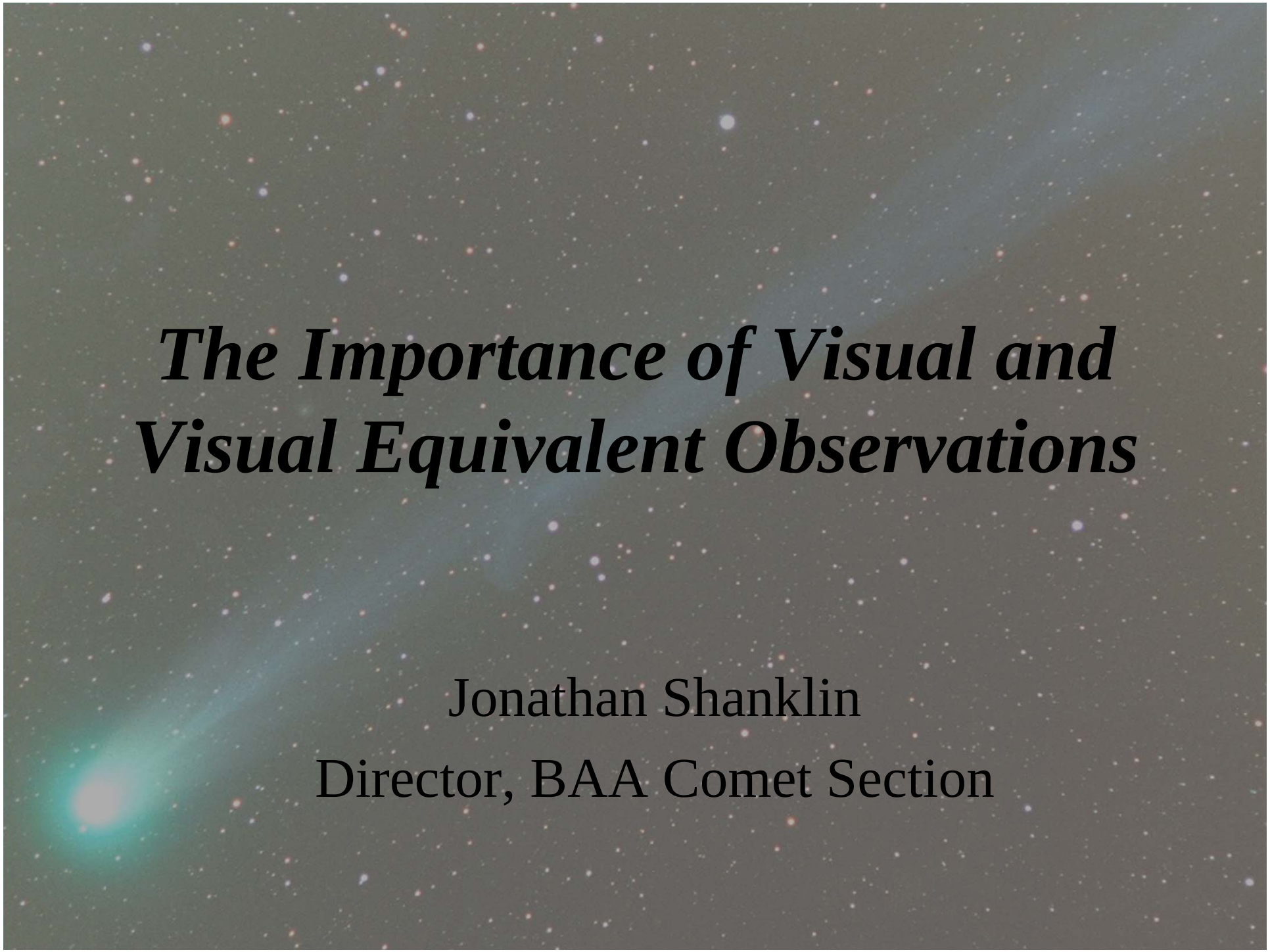


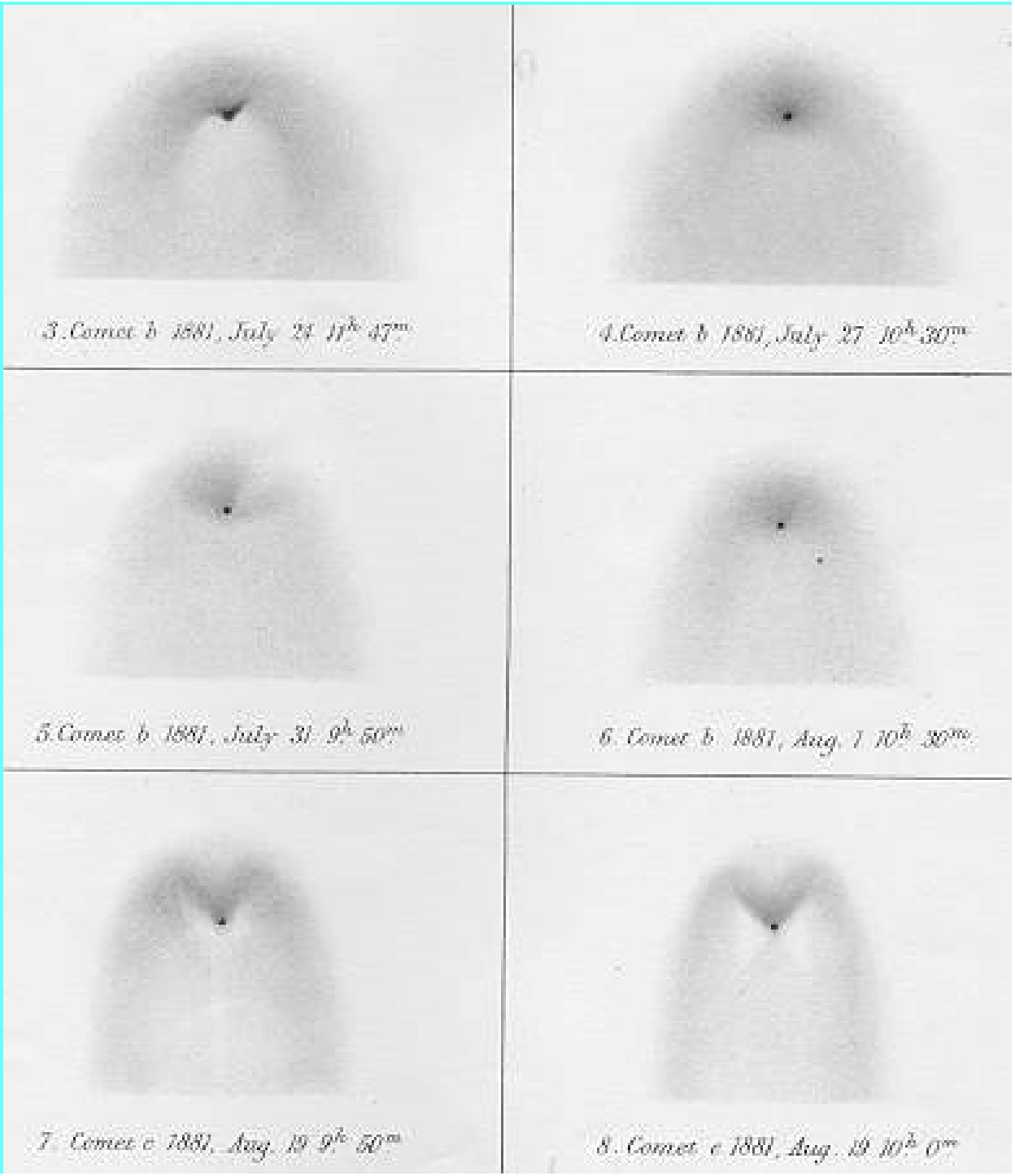
The Importance of Visual and Visual Equivalent Observations

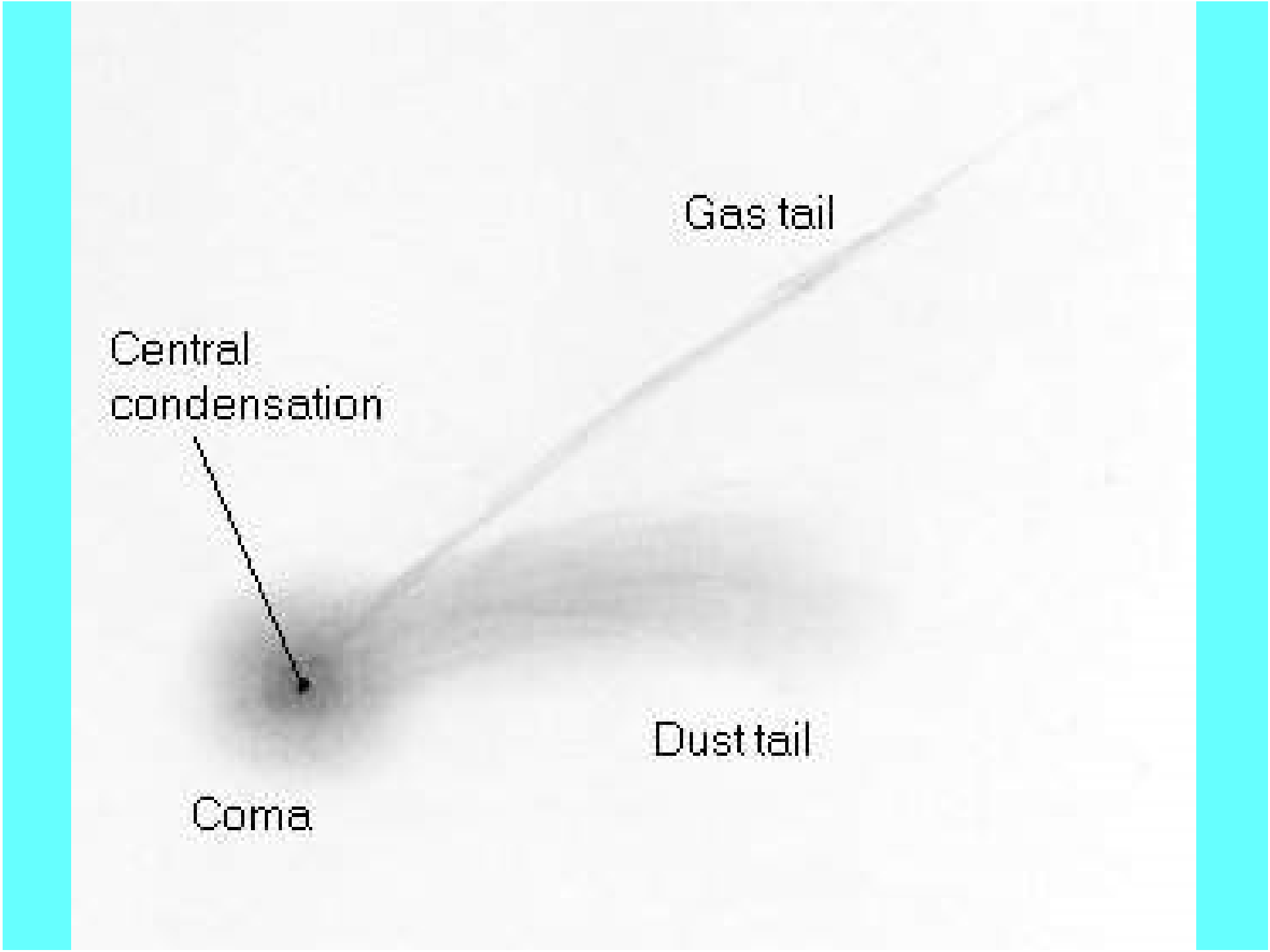
Jonathan Shanklin

Director, BAA Comet Section

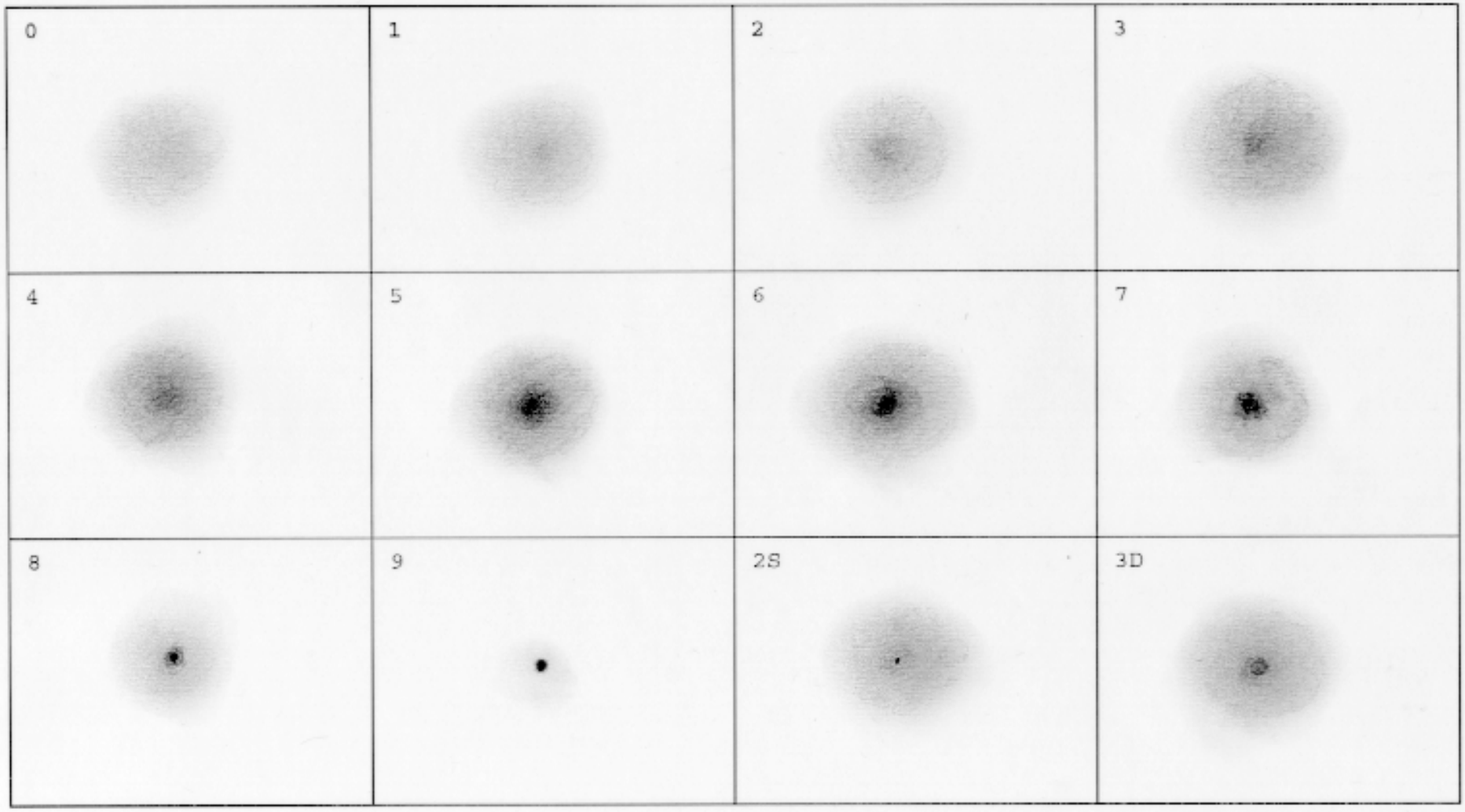
- BAA founded 1890
- Comet Section formed 1891
- Nearly 40,000 observations
- Observations of around 500 different comets, including returns of over 100 periodic comets
- Continuity with this past is vital
- Today there are more active imagers than visual observers in the Section
- But, there are roughly equal numbers routinely contributing magnitude observations

