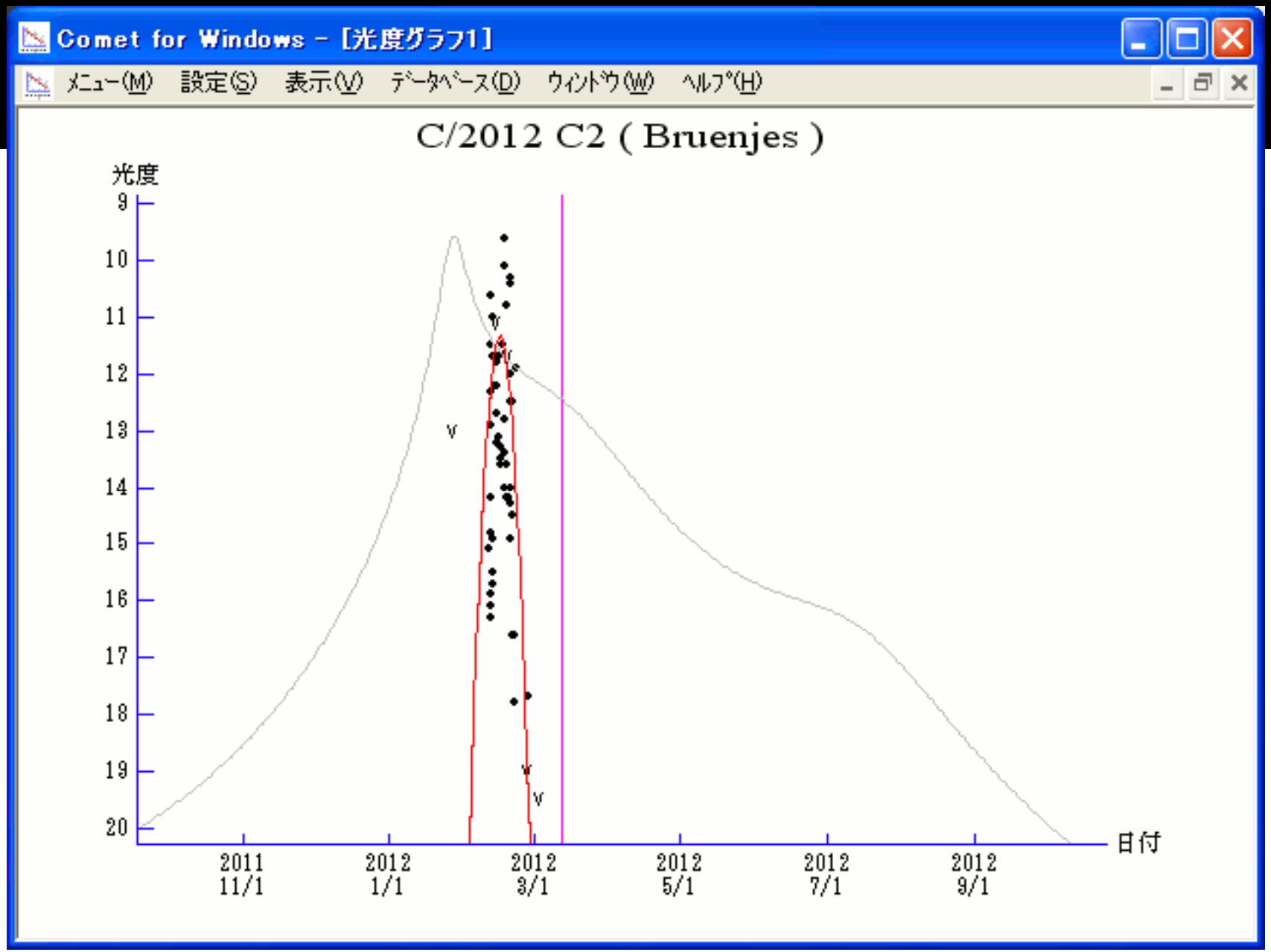
What do we know about it?

