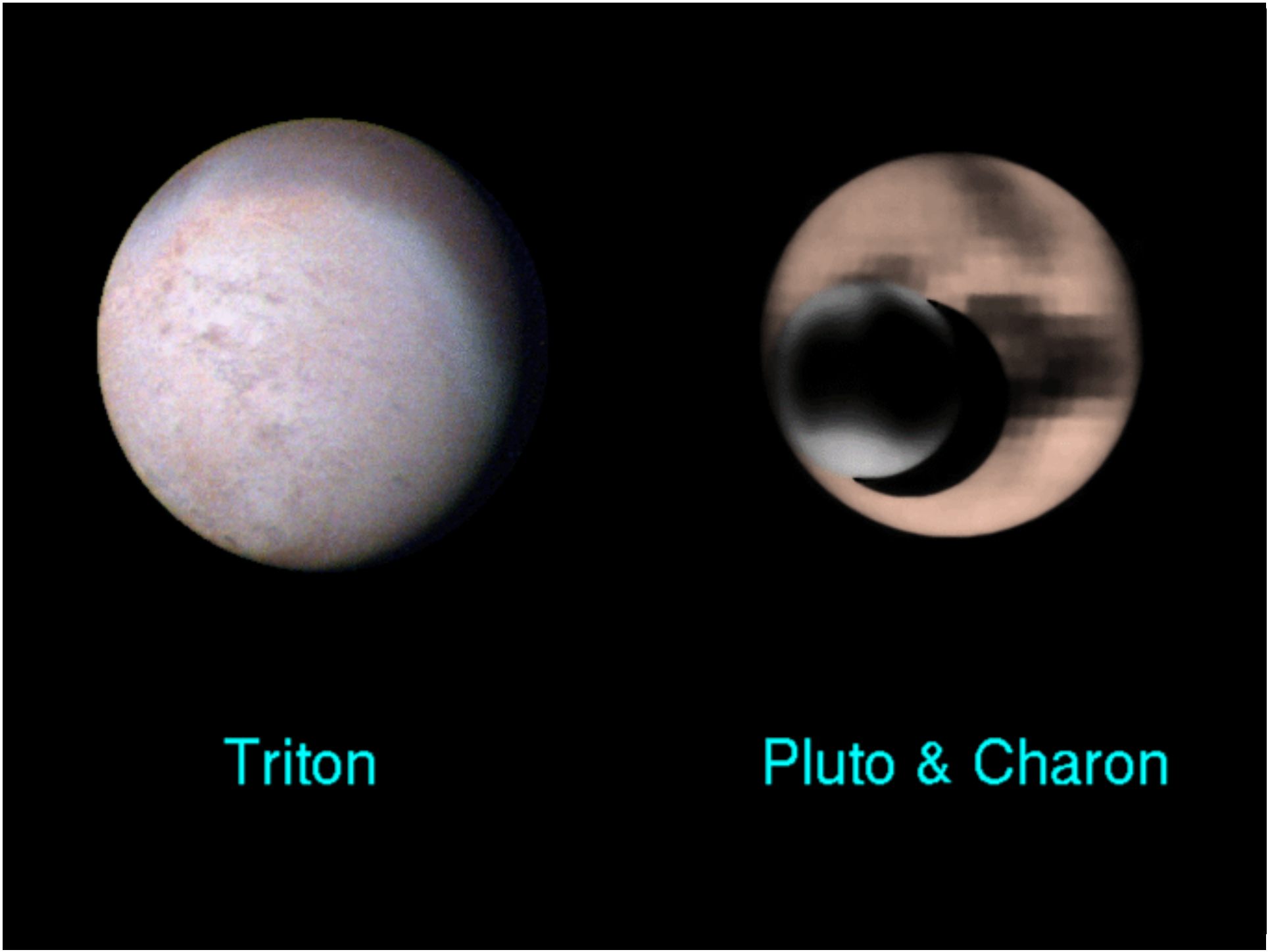
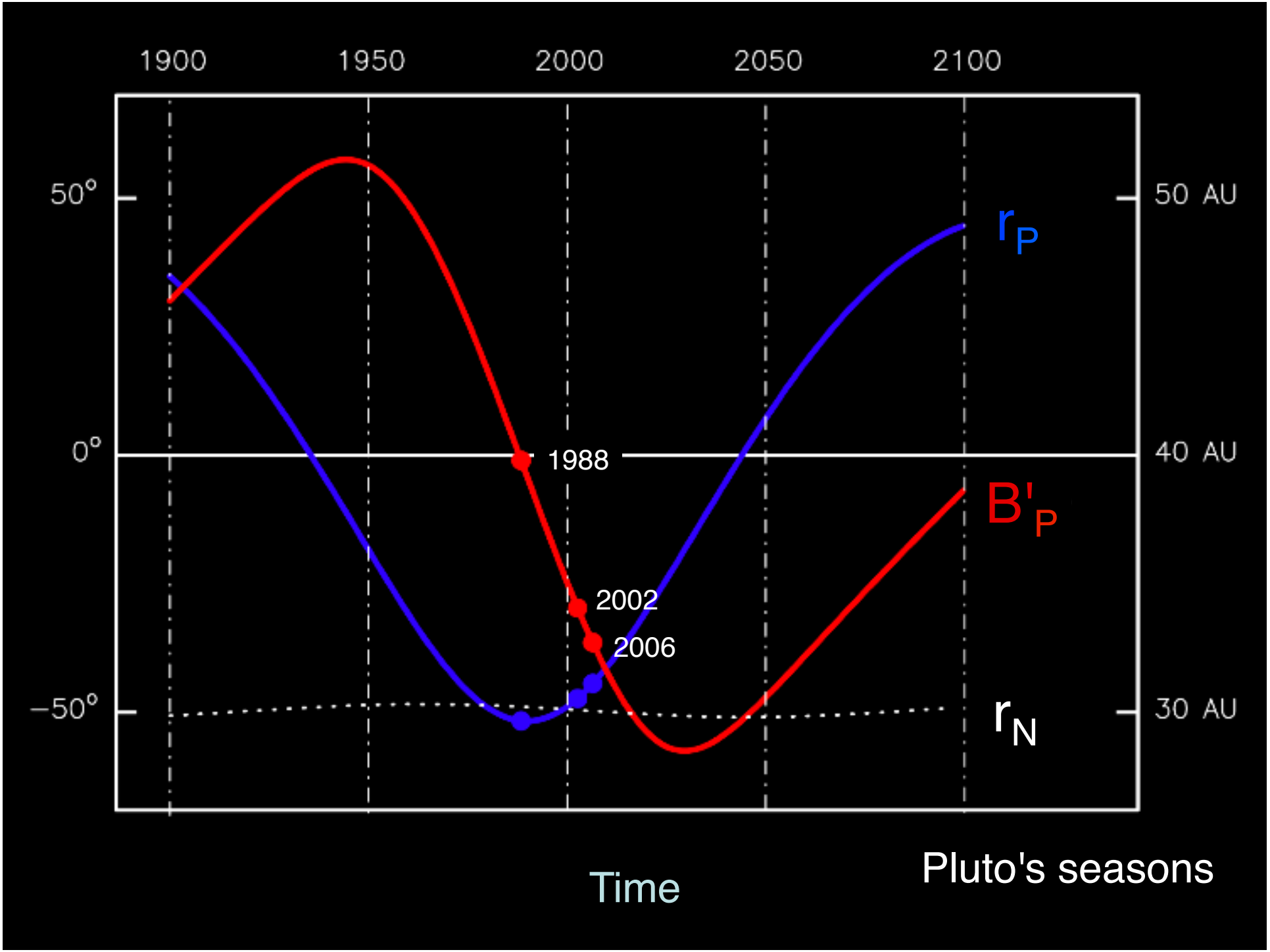
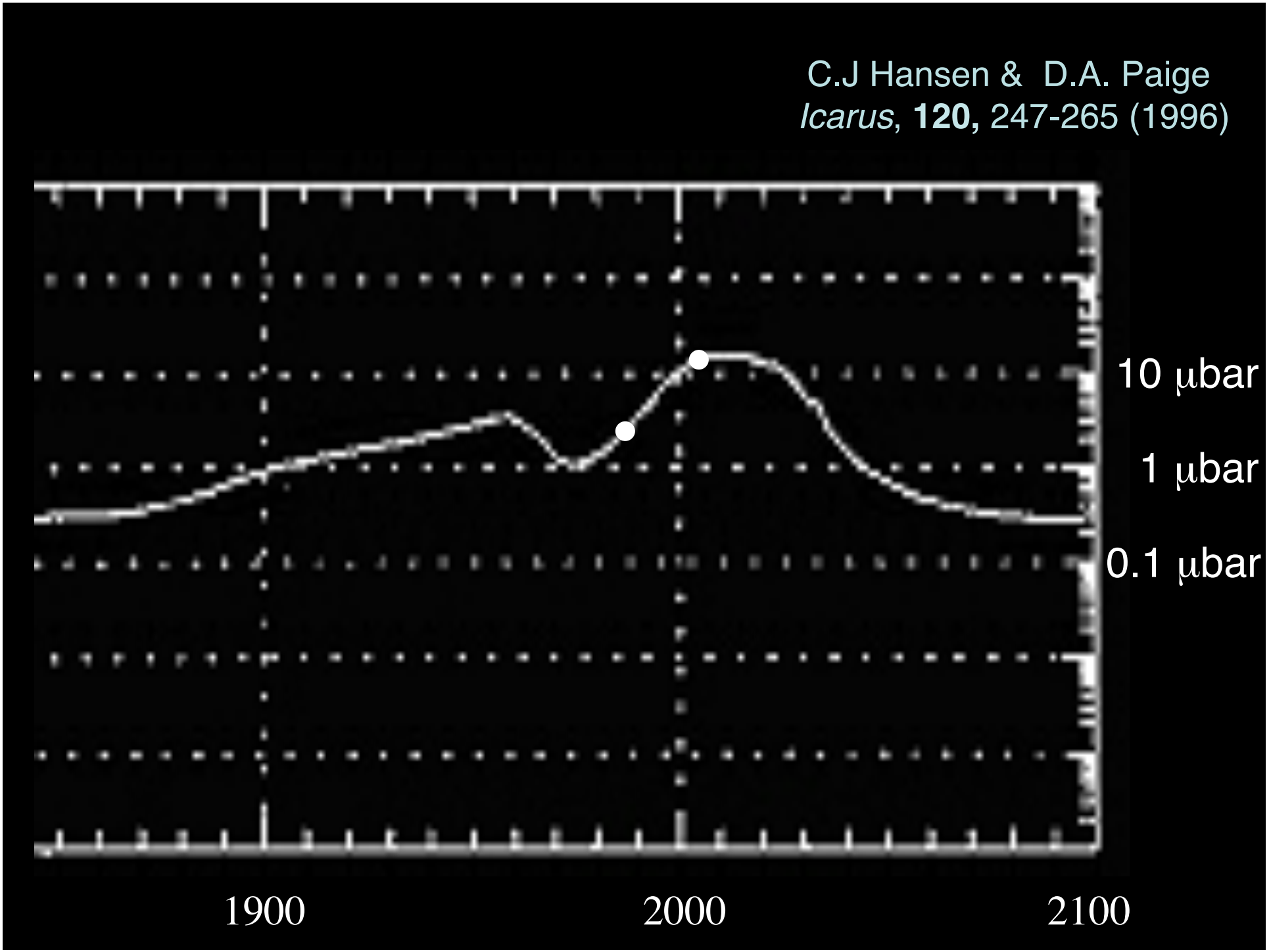
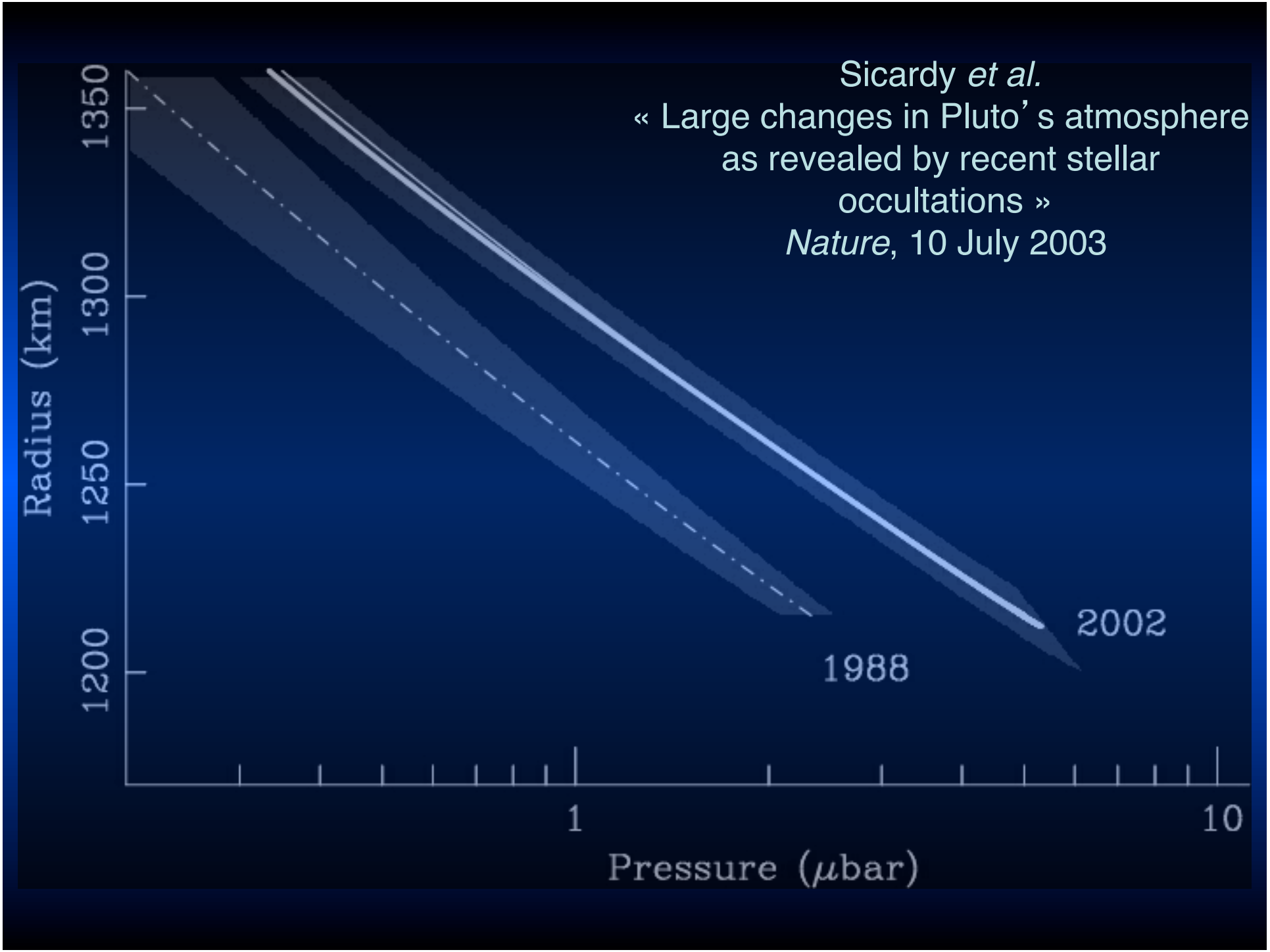
