Determination of the Meteor Limiting Magnitude

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Meteoroids 2016

Purpose

- Fluxes
  - Meteor brightness $\rightarrow$ meteor mass
  - Fluxes to a limiting mass
- Spacecraft risk

Background

$$m_M = m_s - 2.5 \log(d)$$

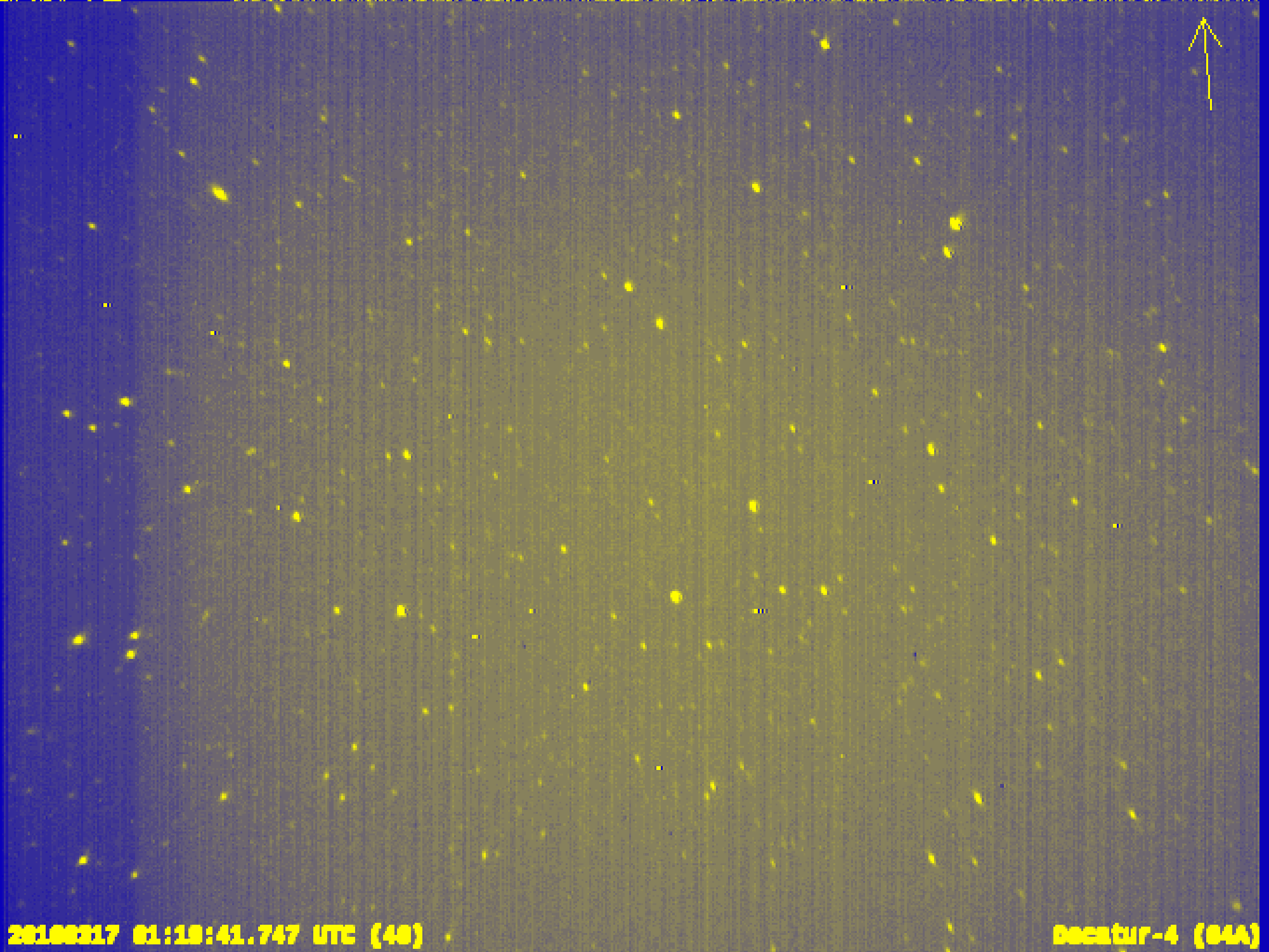
- m_M - Meteor limiting magnitude
- m_s - Stellar limiting magnitude
- d - Distance meteor moves in a frame