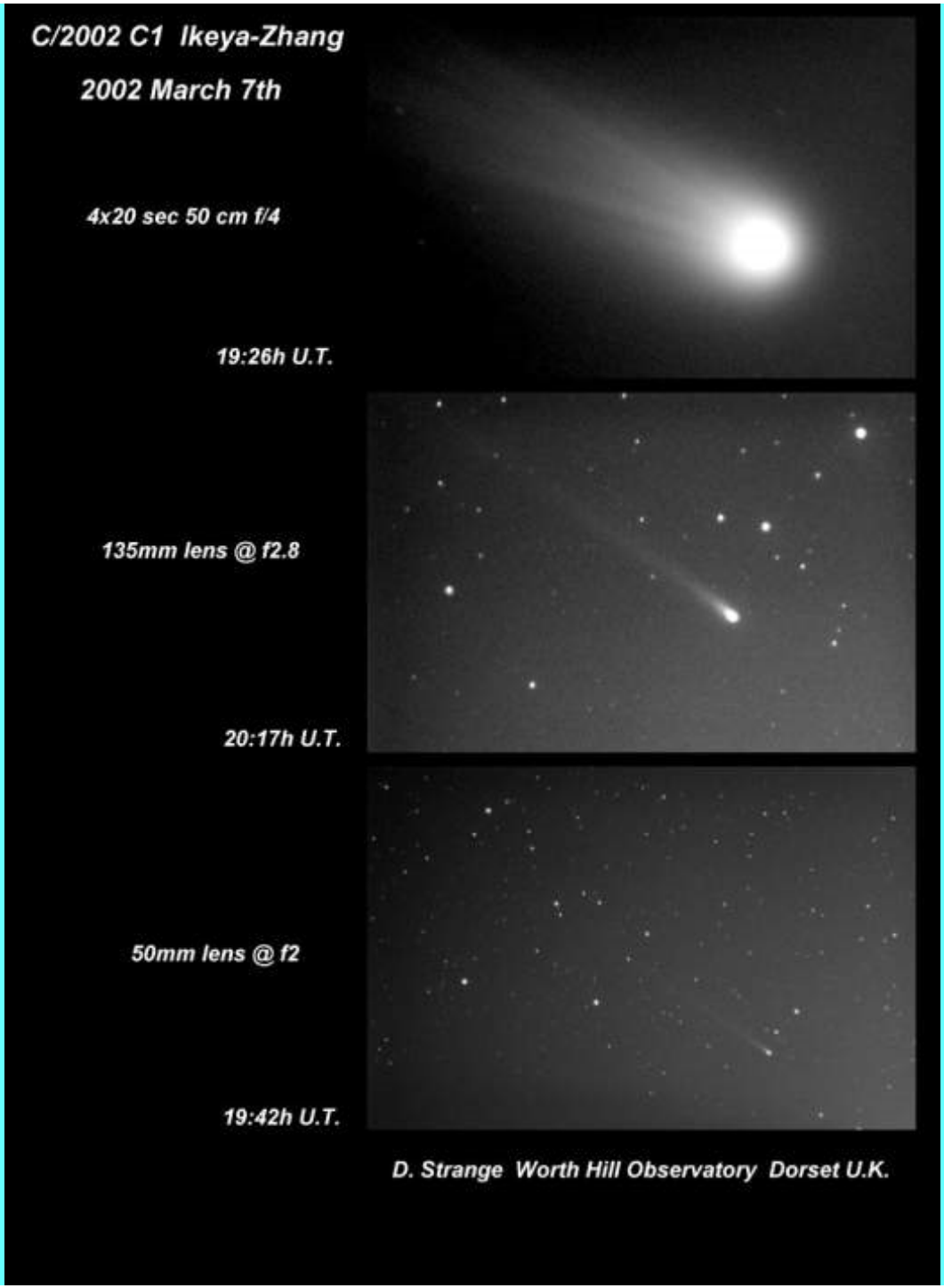
Observing comets




Gas tail
Central
condensation
Dust tail
Coma

Degree of condensation DC



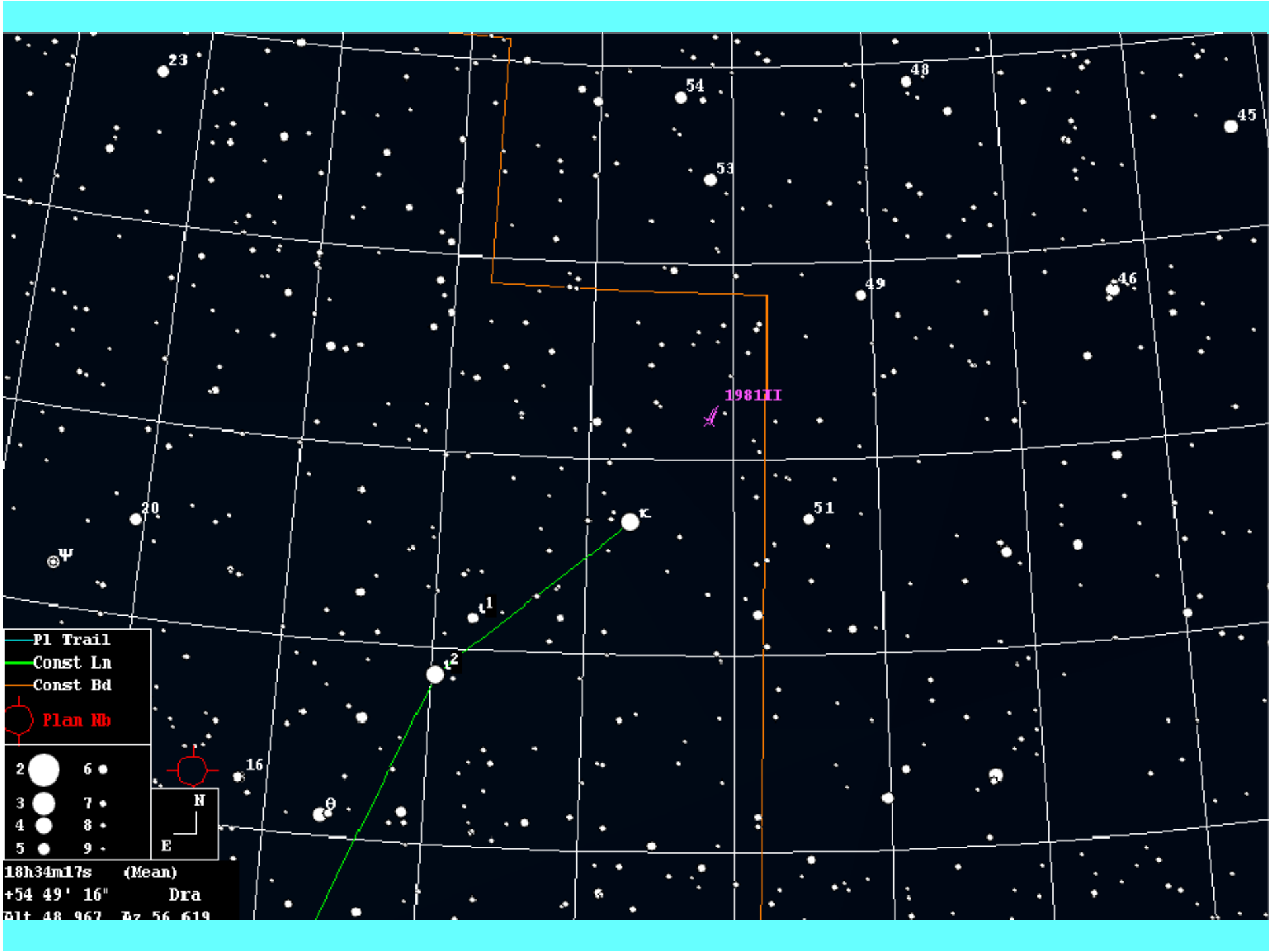

C/2002 C1 Ikeya-Zhang
2002 March 7th
4x20 sec 50 cm f/4
19:26h U.T.
135mm lens @ f2.8
20:17h U.T.
50mm lens @ f2
19:42h U.T.
D. Strange Worth Hill Observatory Dorset U.K.

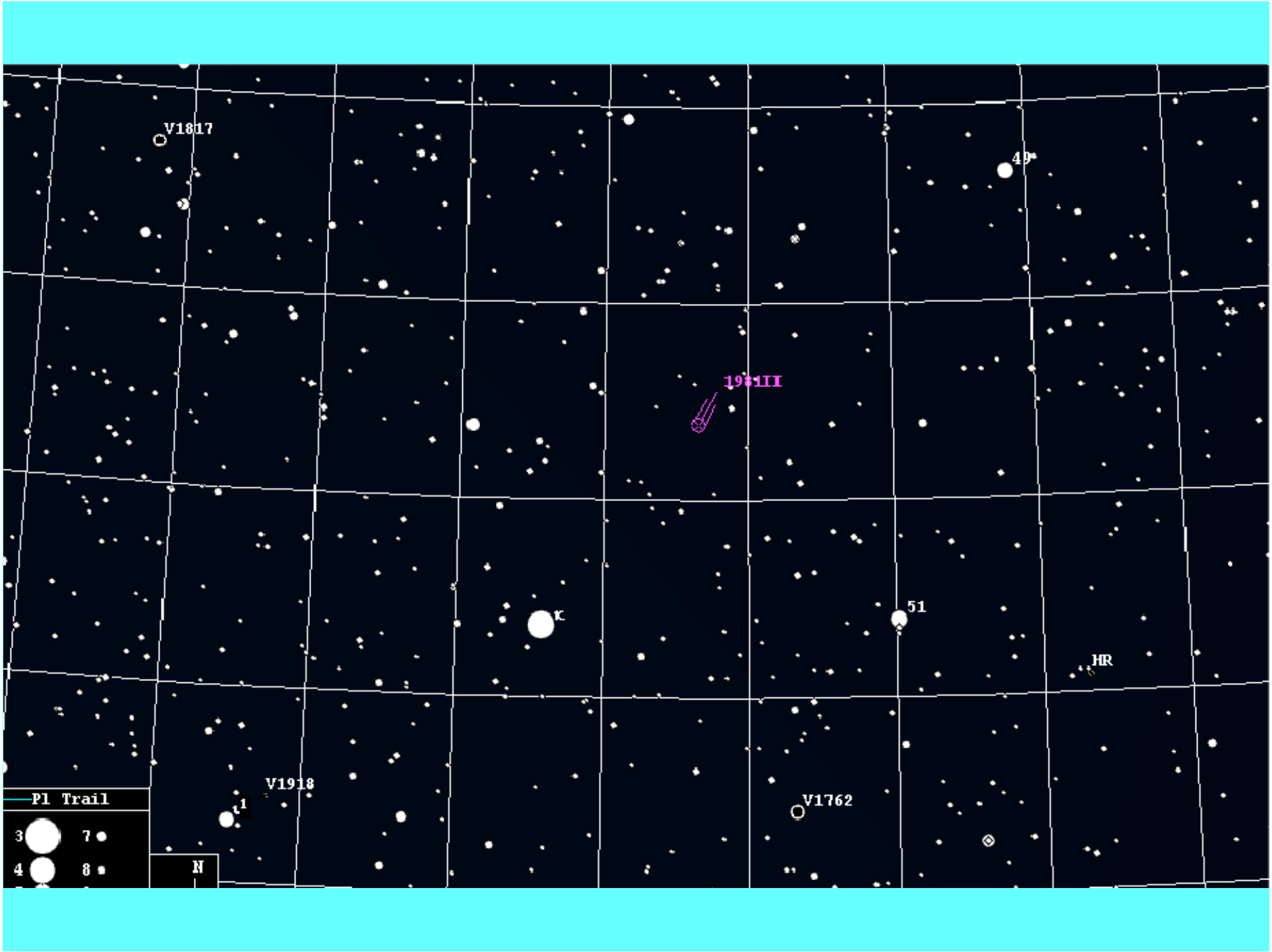
Observations are often made in light polluted areas, which limits the comets you can see.