- Whizzed right past Earth, only 0.19 AU away on January 27th, but was not seen
- Earth orbit intersection distance of 0.052 AU (< 0.050 qualifies as NEO)
- Retrograde inclination


C/2012 C2 (Bruenjes)
Mercury
Venus
Earth
Mars
C/2012 C2 (Bruenjes)
Earth Distance: 0.193 AU
Sun Distance : 1.165 AU
Jan 27, 2012

Probably had an outburst




Comet for Windows - [光度グラフ1]
メニュー(M) 設定(S) 表示(V) データベース(D) ウィンドウ(W) ヘルプ(H)
C/2012 C2 (Bruenjes)
光度
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11
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日付
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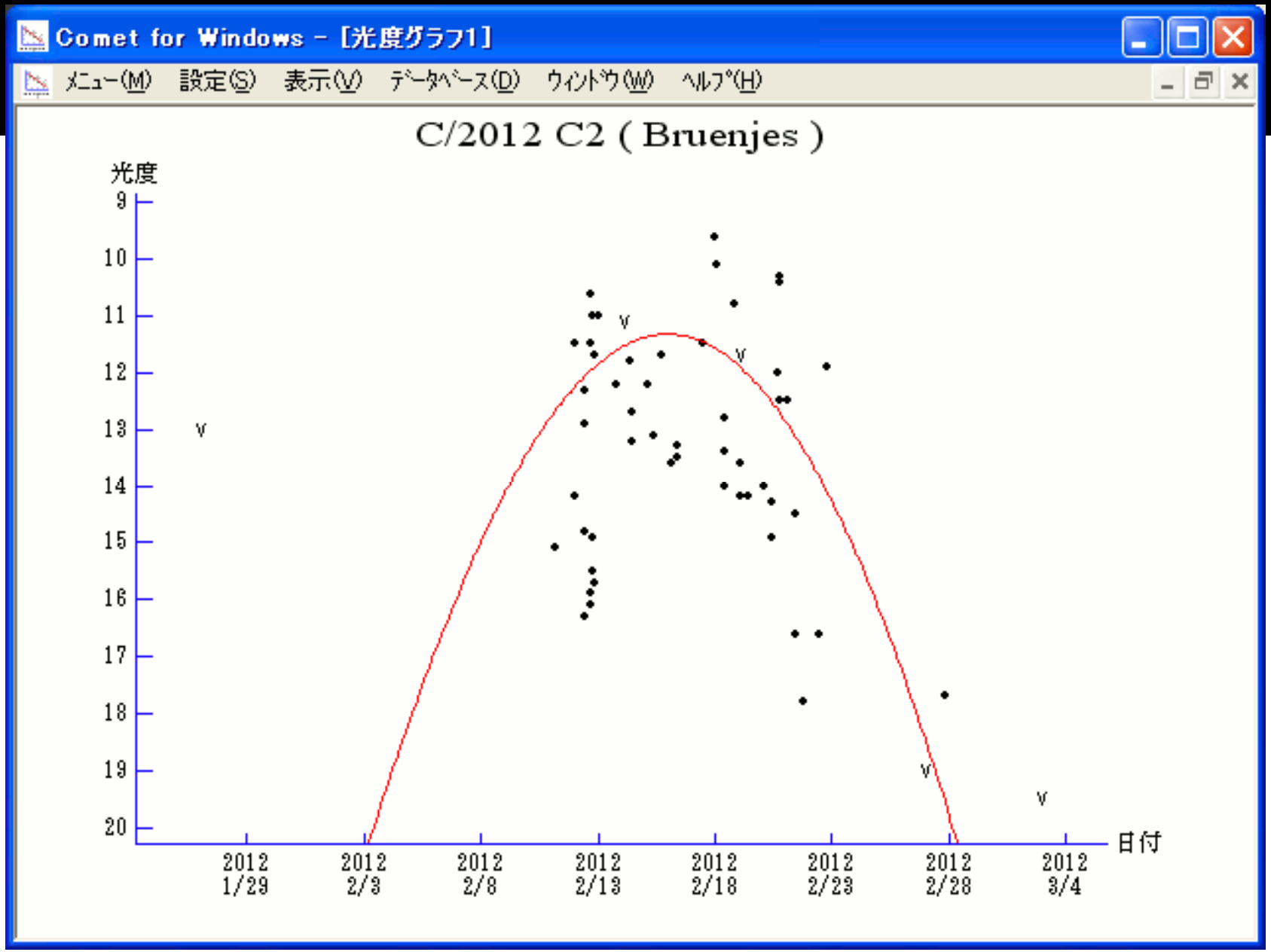
2012 1/1
2012 3/1
2012 5/1
2012 7/1
2012 9/1


Comet for Windows - [光度グラフ1]
メニュー(M) 設定(S) 表示(V) データベース(D) ウィンドウ(W) ヘルプ(H)
C/2012 C2 (Bruenjes)
光度
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18
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日付
2012 1/29
2012 2/3
2012 2/8
2012 2/13
2012 2/18
2012 2/23
2012 2/28
2012 3/4