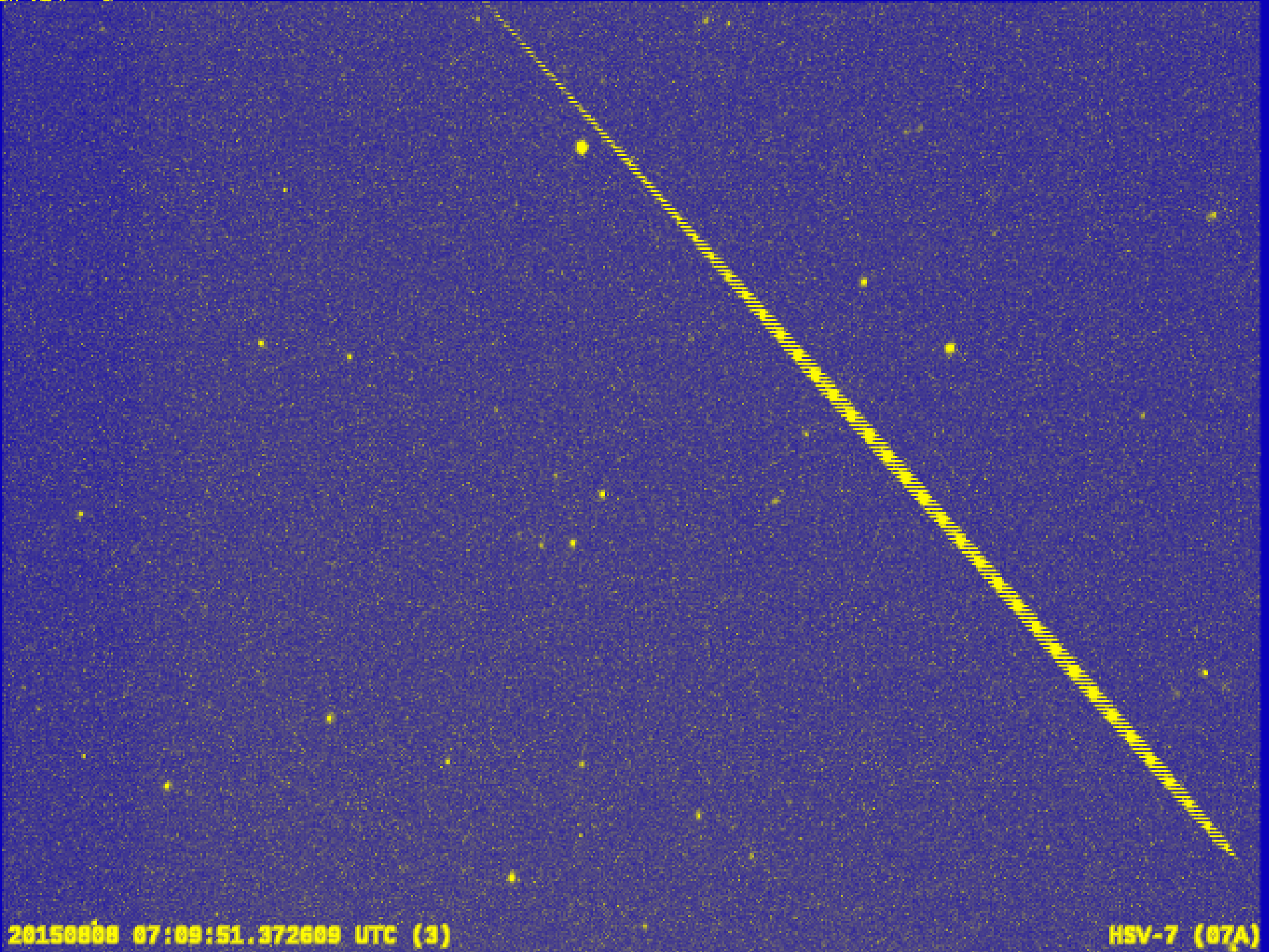
Brown (2002)