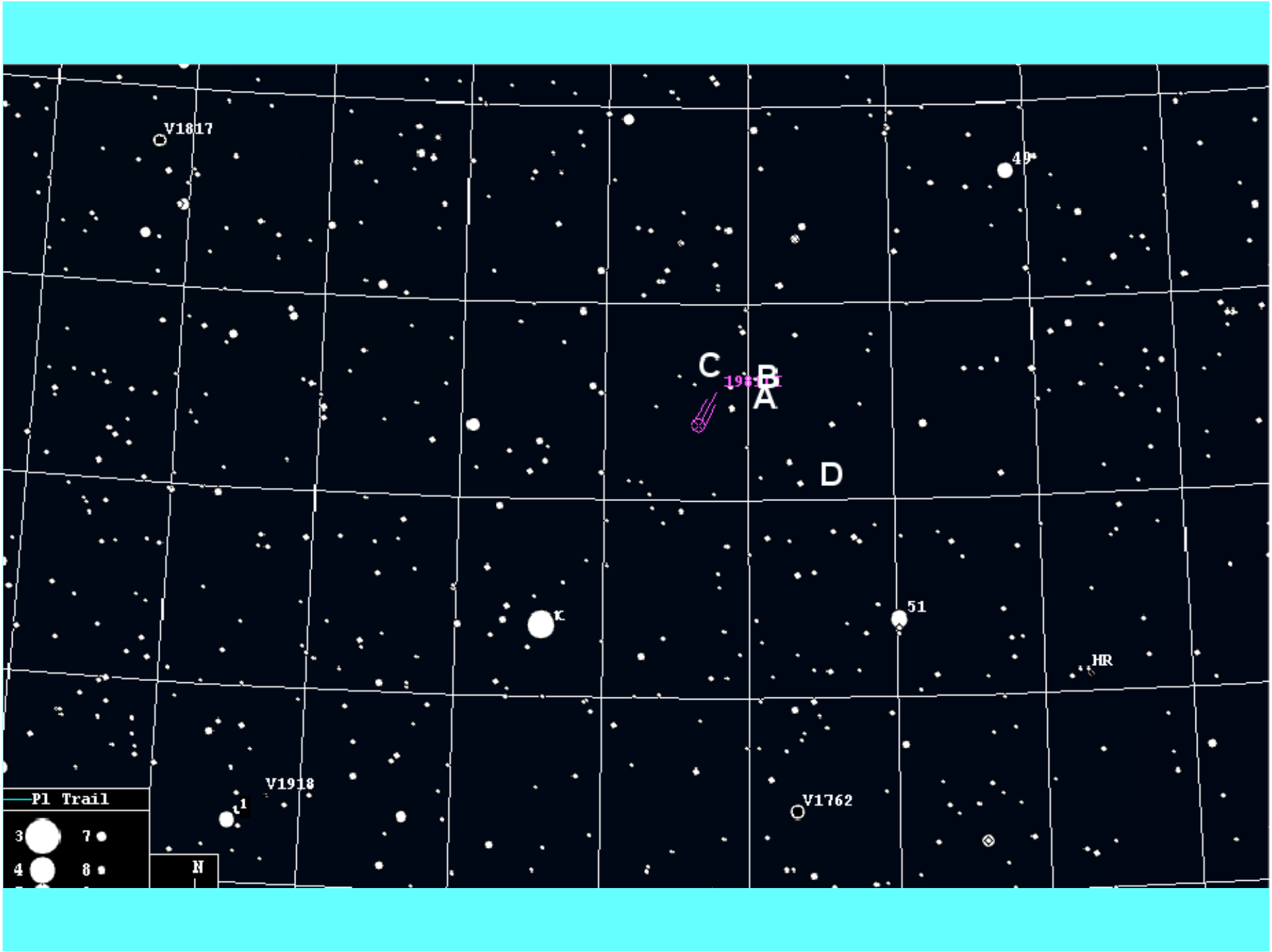
1P/Halley from Antarctica

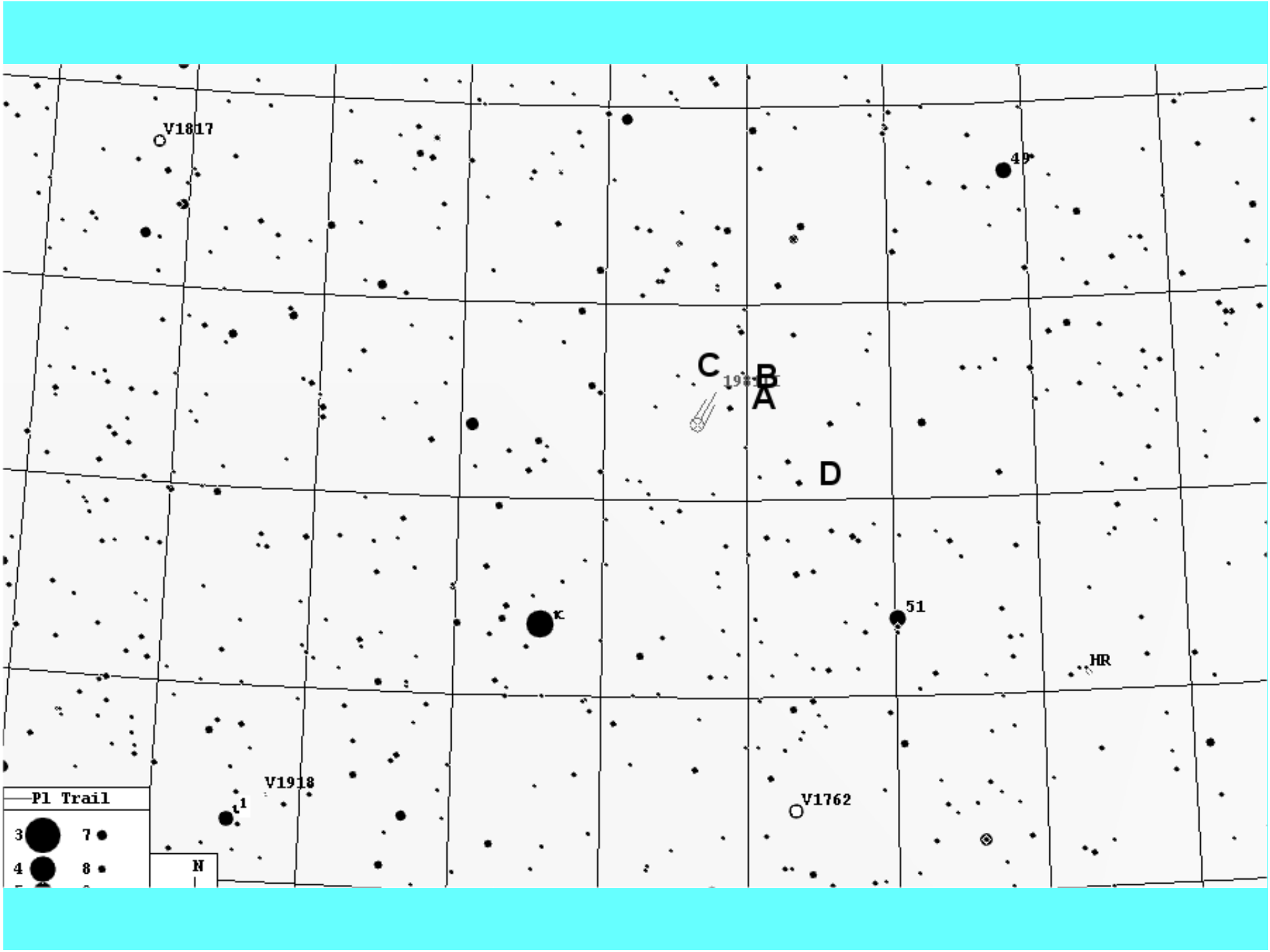
1995 O1 (Hale-Bopp) from Cambridge

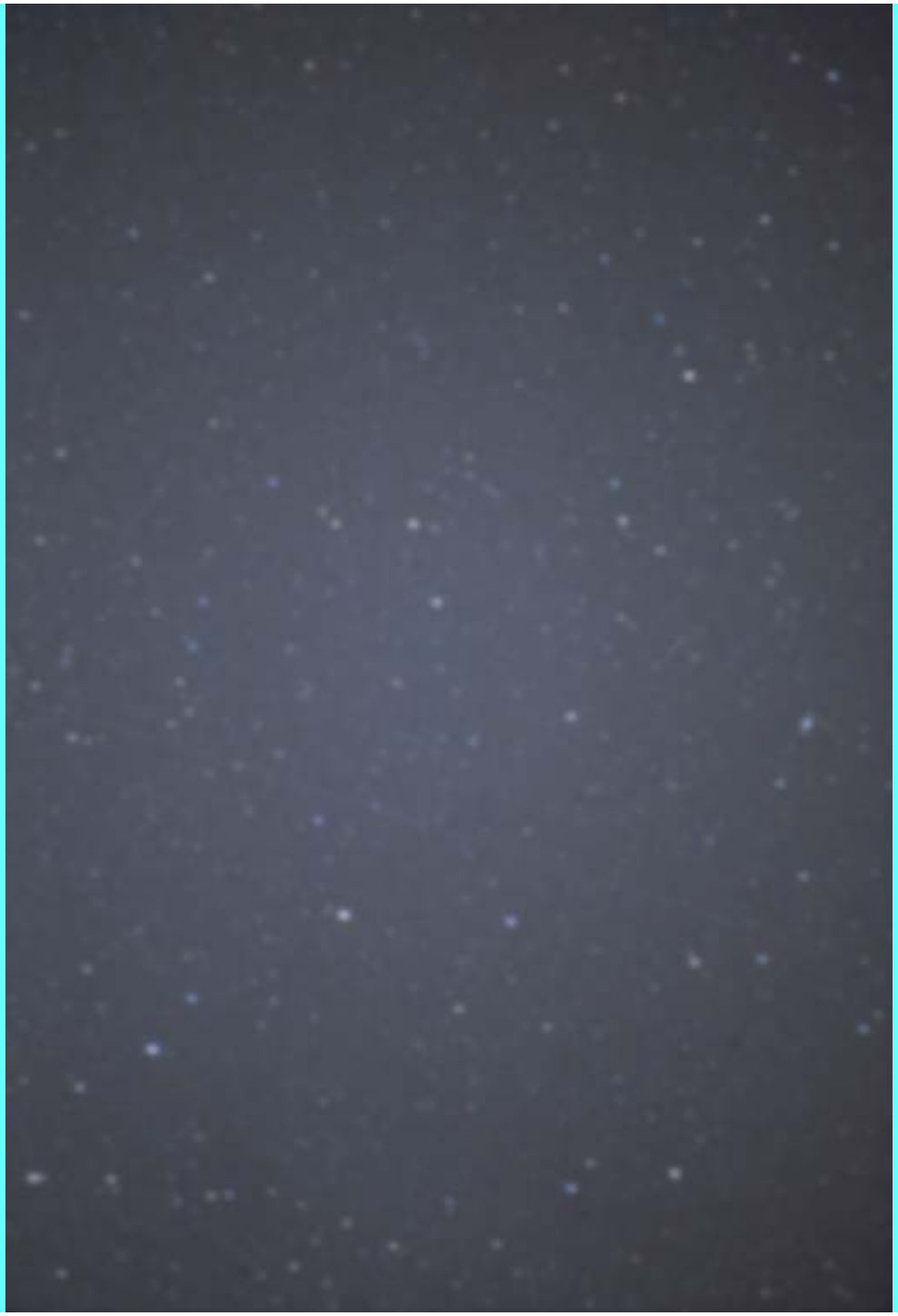

SkyQuest


23
54
48
45
53
49
46
1981II
20
51
κ
Ψ
ι1
ι2
Pl Trail
Const Ln
Const Bd
Plan Nb
2
3
4
5
6
7
8
9
16
θ
N
E
18h34m17s (Mean)
+54 49' 16" Dra
Alt 48.962 Az 56.619


V1817
49
1981II
51
HR
V1918
V1762
P1 Trail
3
4
7
8
N

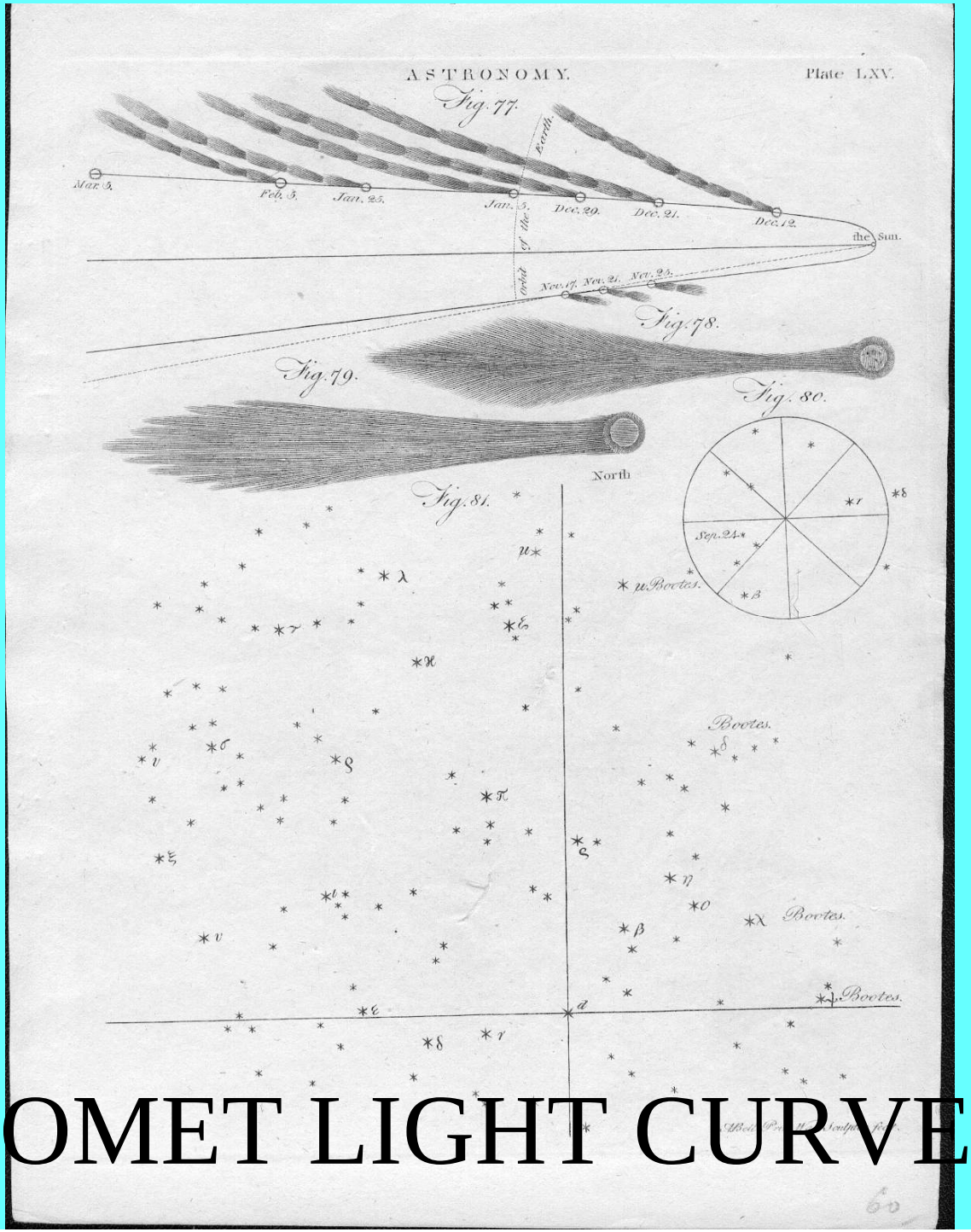

V1817
49
C
B
A
D
51
HR
V1918
V1762
Pl Trail
3
4
7
8
N


V1817
49
C
B
A
D
51
HR
V1918
V1762
Pl Trail
3
7
4
8
N



Observers have to reduce their observations for them to be used in scientific analysis. The key points are : what, when, magnitude, instrument, coma and who. Other information is good, but not so critical. Format is essential.

```
88        2015 06 14.81  S 10.8 TK 40.6L 4  76   2.8  2/          ICQ XX CAM03
88        2015 06 17.80  S 10.7 TK 40.6L 4  76   3.0  2/          ICQ XX CAM03
88        2015 06 21.81  S 11.0 TK 40.6L 4  76   2.5  2           ICQ XX CAM03
88        2015 06 22.79  S 10.8 TK 40.6L 4  76   2.5  2           ICQ XX CAM03
88        2015 07 14.11  S  9.6 TK 20.3T10  77   3    3           ICQ XX GON05
88        2015 07 16.06  B 10.2 TI 20.0T10  80   2    3           ICQ XX LAB02
88        2015 07 22.75  C 11.3 MC 40.6Y 9a 90   0.5              ICQ XX HILaaI
88        2015 07 23.31  S 11.0 AU 22  L 6 160   3    3           ICQ XX GOI
88        2015 07 26.08  B 11.3 TI 20.0T10  80   2    3           ICQ XX LAB02
88        2015 08 08.23  S 11.6 AU 22  L 6 160   1.5  3           ICQ XX GOI
88        2015 08 09.03  S 10.4 TK 20.3T10  77   3    2/          ICQ XX GON05
88        2015 08 09.72  C 11.5 MC 40.6Y 9a 90   0.4              ICQ XX HILaaI
88        2015 08 16.05  B 10.8 TI 20.0T10  50   2.5  2           ICQ XX LAB02
88        2015 08 17.10  C 12.1 MC 50.0L 3a110   1.6              ICQ XX HILaaI
88        2015 08 19.12  S 10.8 TK 20.3T10  77   3    2           ICQ XX GON05
88        2015 08 25.08  C 11.8 MC 50.0L 3a110   0.9              ICQ XX HILaaI
88        2015 09 08.05  S 11.7 TK 20.3T10 100   2    1/          ICQ XX GON05
88        2015 09 08.18  C 12.1 MC 50.0L 3a110   0.7              ICQ XX HILaaI
```



COMET LIGHT CURVES

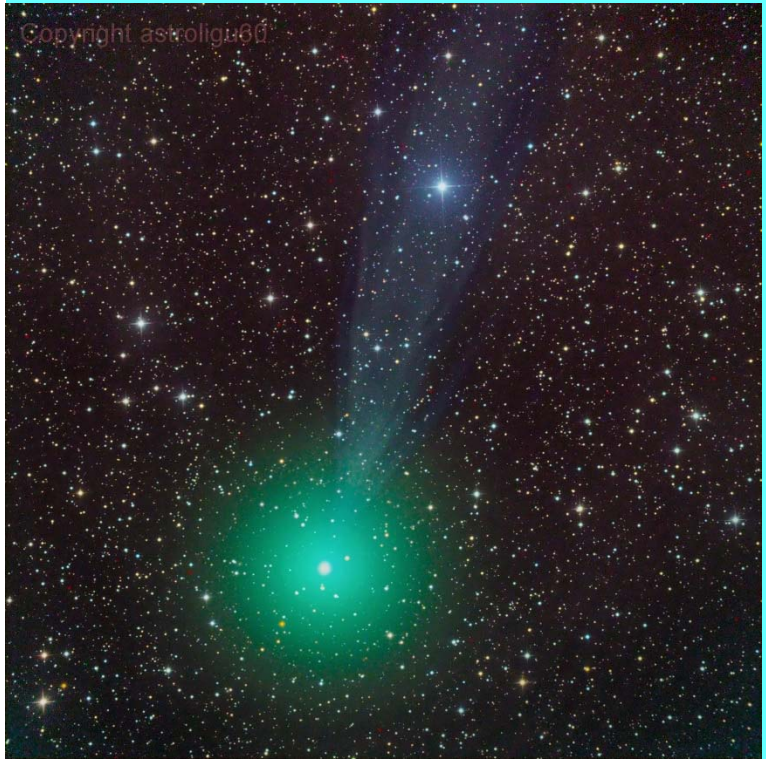
A comet's brightness is described by an equation that represents how the activity changes with distance from the Sun There are two main forms:

One dependent on the distance from the Sun:

$$m = H1 + 5.0 * \log(\Delta) + K1 * \log (r)$$

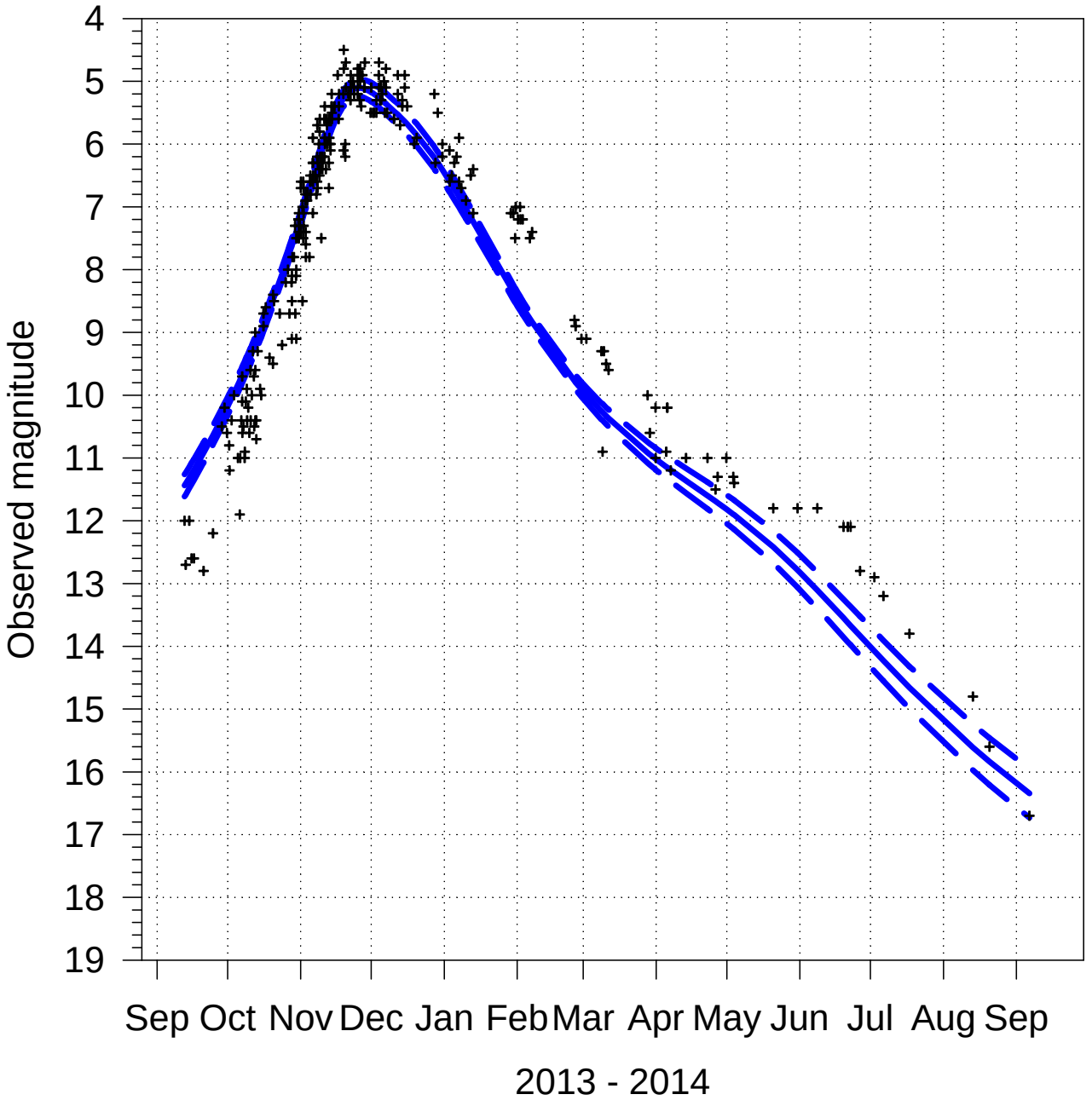
One dependent on the time from perihelion:

$$m = H1 + 5.0 * \log(\Delta) + K1 * \text{abs}(t - T + \Delta t)$$



2013 R1 (Lovejoy) imaged by Mike Glenny on 2013 December 6

Comet 2013 R1 (Lovejoy)