The Triton stellar occultation of 21 May 2008

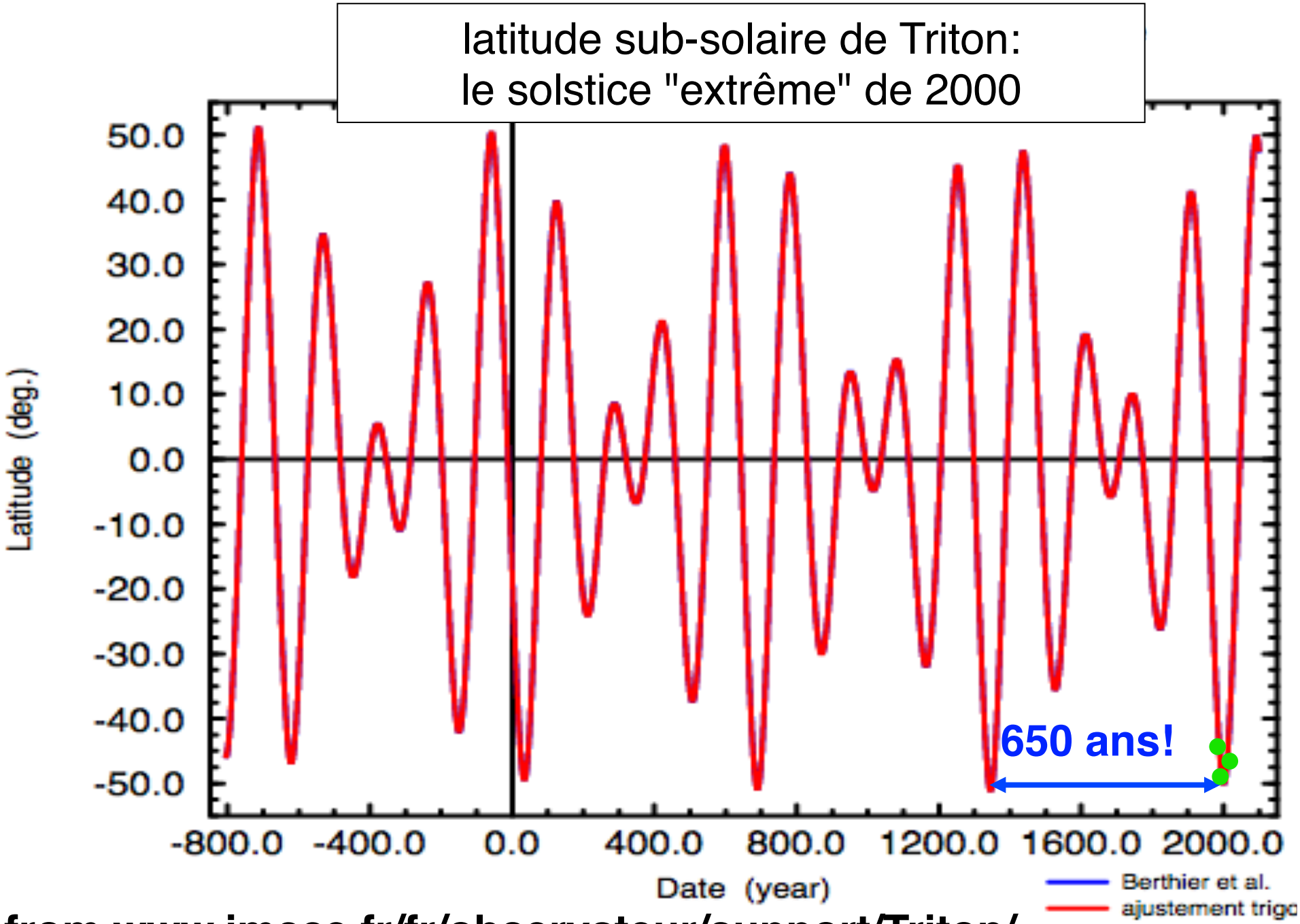
Bruno Sicardy, Y. Boissel, F. Colas, A. Doressoundiram, J. Lecacheux, T. Widemann, M. Castets, E. Frappa, G. Blanchard, T. Payet, J.-P. Teng, K.-L. Bath, W. Beisker, H.-J. Bode, G. Roy, B. Thome, C. de Witt, P. Schönau, D. Buckley, N. Loaring, O. Bernard, M. Assafin, J. Camargo, D. da Silva Neto, F. B. Ribas, A. Andrei, R. Vieira Martins, R. Behrend


Triton
Pluto & Charon


1900
1950
2000
2050
2100
50°
0°
−50°
50 AU
40 AU
30 AU
r_P
B'_P
r_N
1988
2002
2006
Time
Pluto's seasons

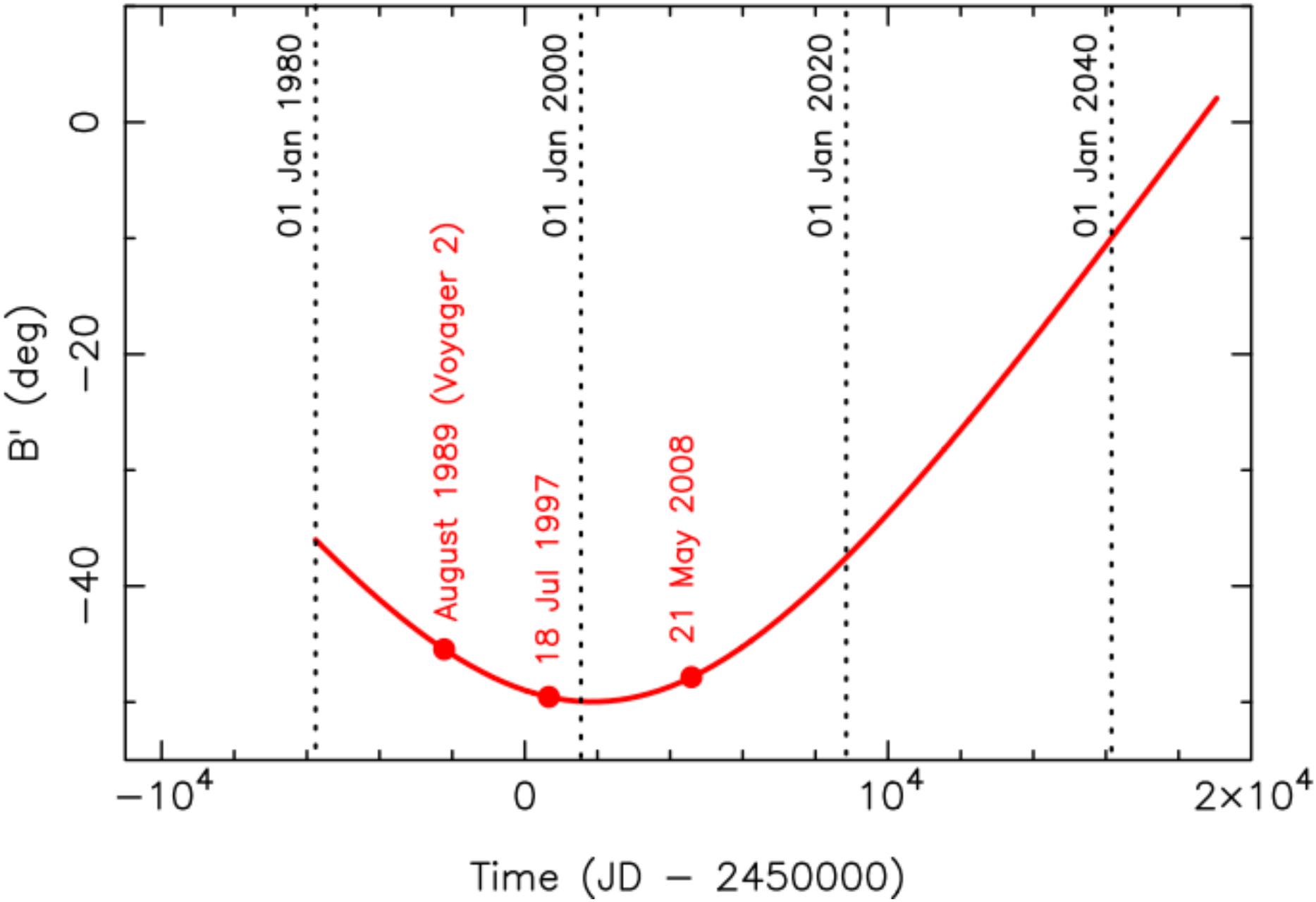