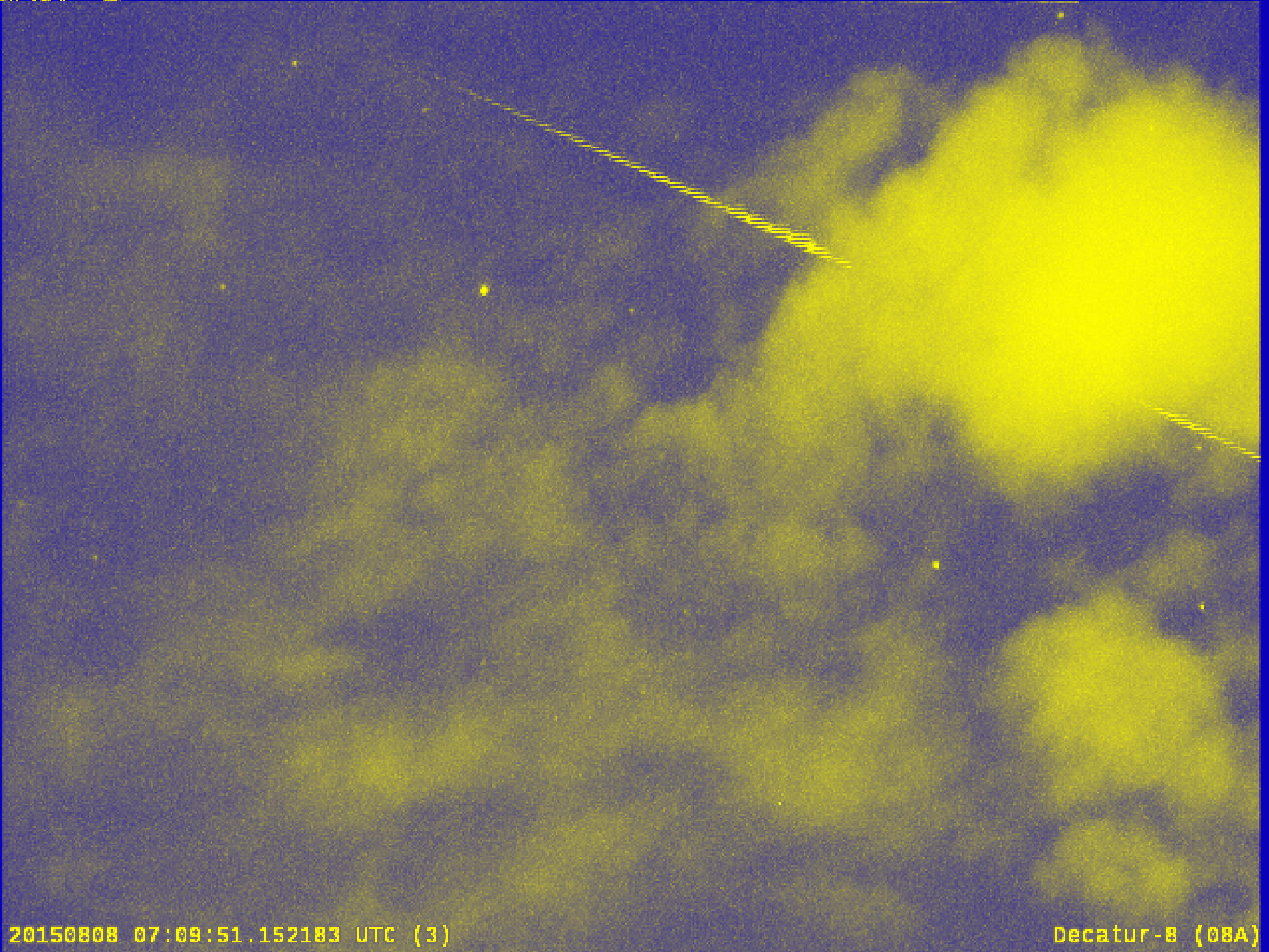
Camera System

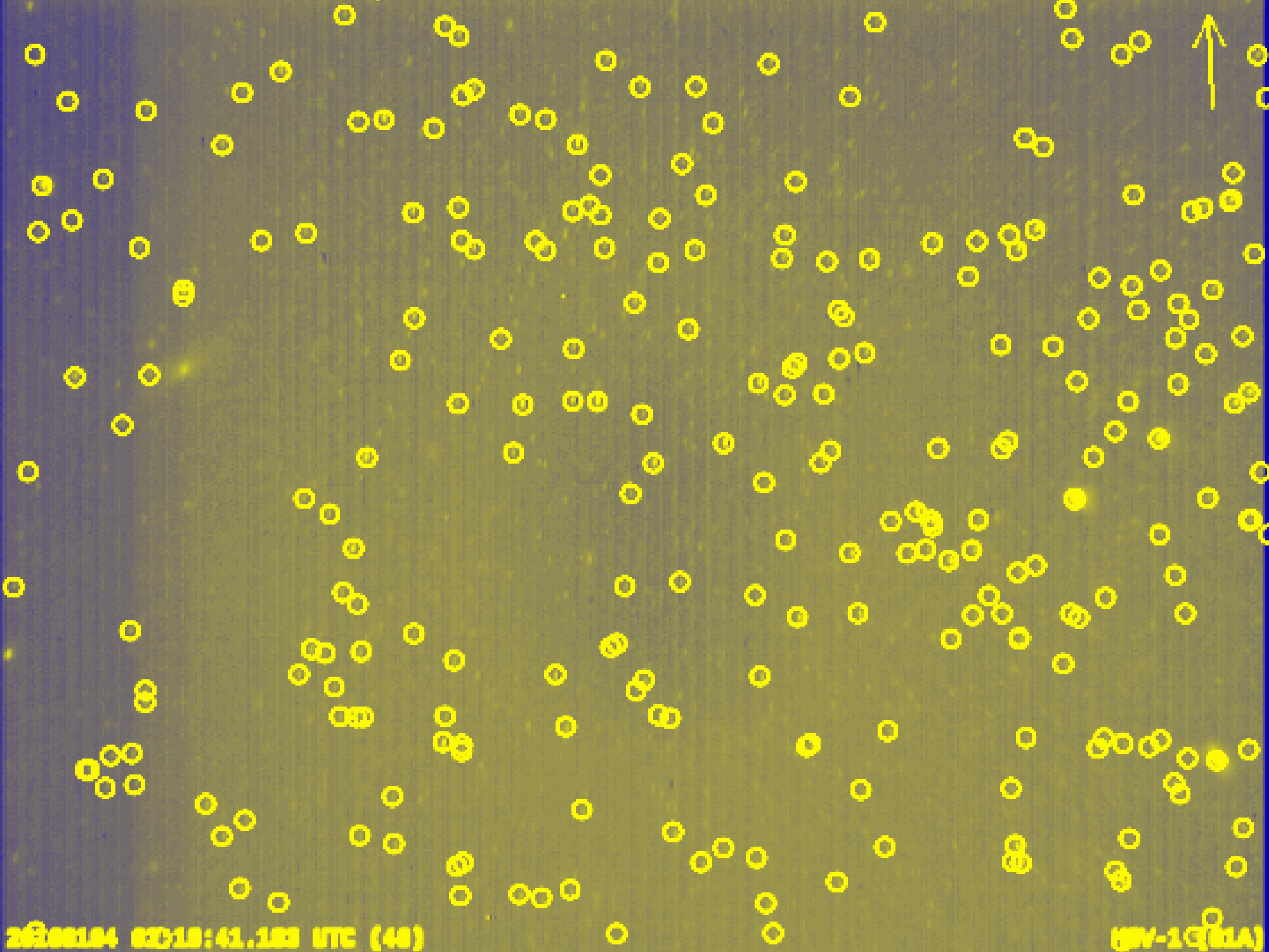
- Watec 902H Ultimate
- 17mm f/0.95 lens
- 31.7 km separation