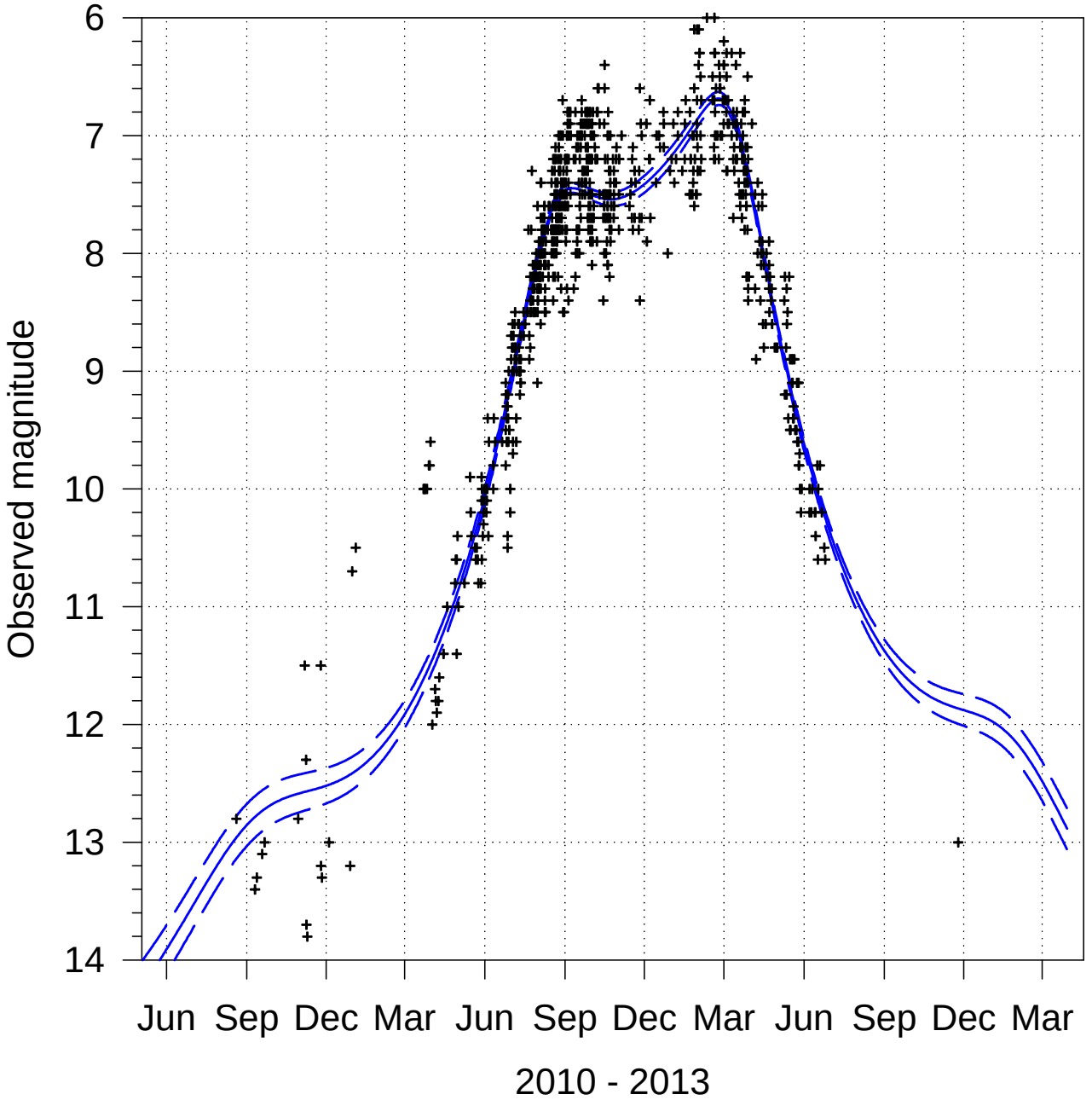


Comet C/2009 P1 (Garradd) and Messier 92

2012 February 03 05:55 UT (28 x 60sec frames, unfiltered, 0.10-m f/2.8 refractor, fov = 136' x 102')

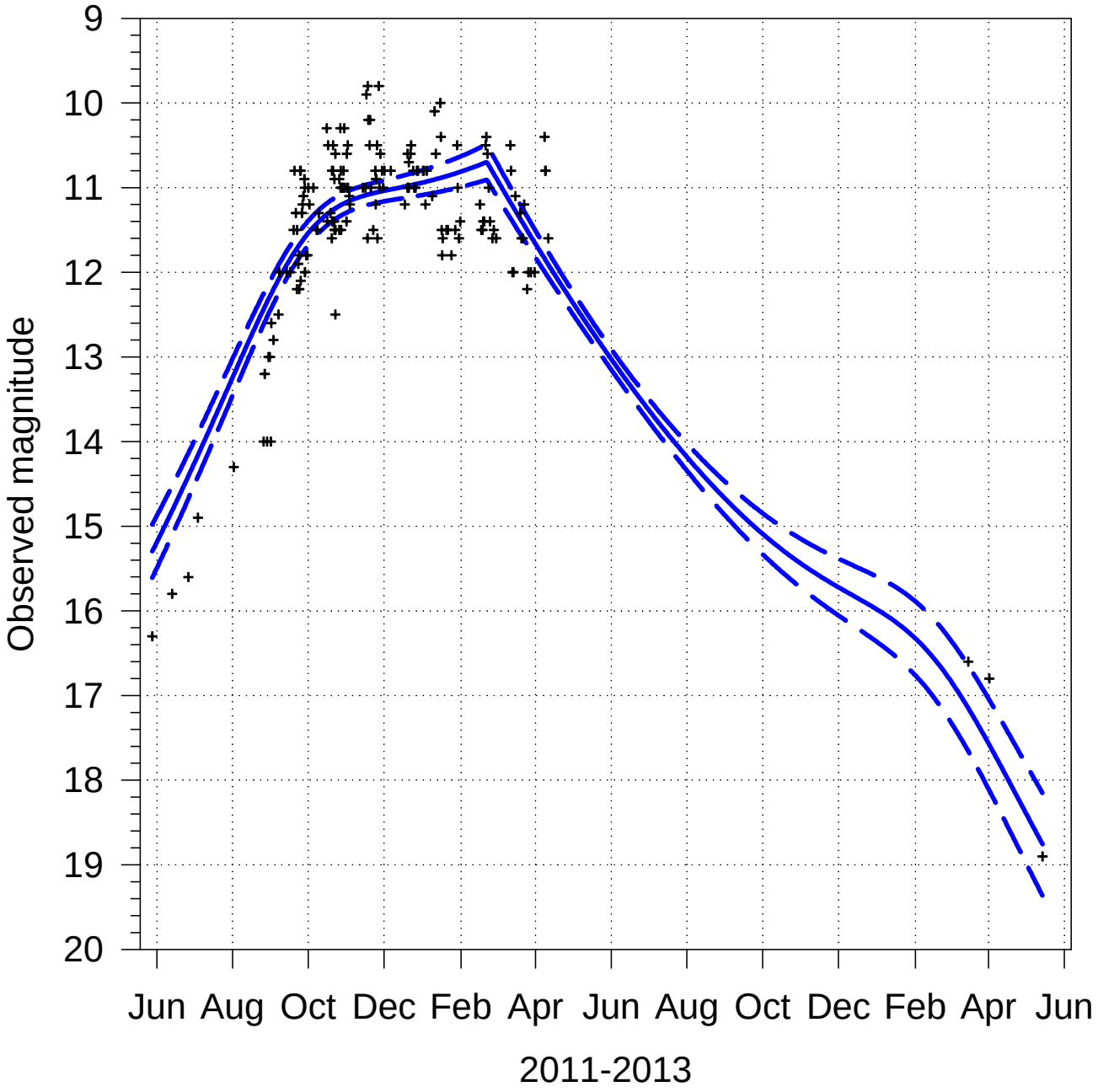
R. Miles Golden Hill Observatory, Dorset, UK

Comet 2009 P1 (Garradd)

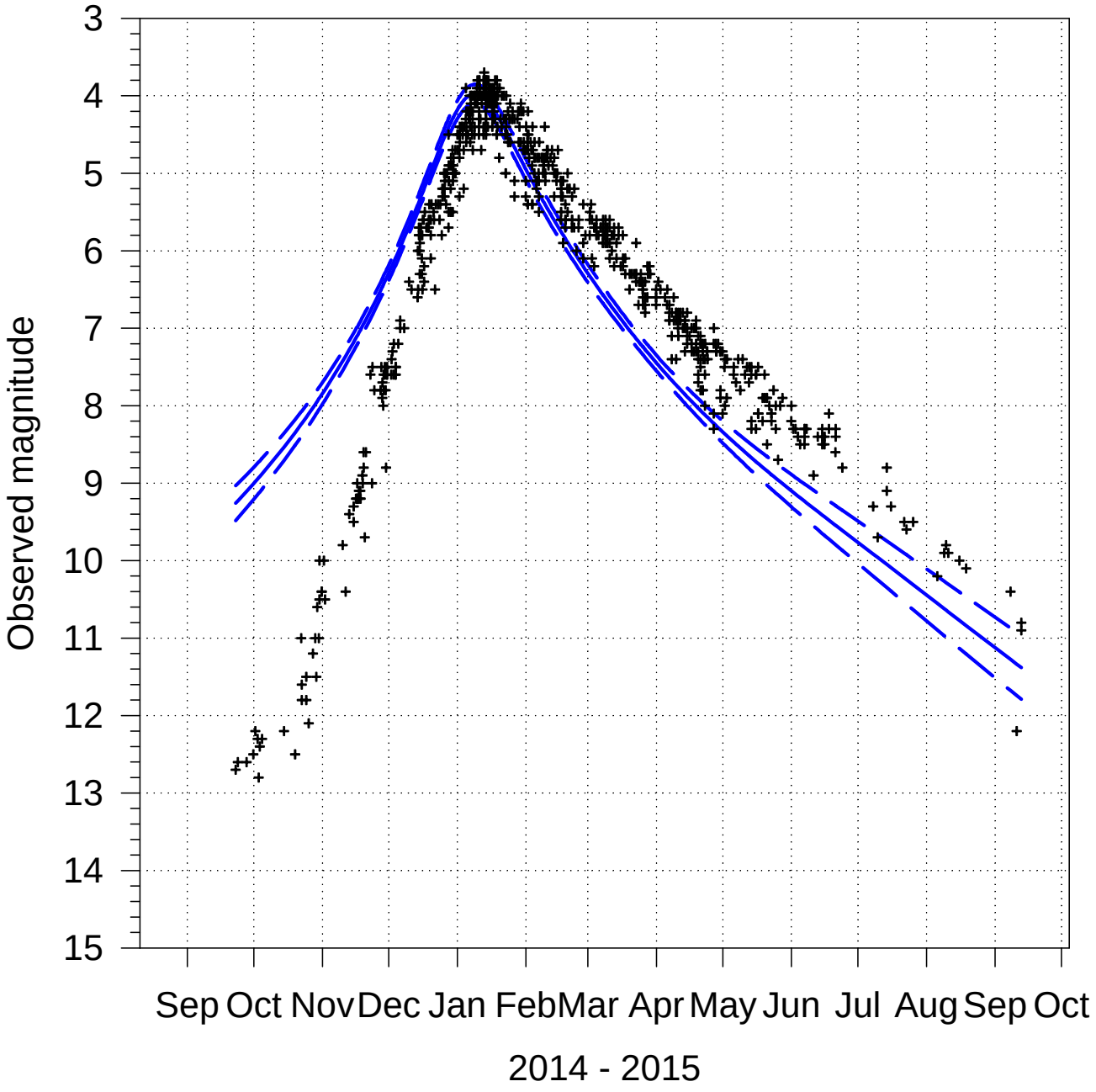


78P/Gehrels imaged by Graham Relf on 2012 January 16

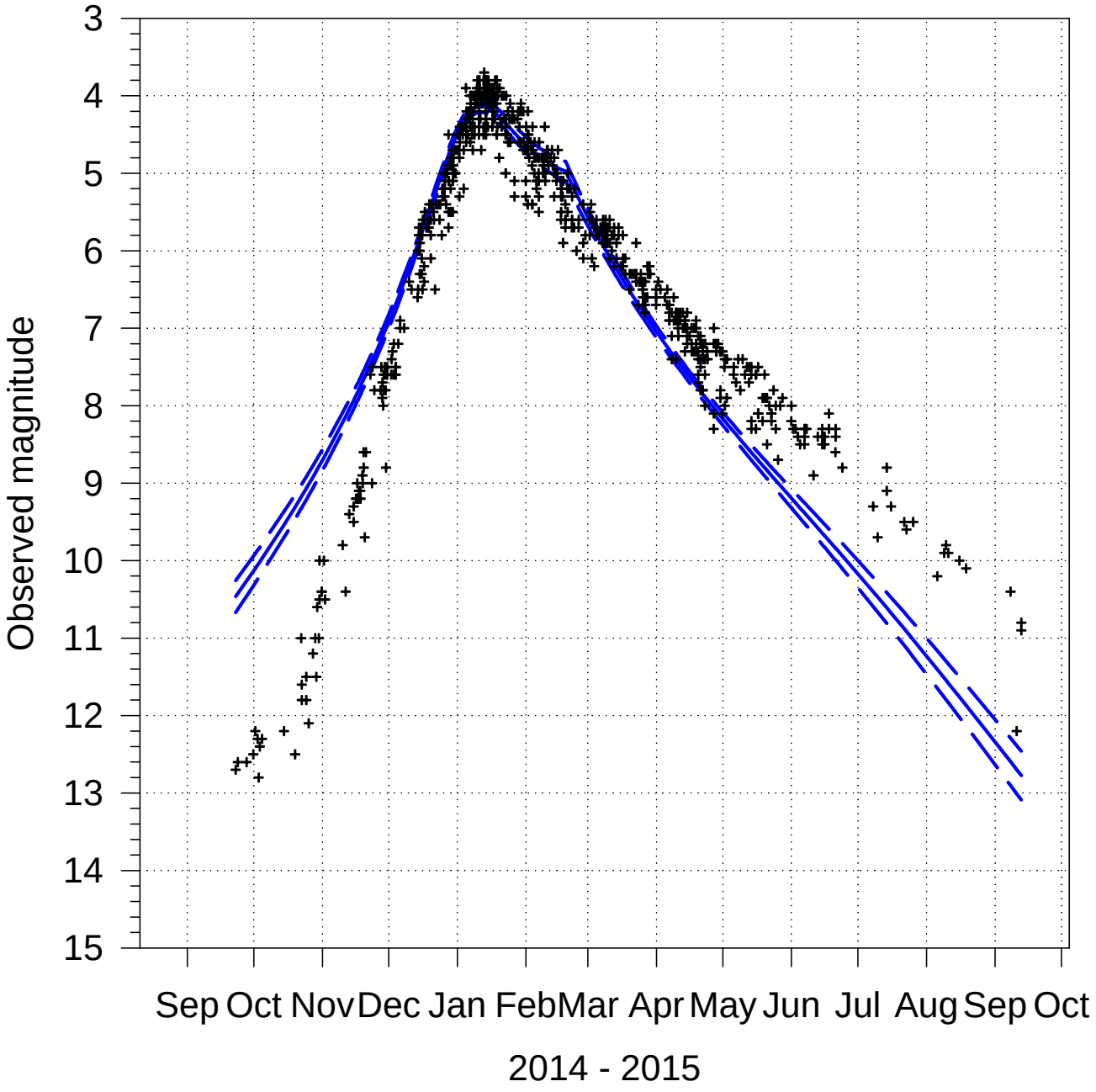
Comet 78P/Gehrels



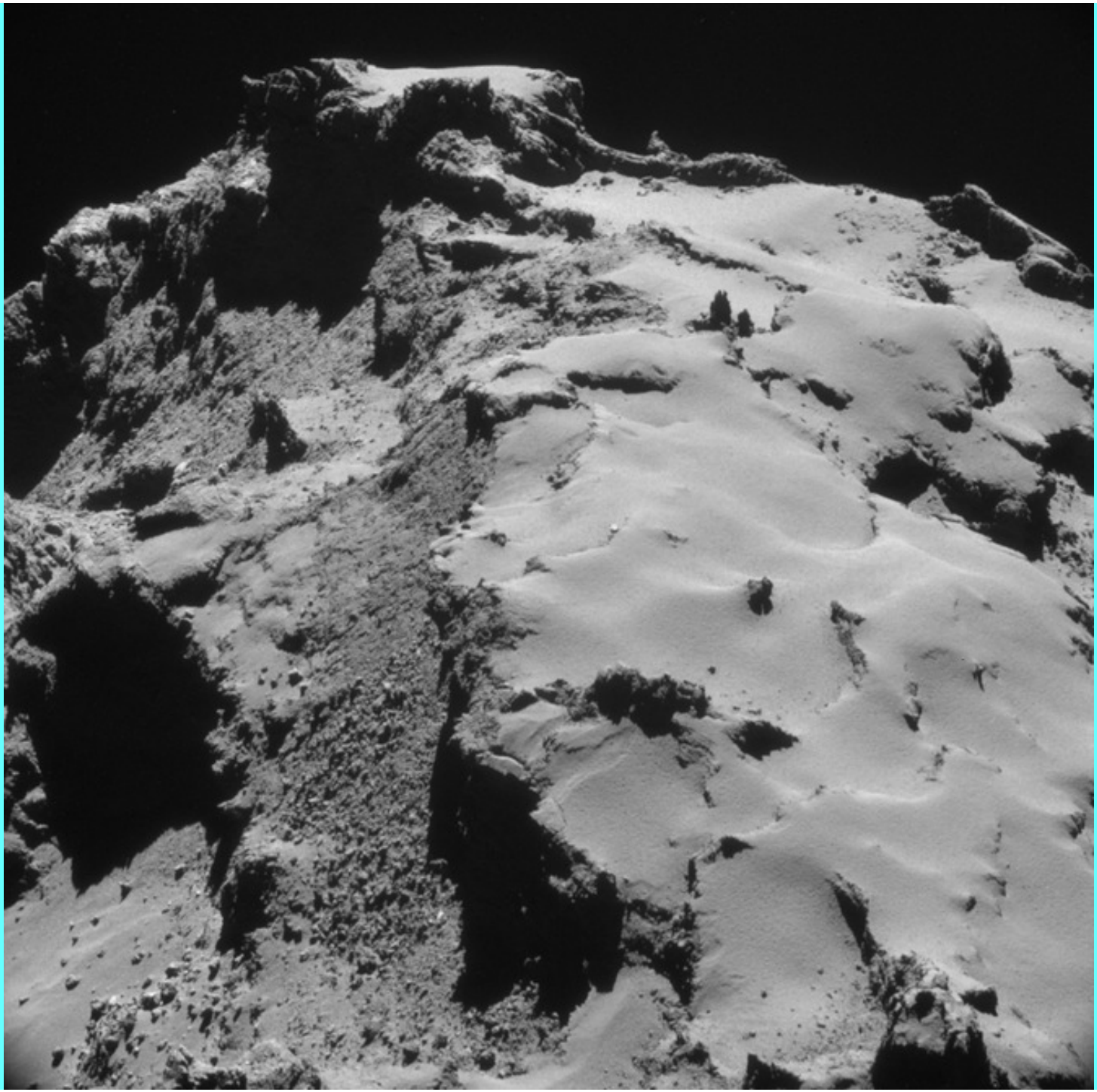
Comet 2014 Q2 (Lovejoy)