Orbital Elements

Orbital Elements at Epoch 2455973.5 (2012-Feb-16.0) TDB
Reference: JPL 5 (heliocentric ecliptic J2000)

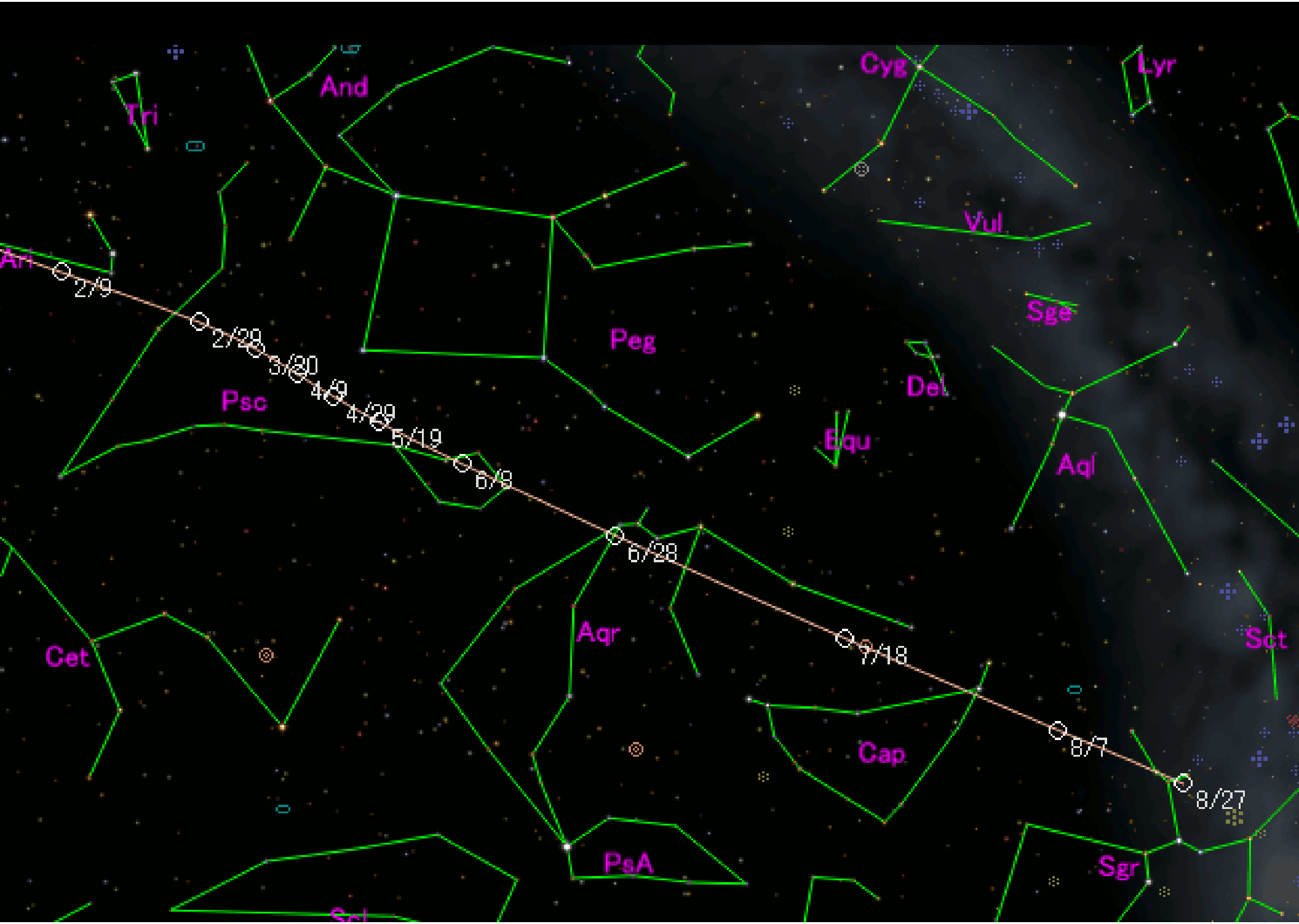
Element	Value	Uncertainty (1-sigma)	Units
e	1.0	0.0022156	
a	n/a	n/a	AU
q	.8013170876615753	0.00072304	AU
i	162.778738302797	0.0072632	deg
node	118.0106351597143	0.011389	deg
peri	62.81422944066519	0.11202	deg
M	n/a	n/a	deg
t_p	2455999.234348632159 (2012-Mar-12.73434863)	0.066362	JED
period	n/a	n/a	d
	n/a	n/a	yr
n	n/a	n/a	deg/d
Q	n/a	n/a	AU