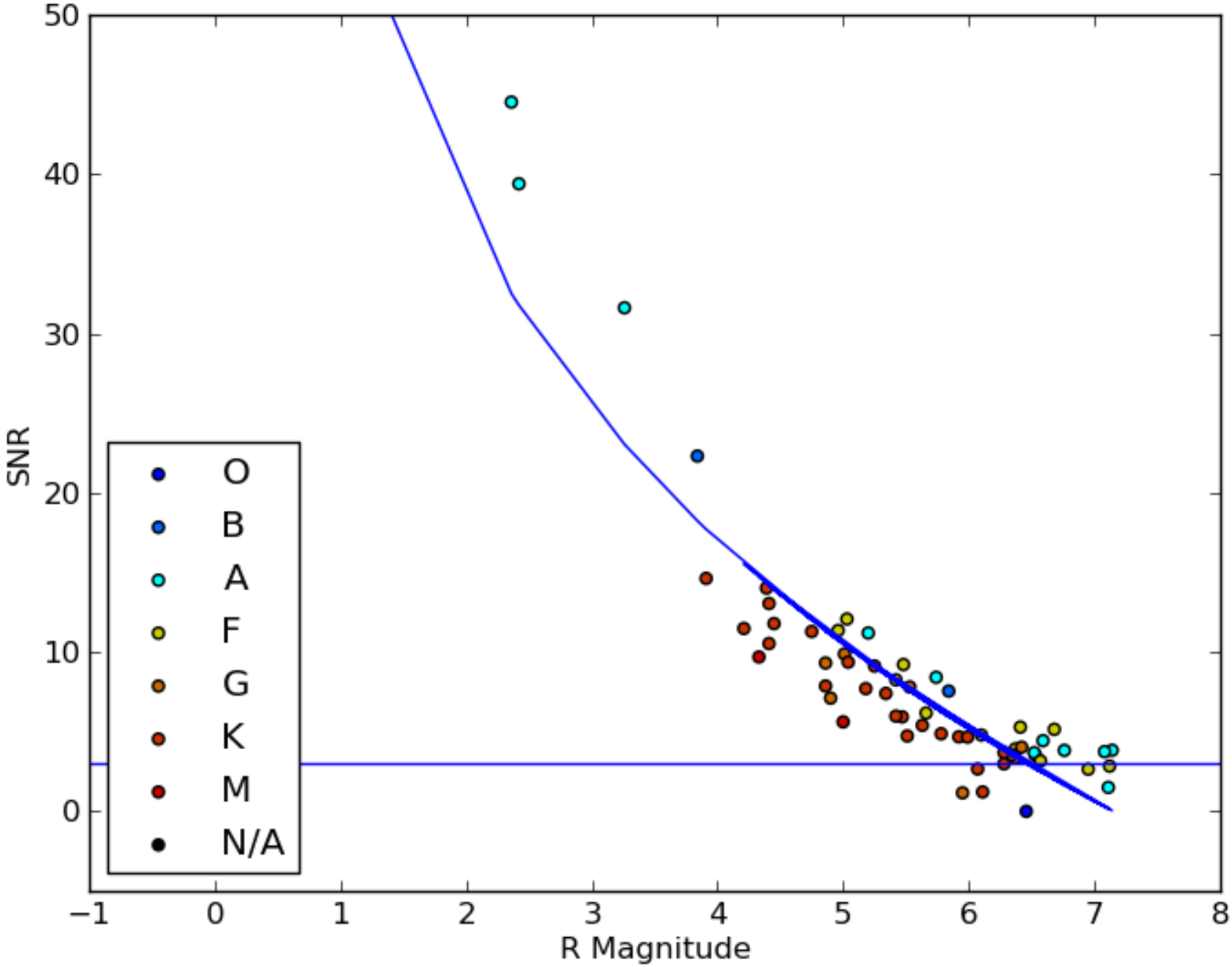

20160317 01:19:41.747 UTC (40)
Decatur-4 (04A)