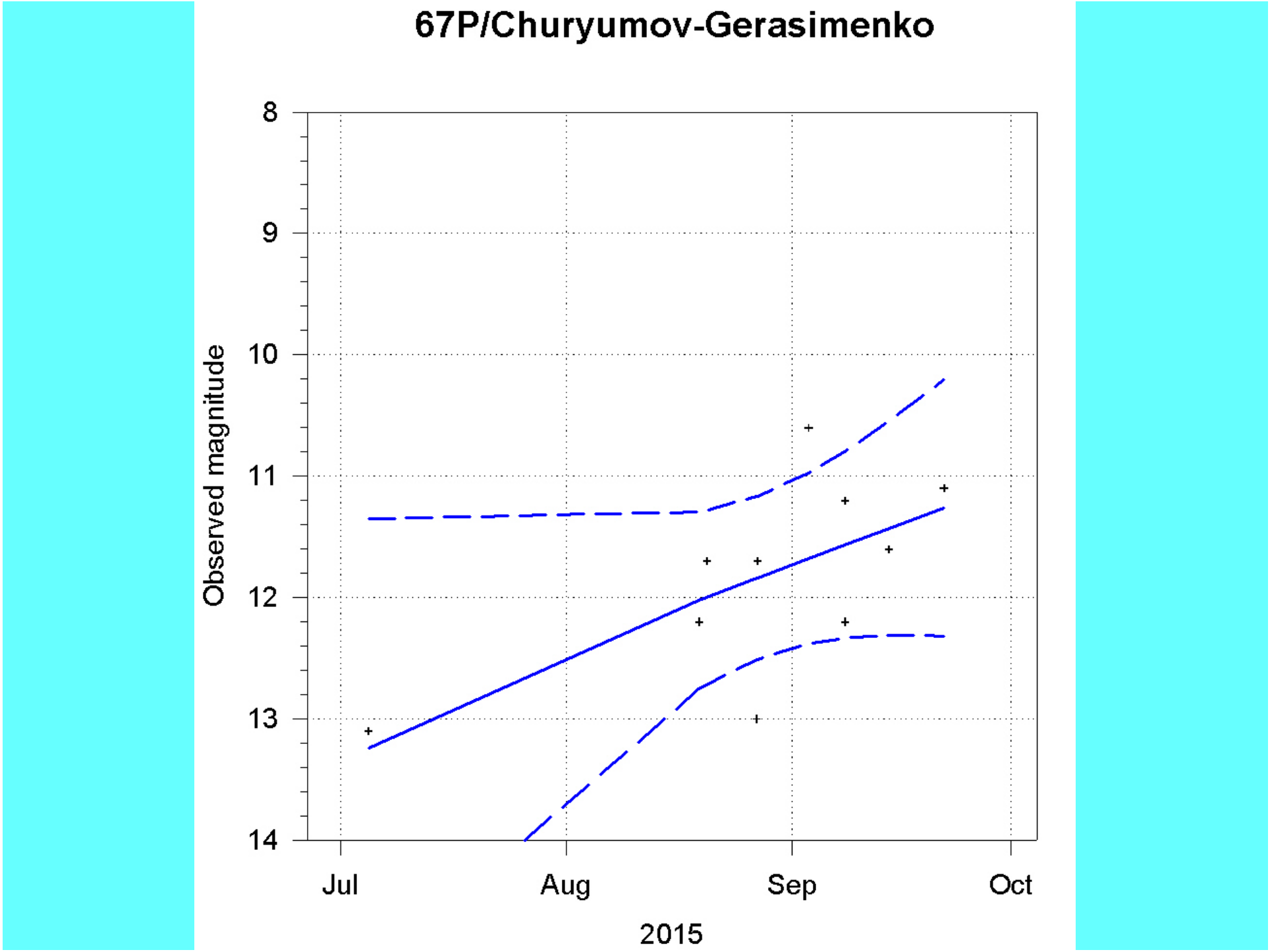


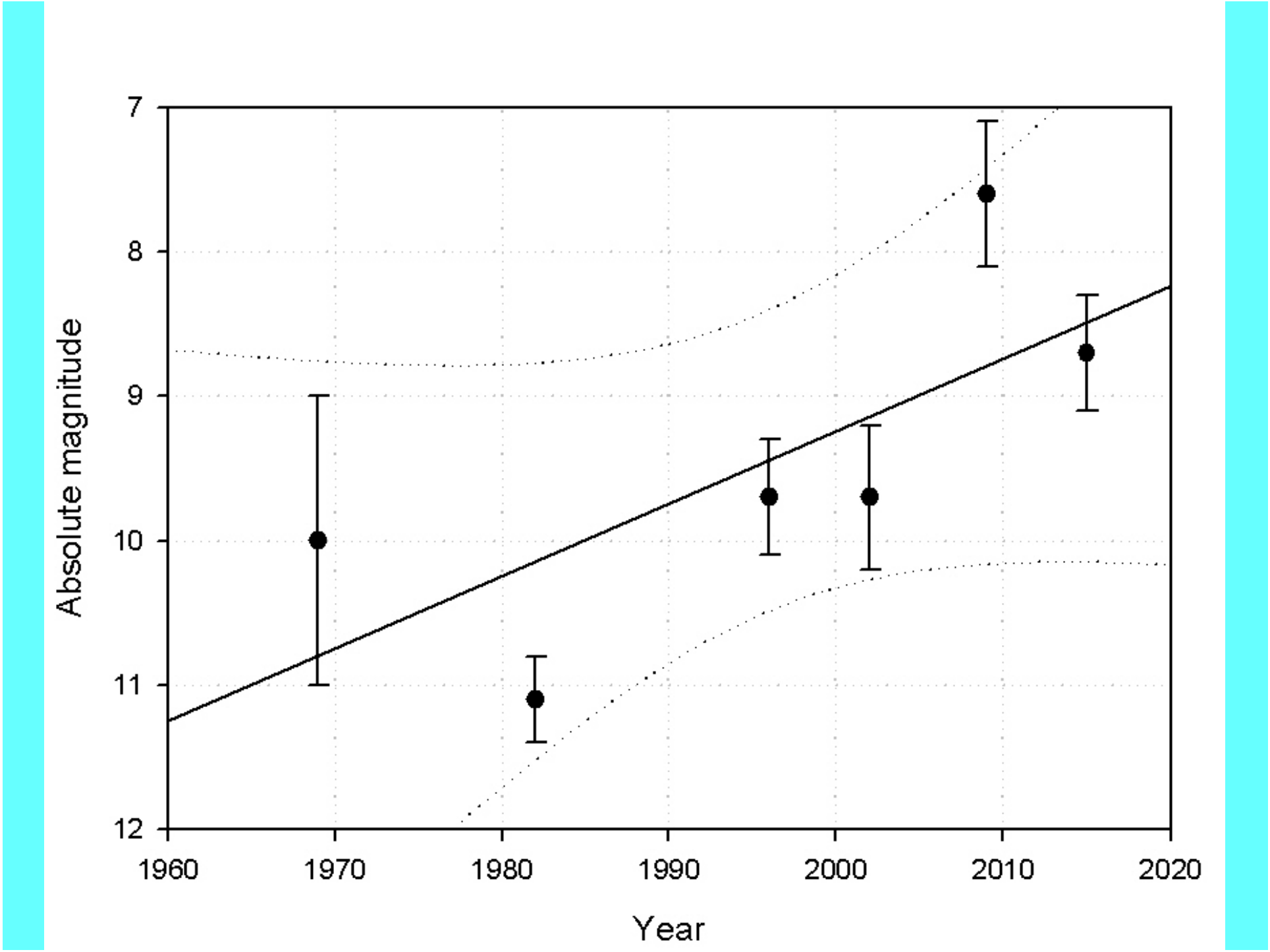
Comet 2014 Q2 (Lovejoy)

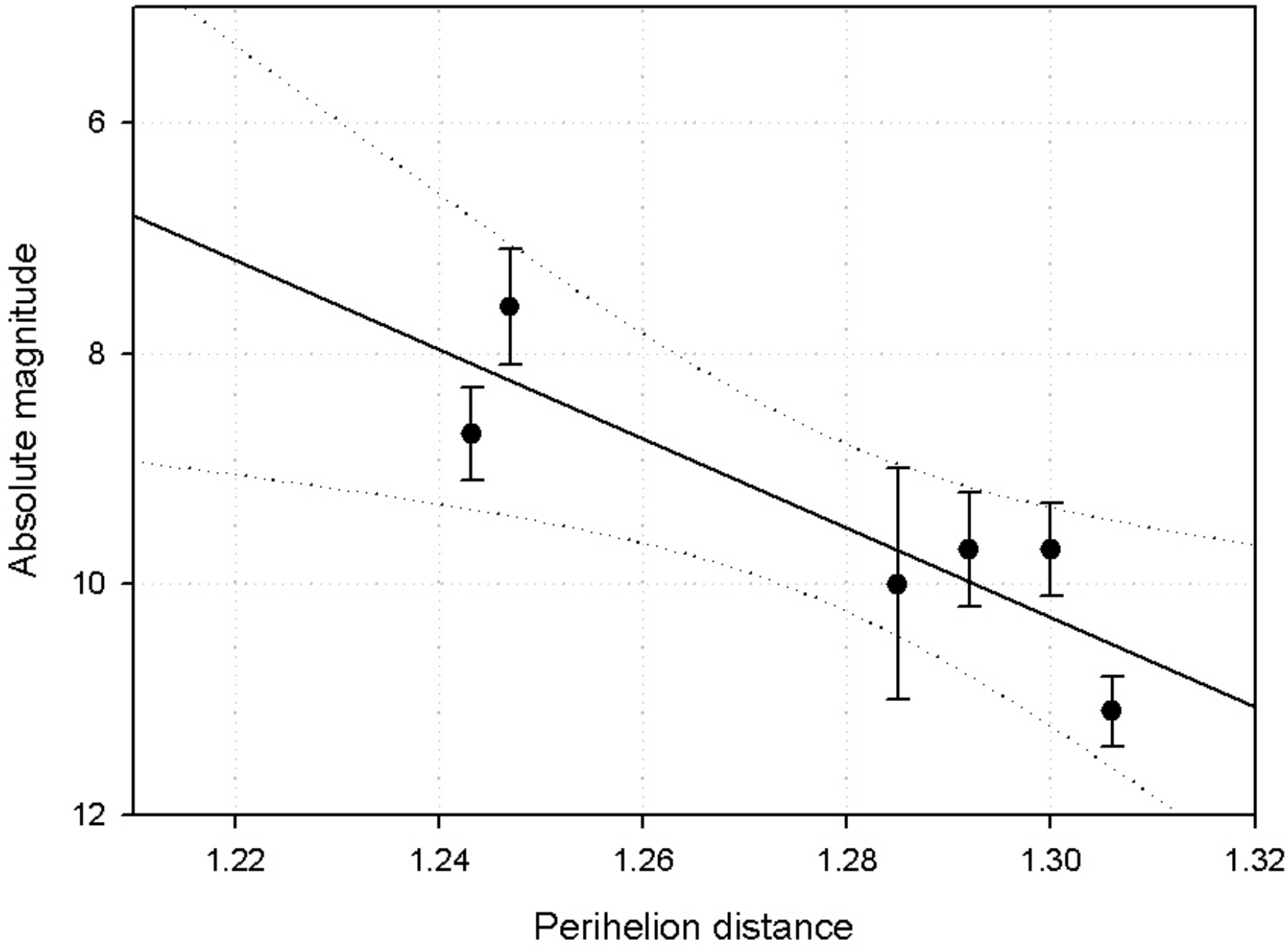



2015 September 13
03:07 UT
Comet 67P Churyumov Gerasimenko
N
[17'x17']
2"/pixel
E
C14@f/6+SBIG ST9XE (unfiltered) +9x120s exposure+Paramount ME
Denis Buczynski@Tarbatness Observatory MPC Code I81



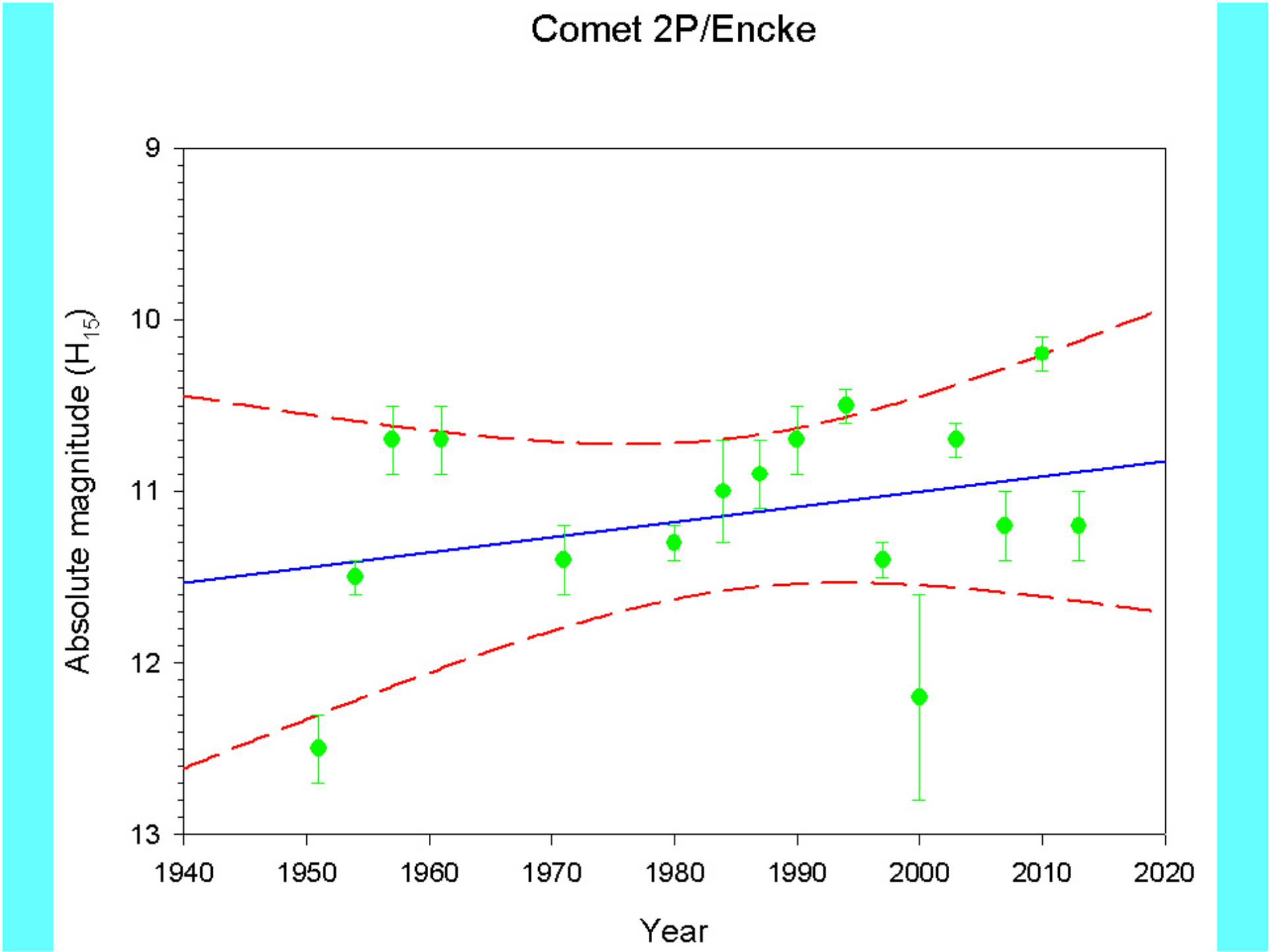

67P/Churyumov-Gerasimenko
Observed magnitude
8
9
10
11
12
13
14
Jul
Aug
Sep
Oct
2015