Orbit Determination Parameters

# obs. used (total)	237
data-arc span	11 days
first obs. used	2012-02-11
last obs. used	2012-02-22
two-body model	T
fit RMS	.82996
data source	ORB
producer	Otto Matic
solution date	2012-Mar-02 15:50:16

Additional Information

Earth MOID = .0521925 AU


Tri
And
Cyg
Lyr
Vul
Ari
2/9
2/28
3/20
4/9
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5/19
6/8
6/28
7/18
8/7
8/27
Peg
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Equ
Sge
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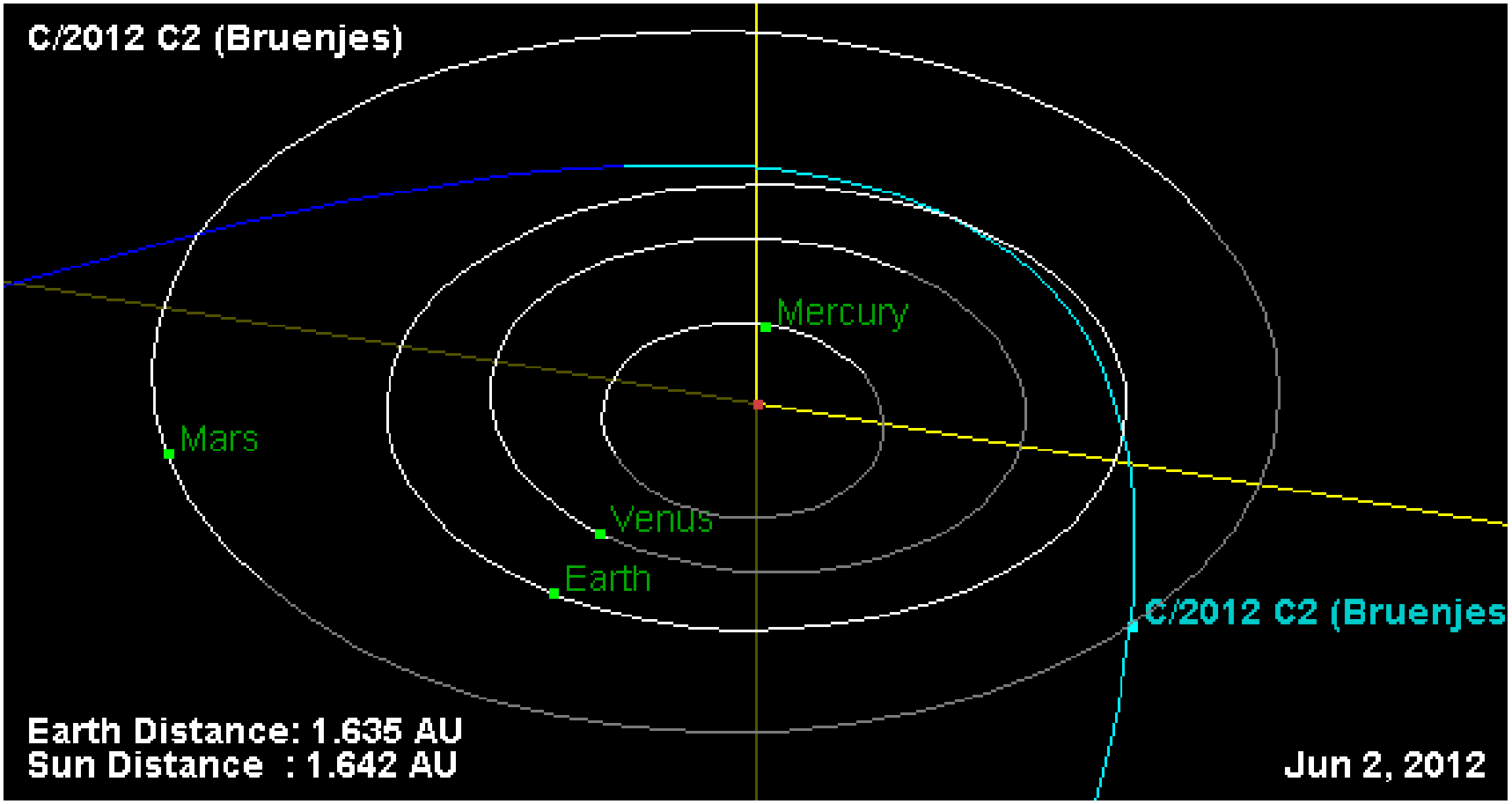
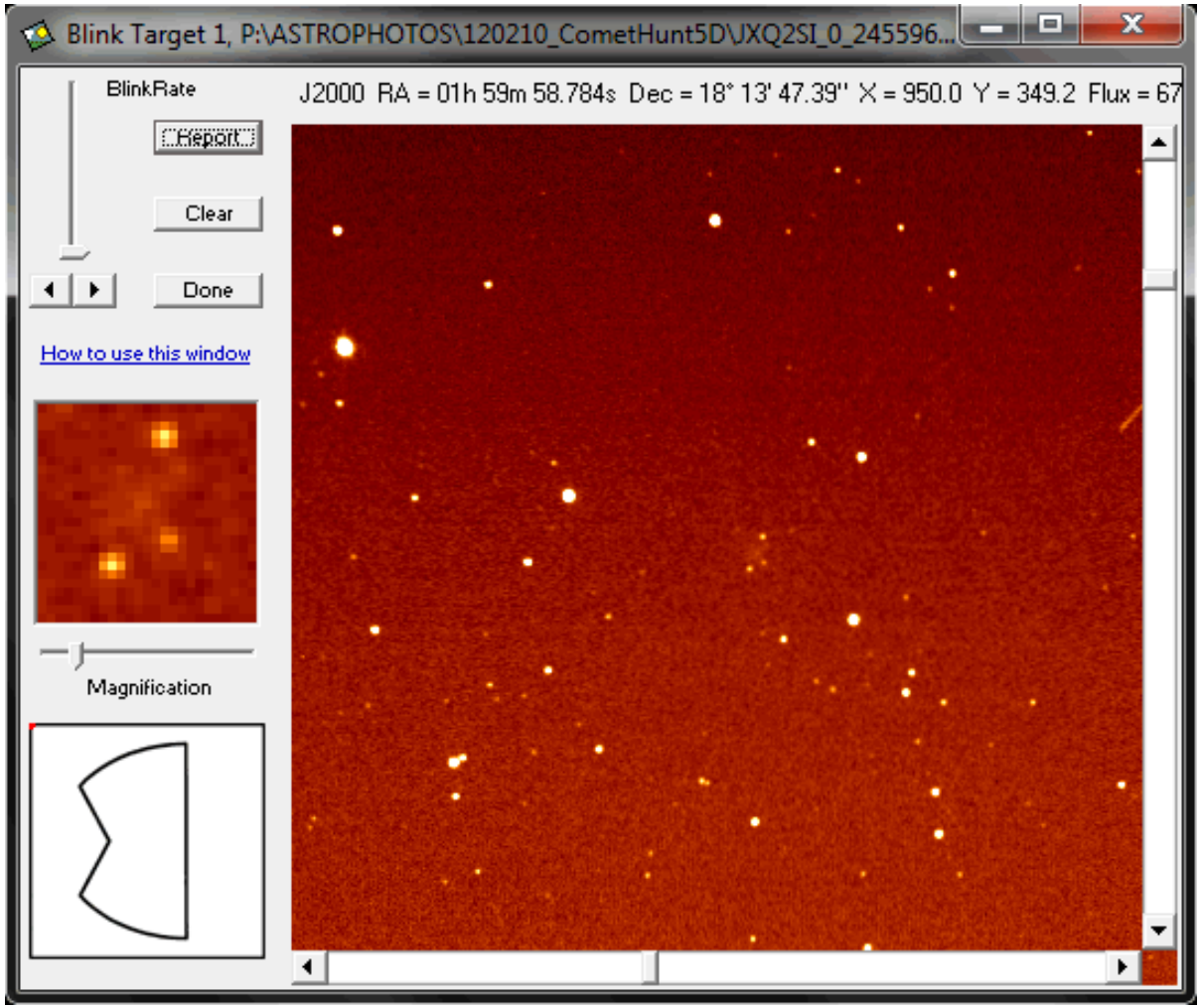
Aqr
Cet
Cap
Sct
PsA
Sgr

Location Today



Questions?


Blink Target 1, P:\ASTROPHOTOS\120210_CometHunt5D\JXQ2SI_0_245596...
BlinkRate
Report
Clear
Done
How to use this window
Magnification
J2000 RA = 01h 59m 58.784s Dec = 18° 13' 47.39" X = 950.0 Y = 349.2 Flux = 67