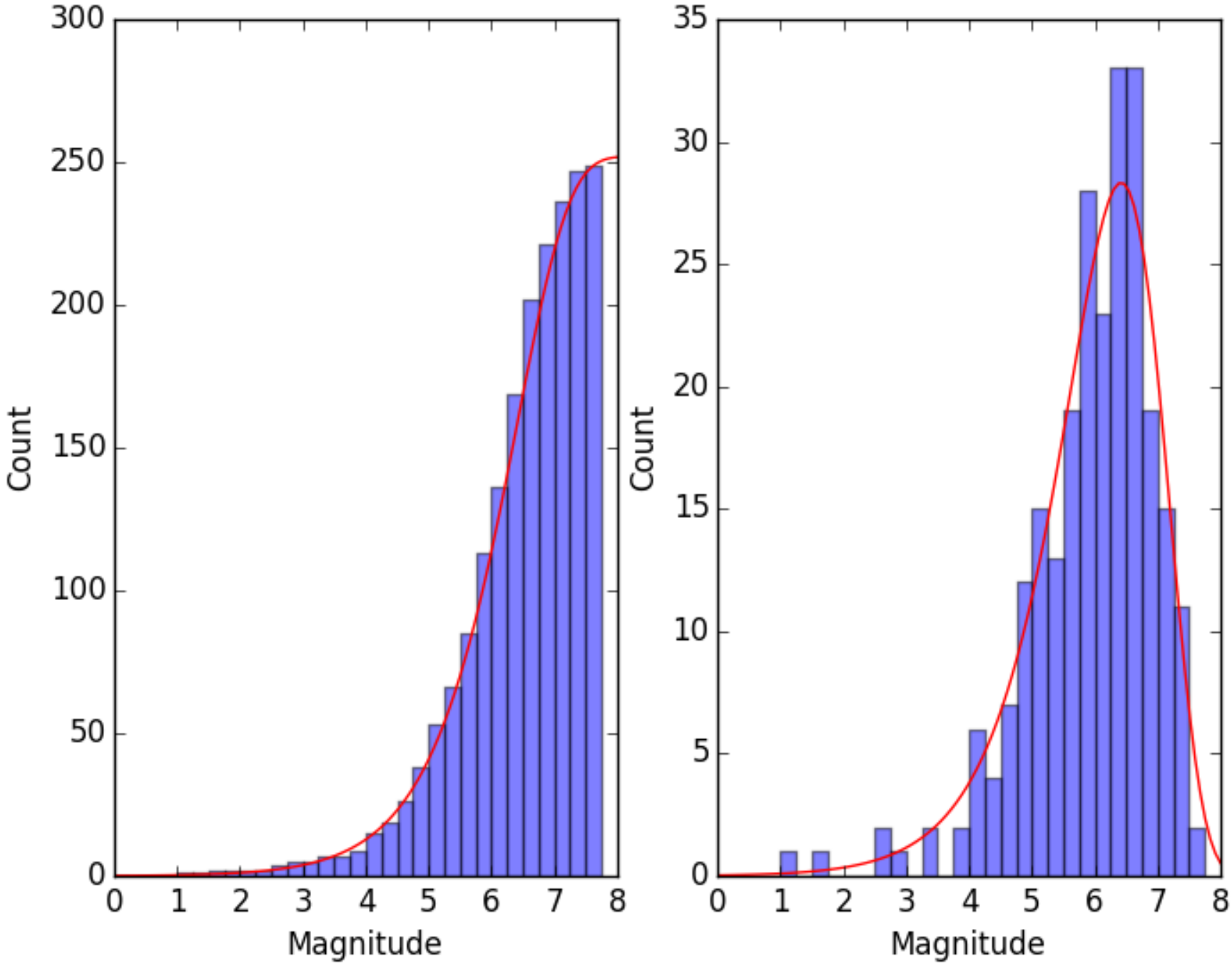

20180317 01:10:41.747 UTC (40)
Decatur-4 (04A)