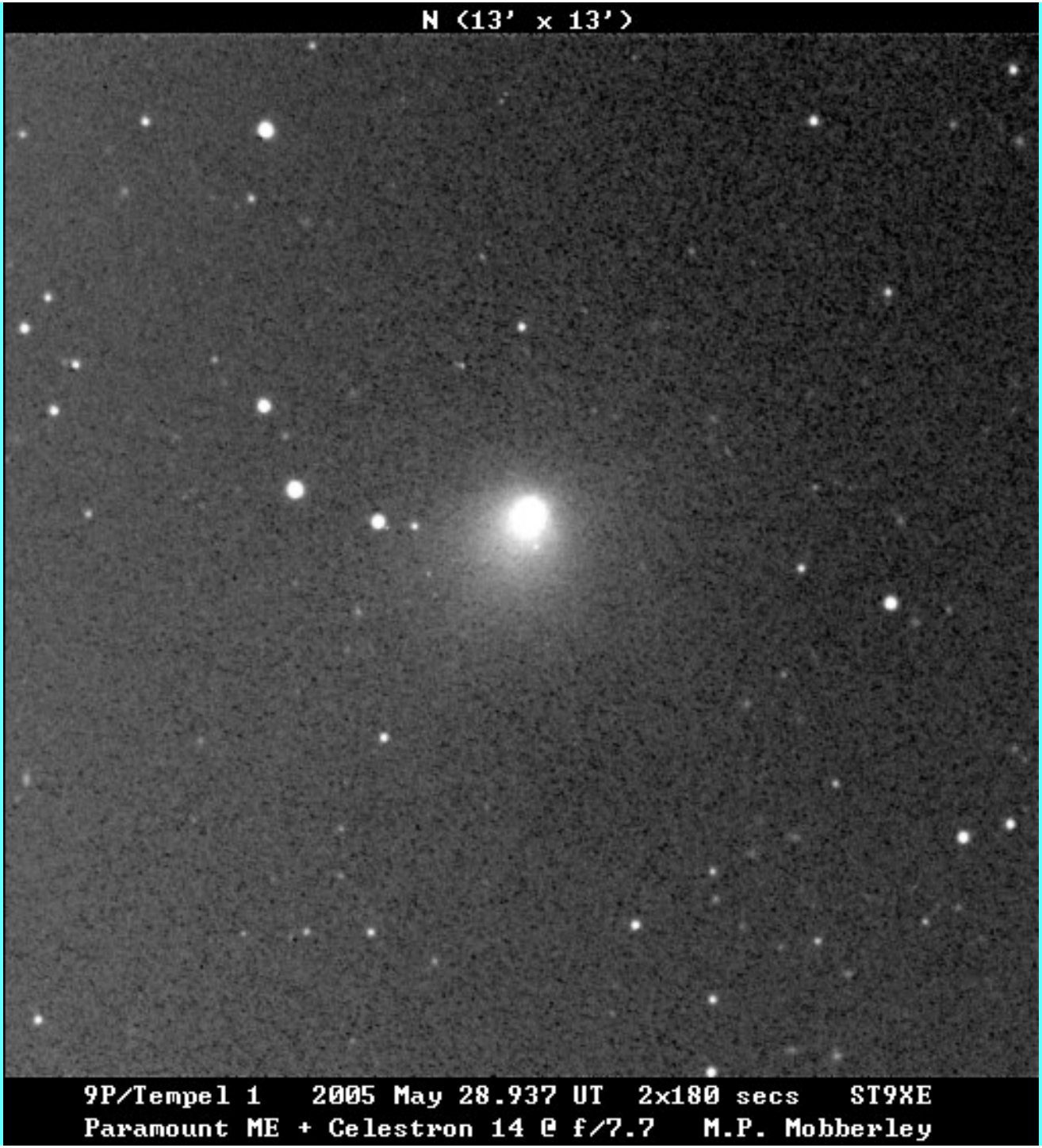

7
8
9
10
11
12
Absolute magnitude
1960
1970
1980
1990
2000
2010
2020
Year


Absolute magnitude
6
8
10
12
1.22
1.24
1.26
1.28
1.30
1.32
Perihelion distance

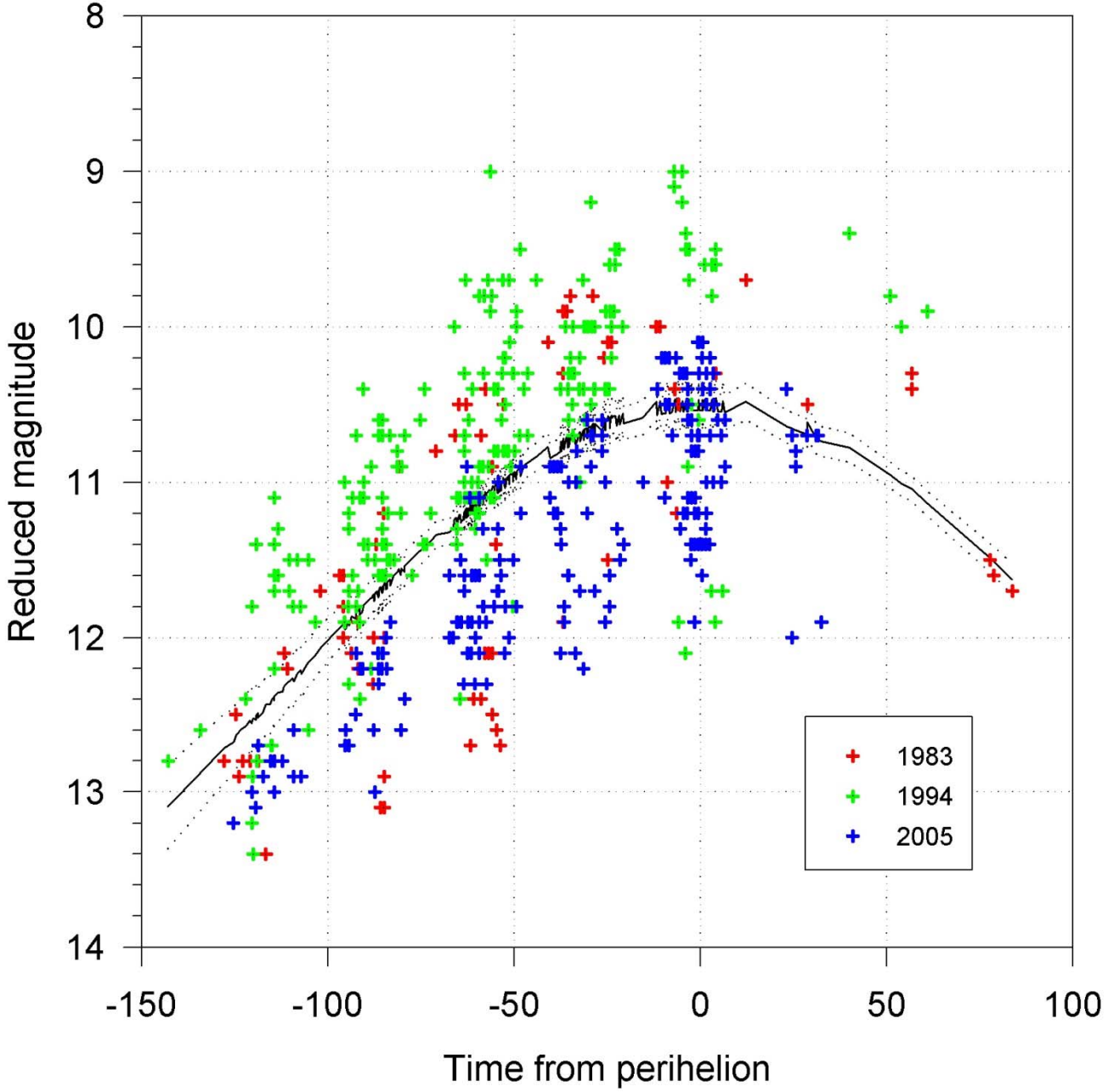
2P/Encke on 2013 November 4 imaged by Damian Peach.

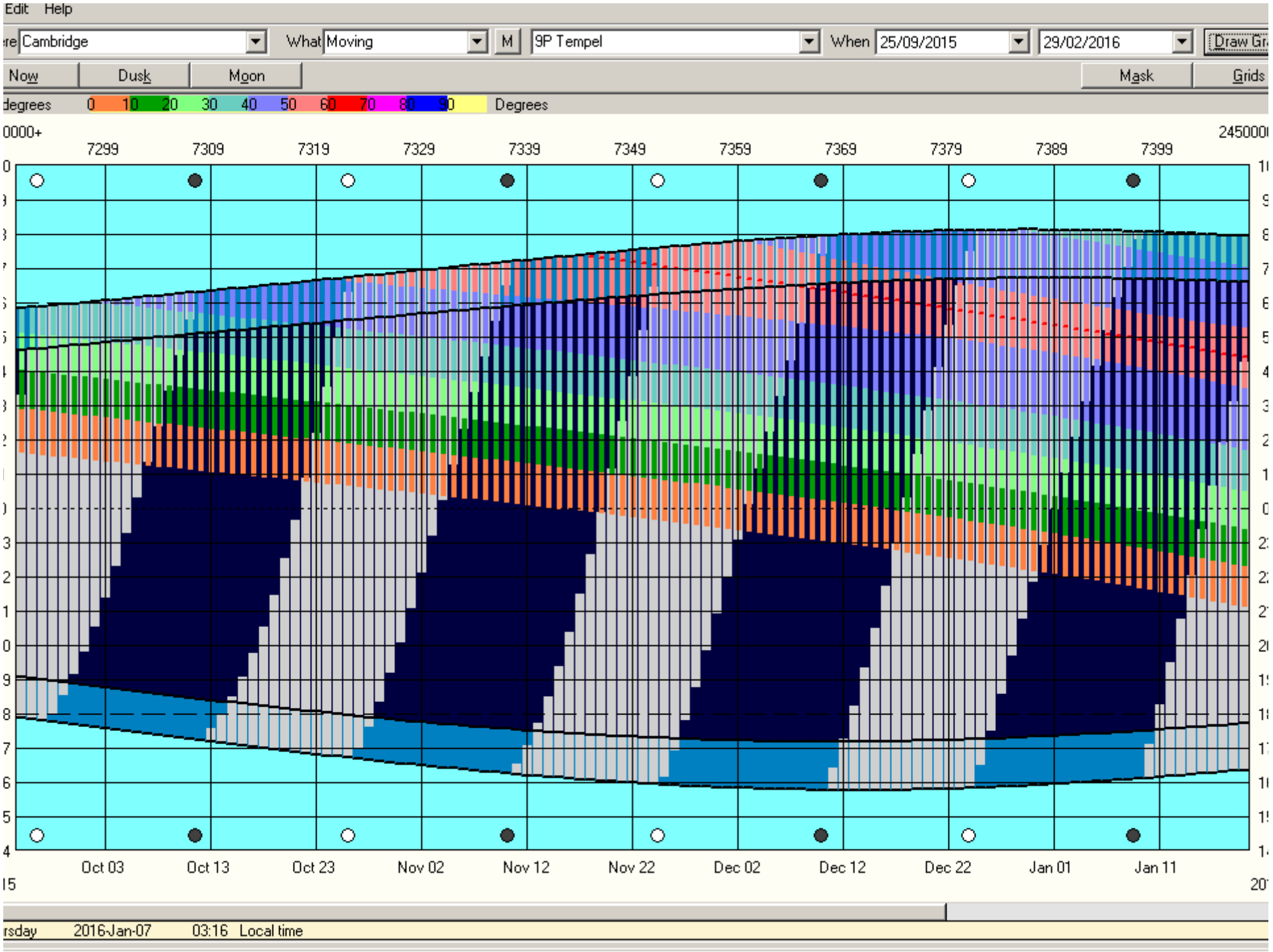
It was just over two weeks from perihelion

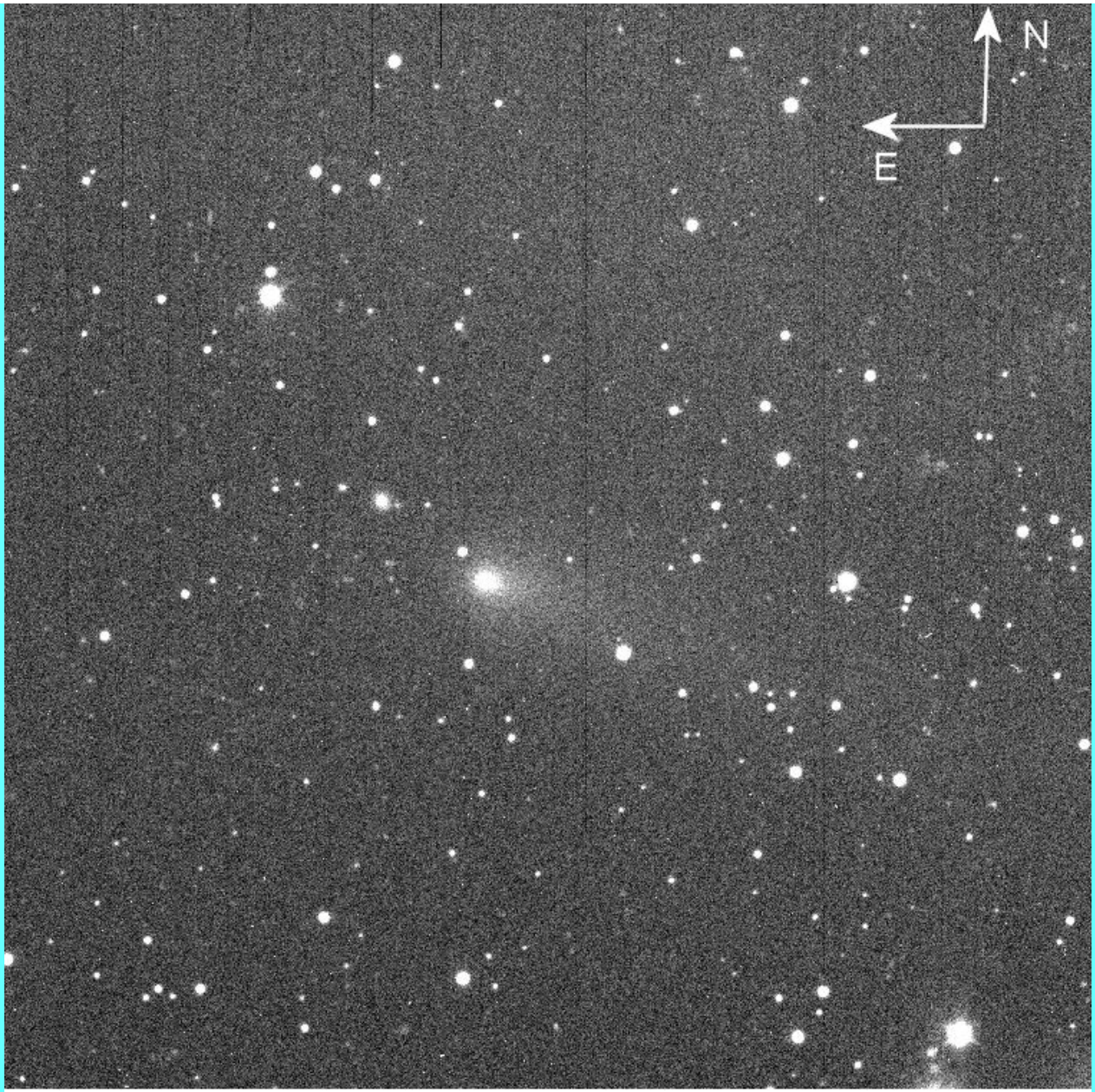

Comet 2P/Encke
Absolute magnitude (H_{15})
9
10
11
12
13
1940
1950
1960
1970
1980
1990
2000
2010
2020
Year


N (13' x 13')
9P/Tempel 1 2005 May 28.937 UT 2x180 secs ST9XE
Paramount ME + Celestron 14 @ f/7.7 M.P. Mobberley

Comet 9P/Tempel




Edit Help
Cambridge
What Moving
M
9P Tempel
When 25/09/2015
29/02/2016
Draw Gr
Now
Dusk
Moon
Mask
Grids
degrees 0 10 20 30 40 50 60 70 80 90 Degrees
7299 7309 7319 7329 7339 7349 7359 7369 7379 7389 7399
Oct 03 Oct 13 Oct 23 Nov 02 Nov 12 Nov 22 Dec 02 Dec 12 Dec 22 Jan 01 Jan 11
rsday 2016-Jan-07 03:16 Local time