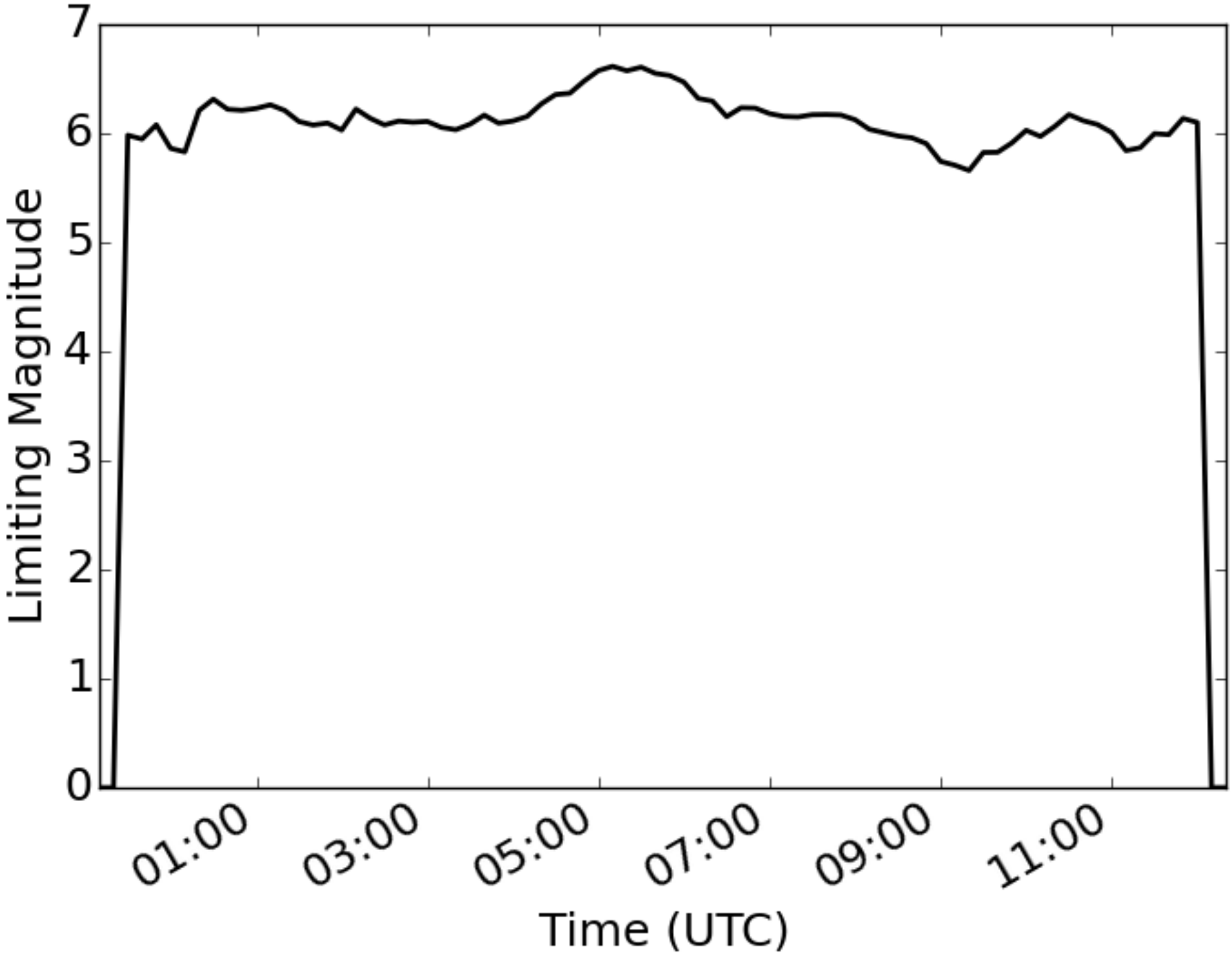

20150808 07:09:51.372609 UTC (3)
HSV-7 (07A)


20150808 07:09:51.152183 UTC (3)
Decatur-8 (08A)




50
40
30
20
10
0
SNR
−1
0
1
2
3
4
5
6
7
8
R Magnitude
O
B
A
F
G
K
M
N/A


300
250
200
150
100
50
0
Count
0 1 2 3 4 5 6 7 8
Magnitude
35
30
25
20
15
10
5
0
Count
0 1 2 3 4 5 6 7 8
Magnitude


Limiting Magnitude
0
1
2
3
4
5
6
7
01:00
03:00
05:00
07:00
09:00
11:00
Time (UTC)

Background

$$m_M = m_s - 2.5 \log(d)$$

- m_M - Meteor limiting magnitude
- m_s - Stellar limiting magnitude
- d - Distance meteor moves in a frame

Brown (2002)

Meteor limiting magnitude

$$d = \left(\frac{180\, r\, V_g\, \tau \sin\zeta}{\pi\, \mathrm{FOV} \times R \times \mathrm{FWHM}} \right)$$

- r - Camera resolution
- V_g - Geocentric velocity
- τ - Integration time
- ζ - Camera pointing to radiant angle

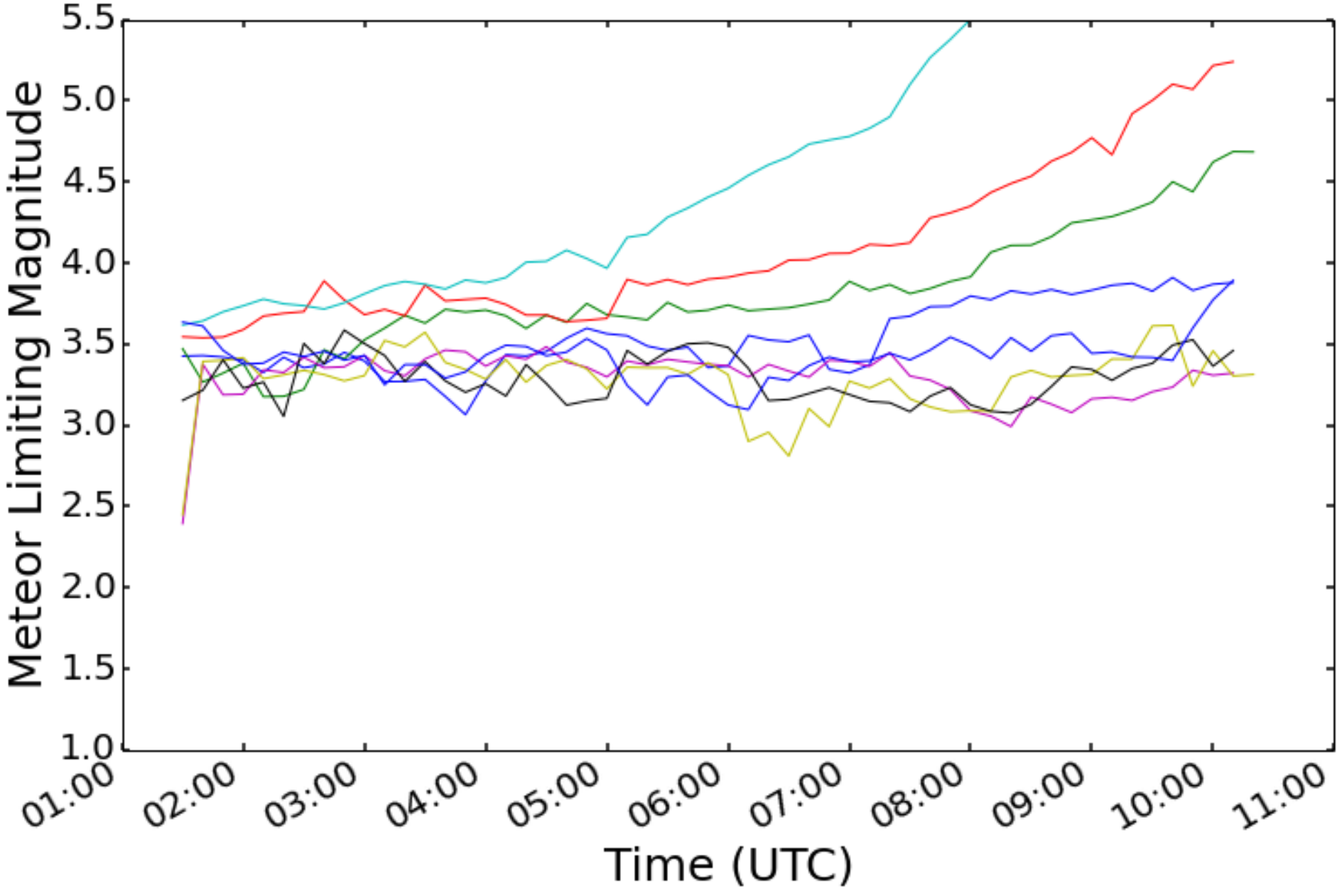
Brown (2002)

Meteor limiting magnitude

$$d = \left(\frac{180\, r\, V_g\, \tau \sin\zeta}{\pi\, \mathrm{FOV} \times R \times \mathrm{FWHM}} \right)$$

- FOV - Camera field of view
- R - Range
- FWHM - Full width half max

Brown (2002)


Meteor Limiting Magnitude
5.5
5.0
4.5
4.0
3.5
3.0
2.5
2.0
1.5
1.0
01:00
02:00
03:00
04:00
05:00
06:00
07:00
08:00
09:00
10:00
11:00
Time (UTC)