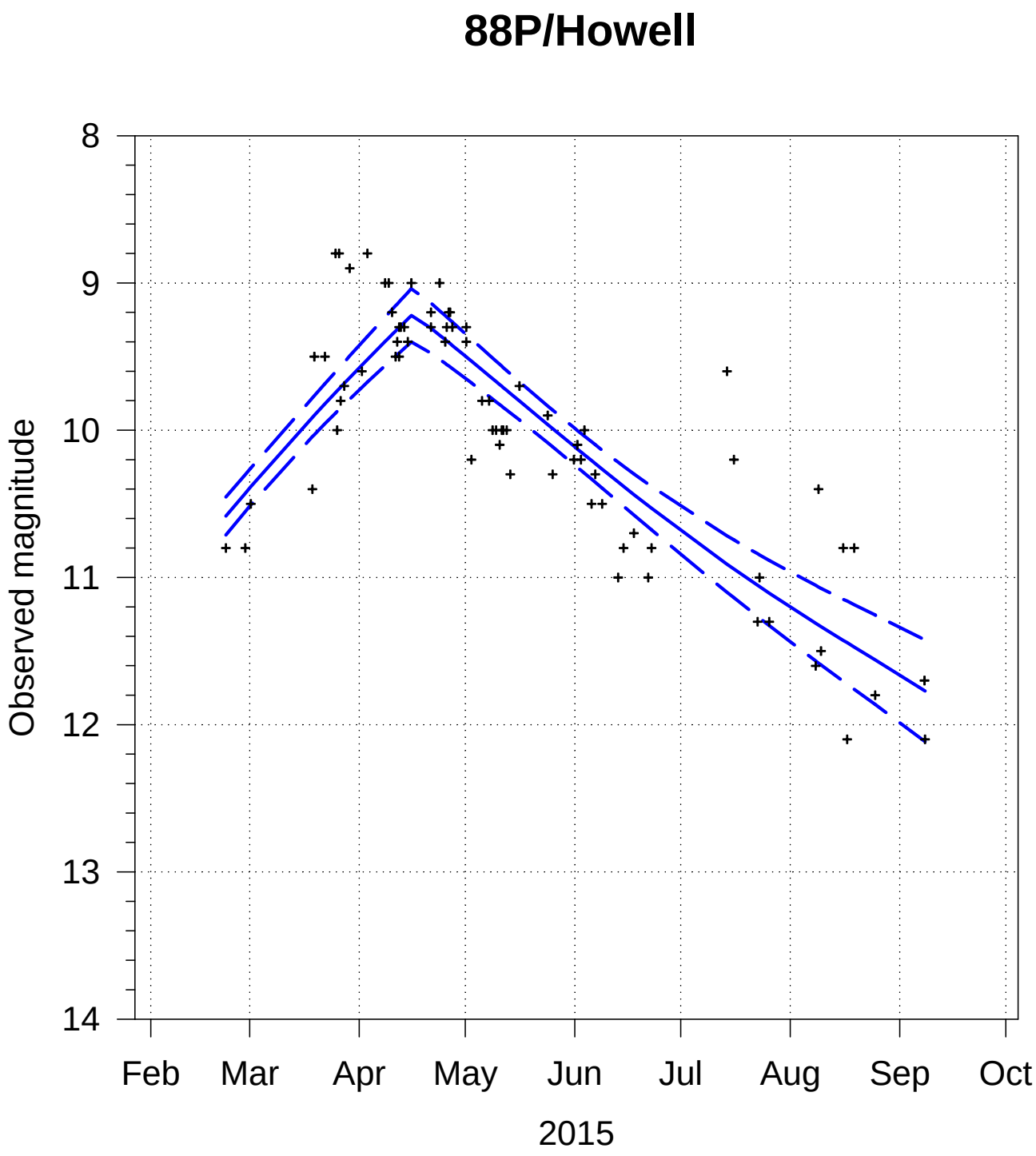


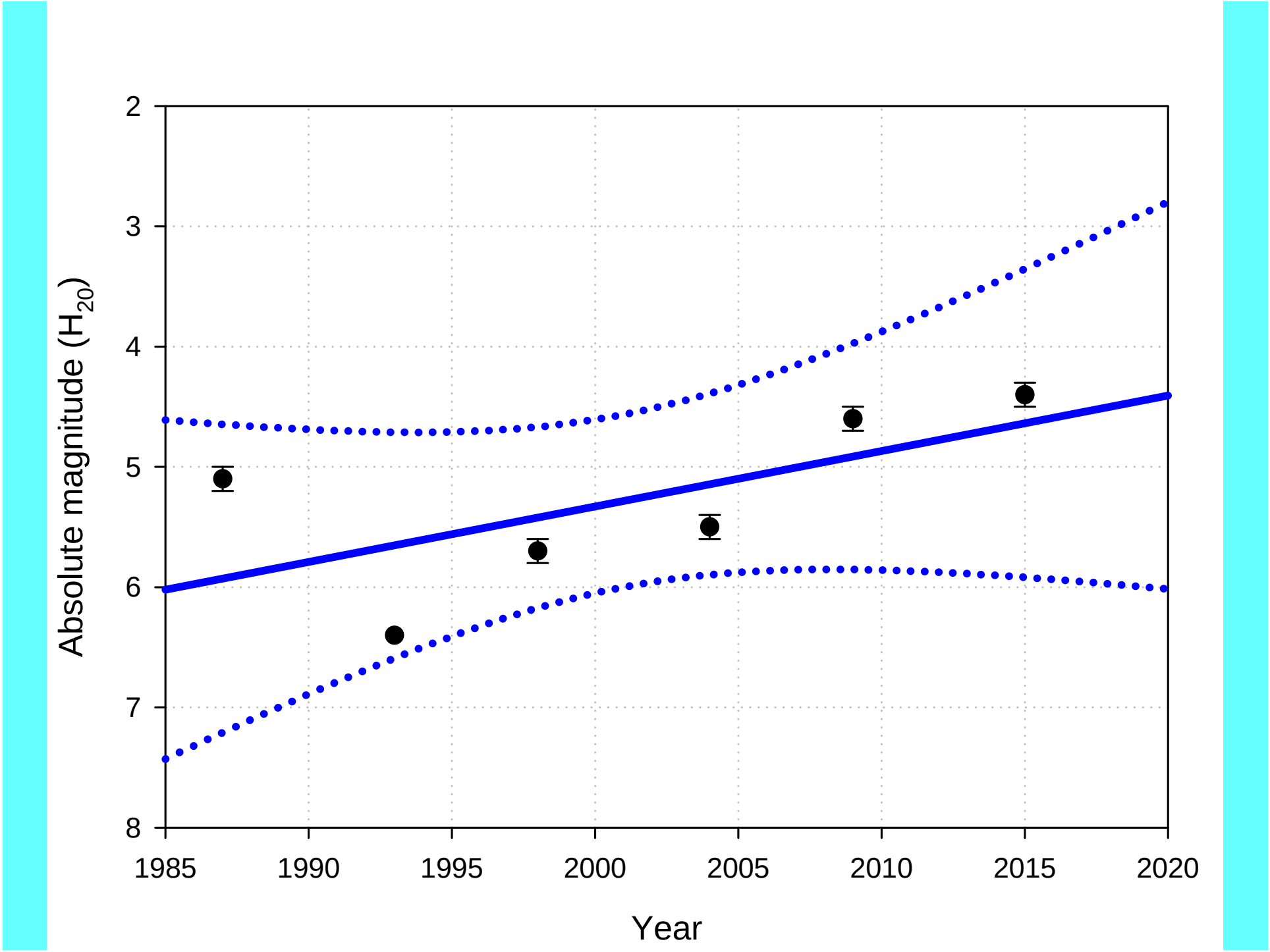
Comet 88P/Howell, 2015 Sep 22, 1009UT, 20x20 arc mins, 85s exp, SSON OMI 0.61m f/10 Cassegrain, FLI Proline PLO9000 CCD, unfiltered, R Dymock, MPC G68

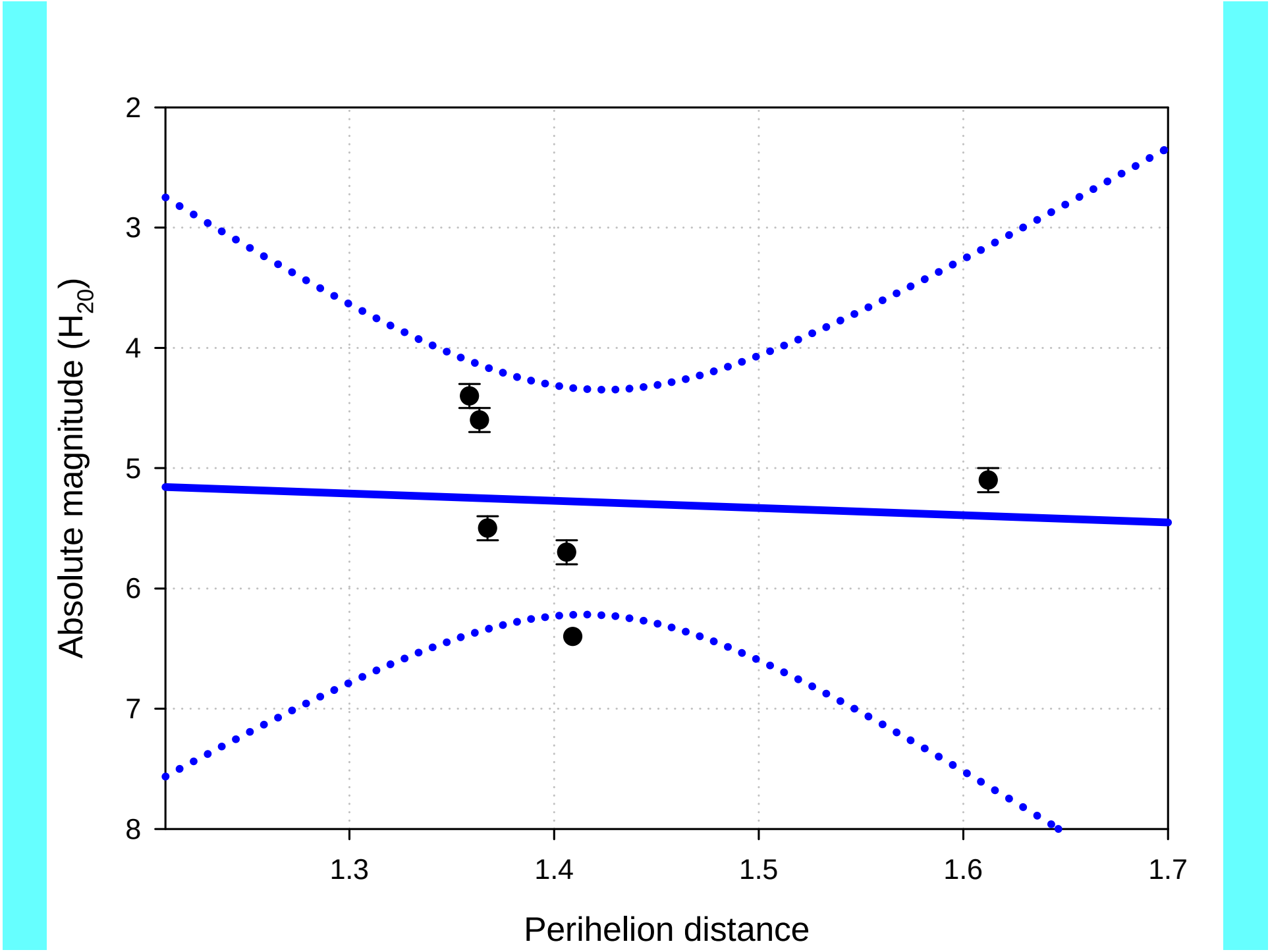
74 observations

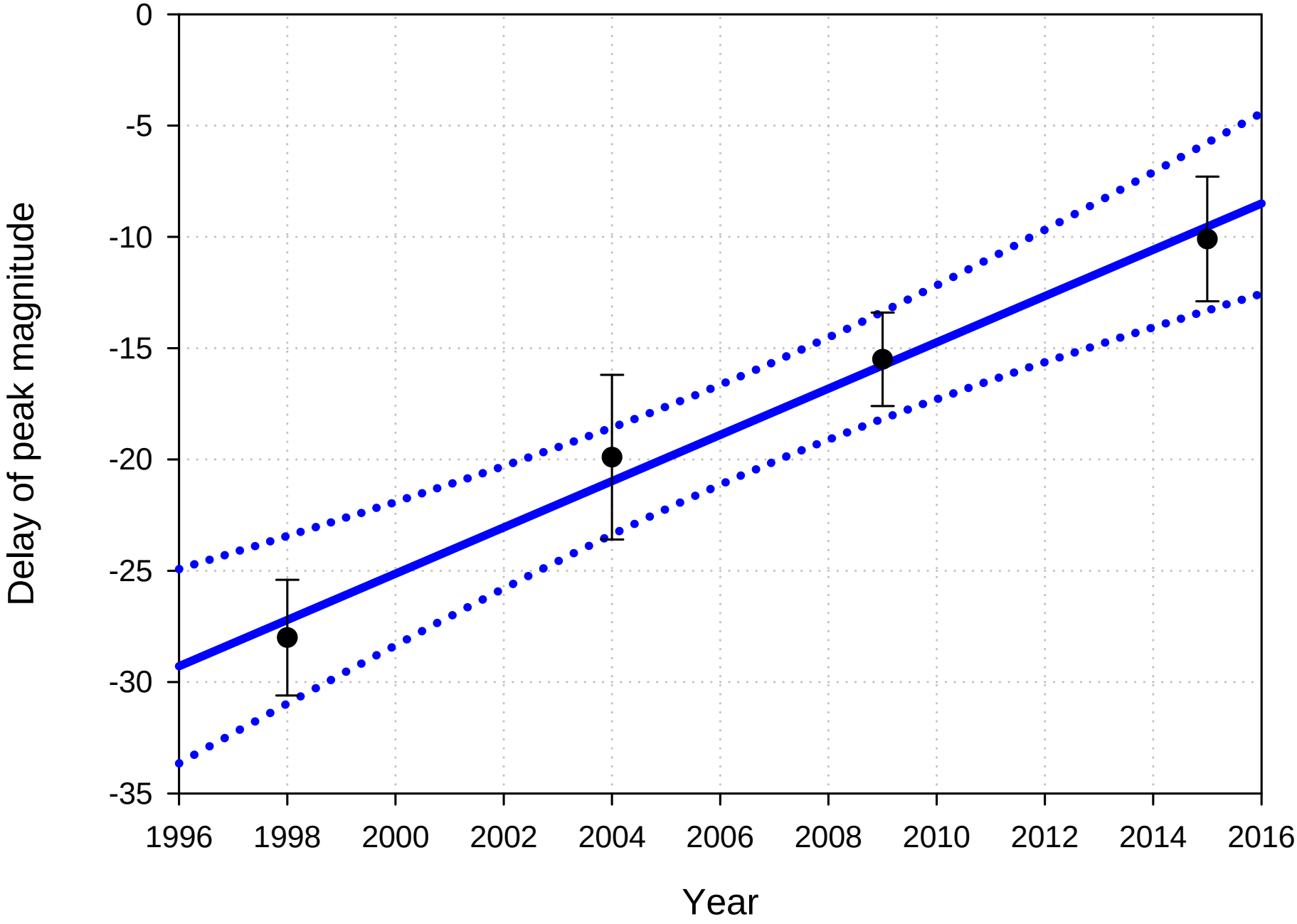
69 are visual, with most from the southern hemisphere

Five since July 22 are VEM and generally are a better fit to the linear light curve




Absolute magnitude (H_{20})
2
3
4
5
6
7
8
1985
1990
1995
2000
2005
2010
2015
2020
Year


2
3
4
5
6
7
8
Absolute magnitude (H_{20})
1.3
1.4
1.5
1.6
1.7
Perihelion distance

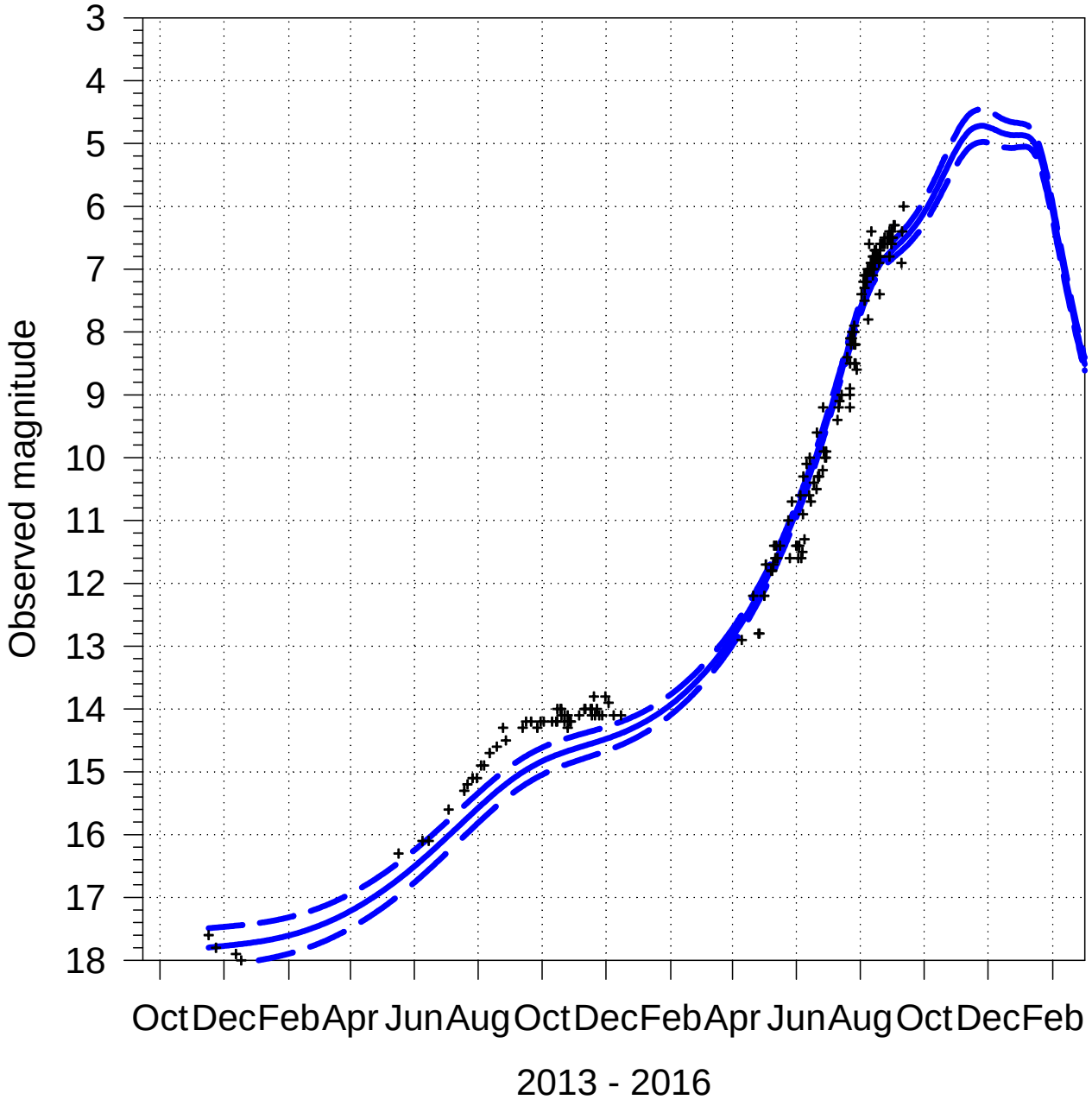

0
-5
-10
-15
-20
-25
-30
-35
Delay of peak magnitude
1996
1998
2000
2002
2004
2006
2008
2010
2012
2014
2016
Year

Comet C/2013 US10 (Catalina)
2015 Sep 16.376

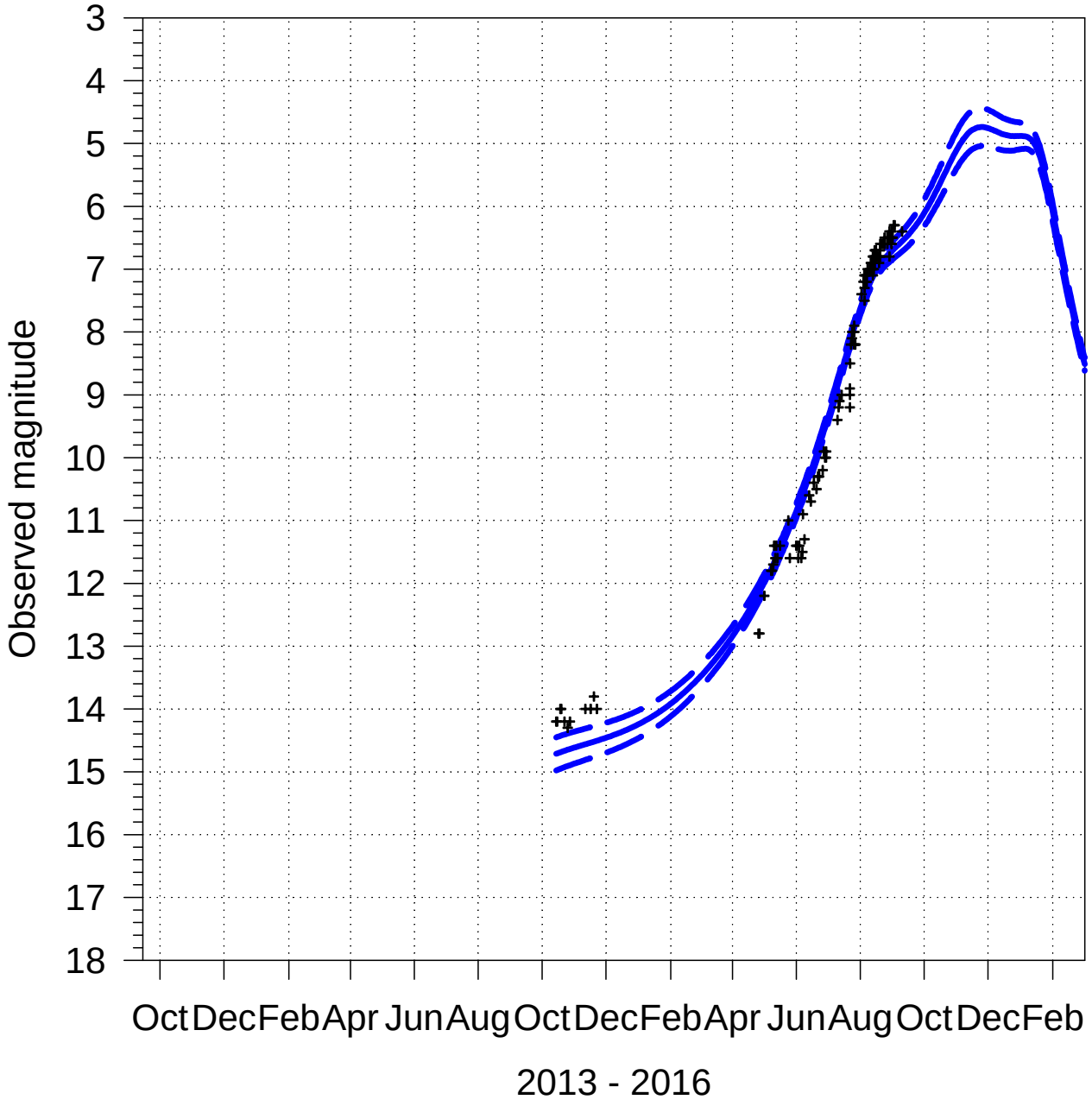
FOV 86′ x 56′ LRGB 180:120:120:120s Bin 2x2 (North is right)
16″ F/3.5 ASA Astrograph Apogee Apsen CG16070 CCD

Ian Sharp
SSO Australia

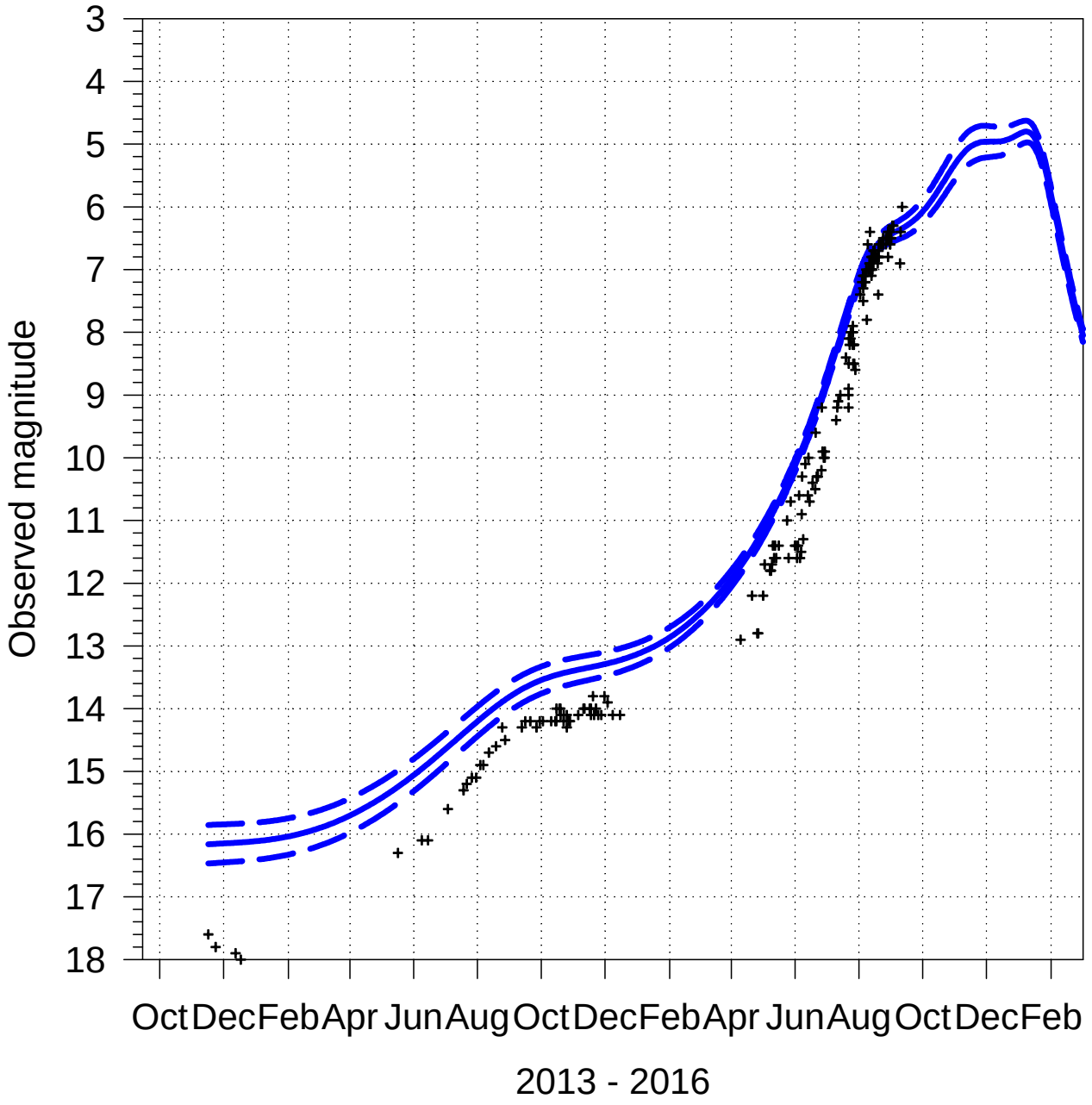
Comet 2013 US_{10} (Catalina)

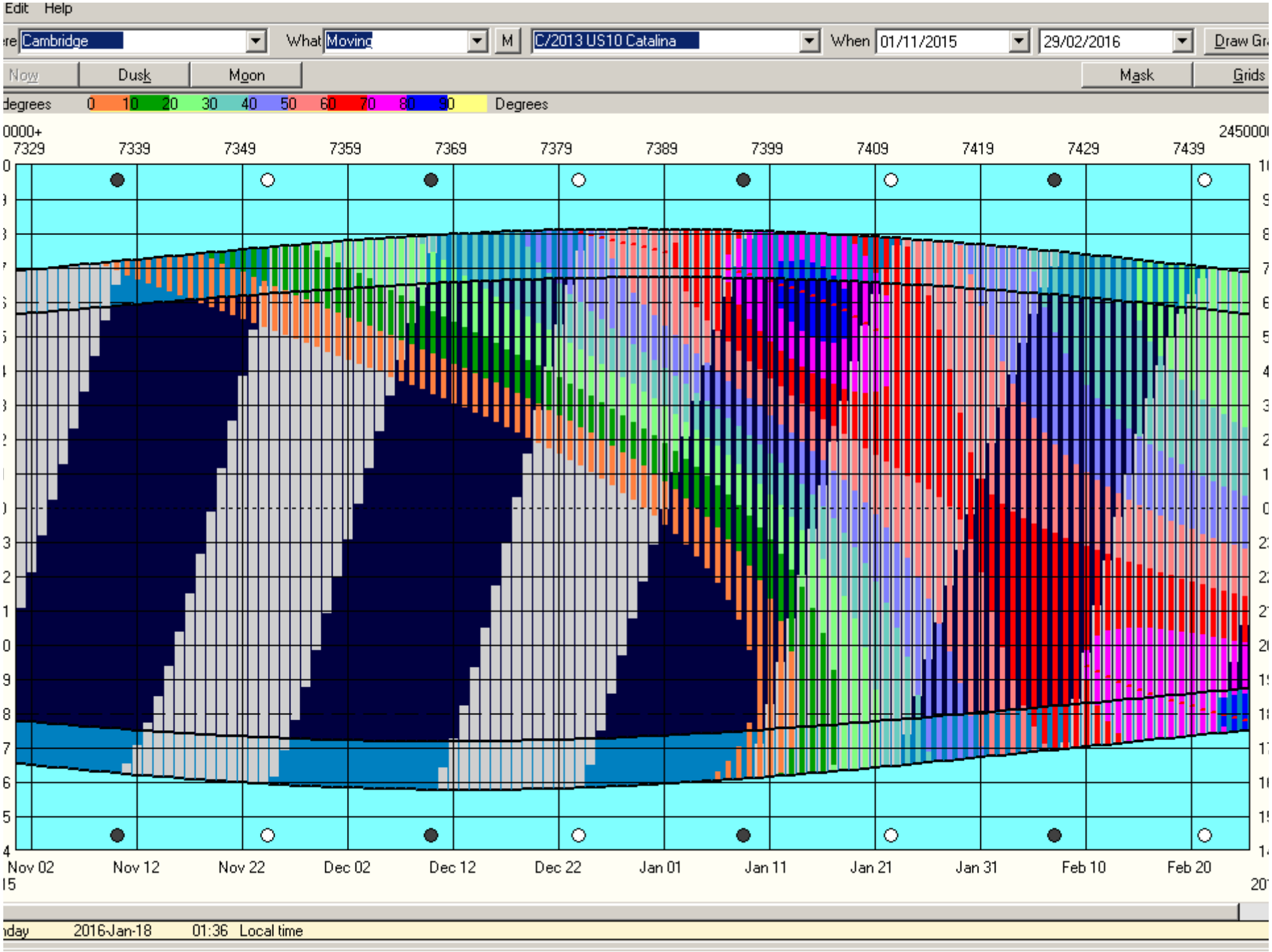


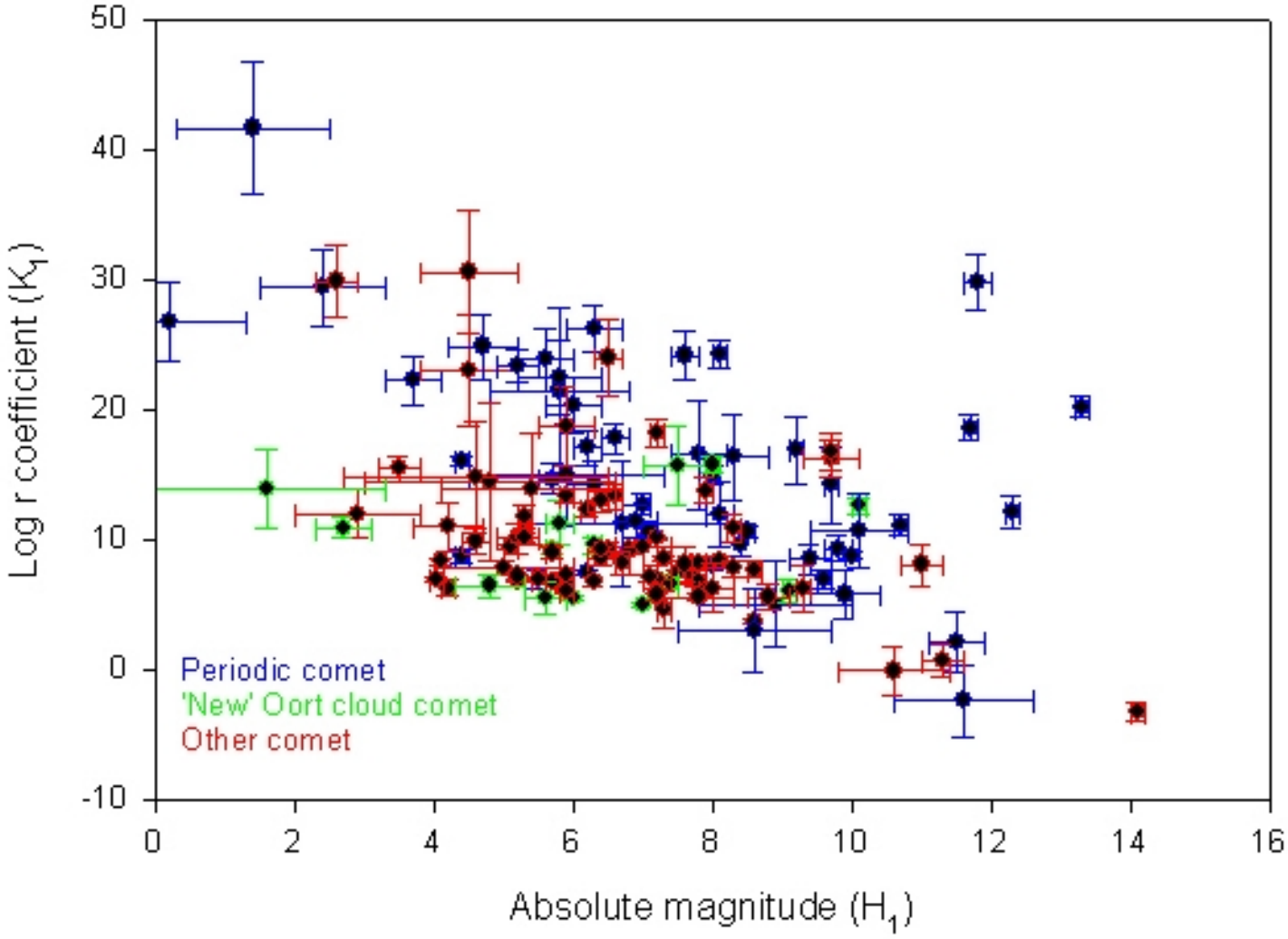
Comet 2013 US_{10} (Catalina)



Comet 2013 US_{10} (Catalina)




Edit Help
Cambridge
What Moving
M
C/2013 US10 Catalina
When 01/11/2015
29/02/2016
Draw Gr
Now
Dusk
Moon
Mask
Grids
degrees 0 10 20 30 40 50 60 70 80 90 Degrees
7329 7339 7349 7359 7369 7379 7389 7399 7409 7419 7429 7439
Nov 02 Nov 12 Nov 22 Dec 02 Dec 12 Dec 22 Jan 01 Jan 11 Jan 21 Jan 31 Feb 10 Feb 20
2016-Jan-18 01:36 Local time



The better determined magnitude parameters show clear differences between short period and long period comets, though there are subtle biases in the determination of these parameters

Go out and observe!