C.J Hansen & D.A. Paige
Icarus, **120,** 247-265 (1996)
10 μbar
1 μbar
0.1 μbar
1900
2000
2100

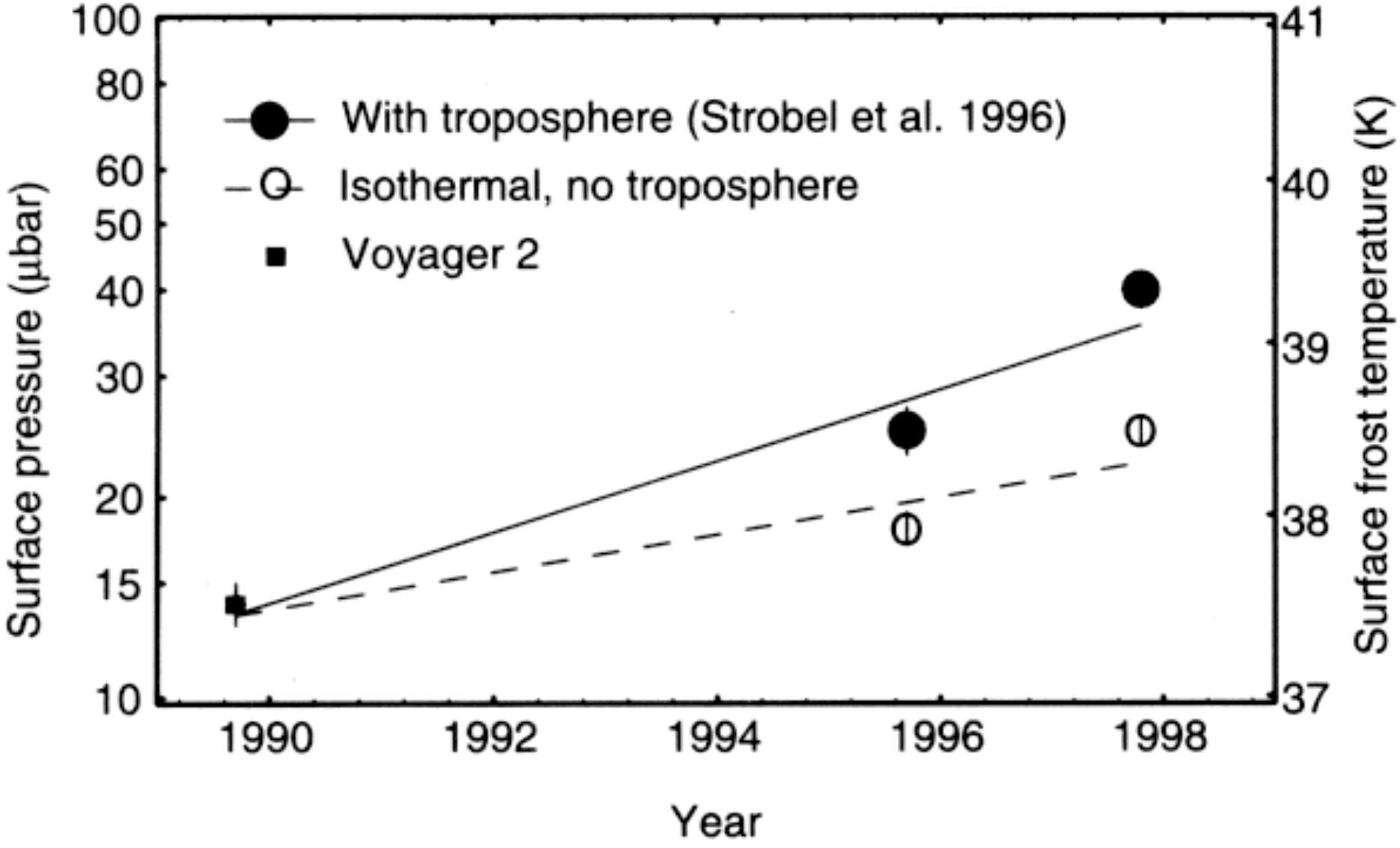

Sicardy *et al.*
« Large changes in Pluto's atmosphere as revealed by recent stellar occultations »
Nature, 10 July 2003
Radius (km)
1350
1300
1250
1200
2002
1988
1
10
Pressure (μbar)



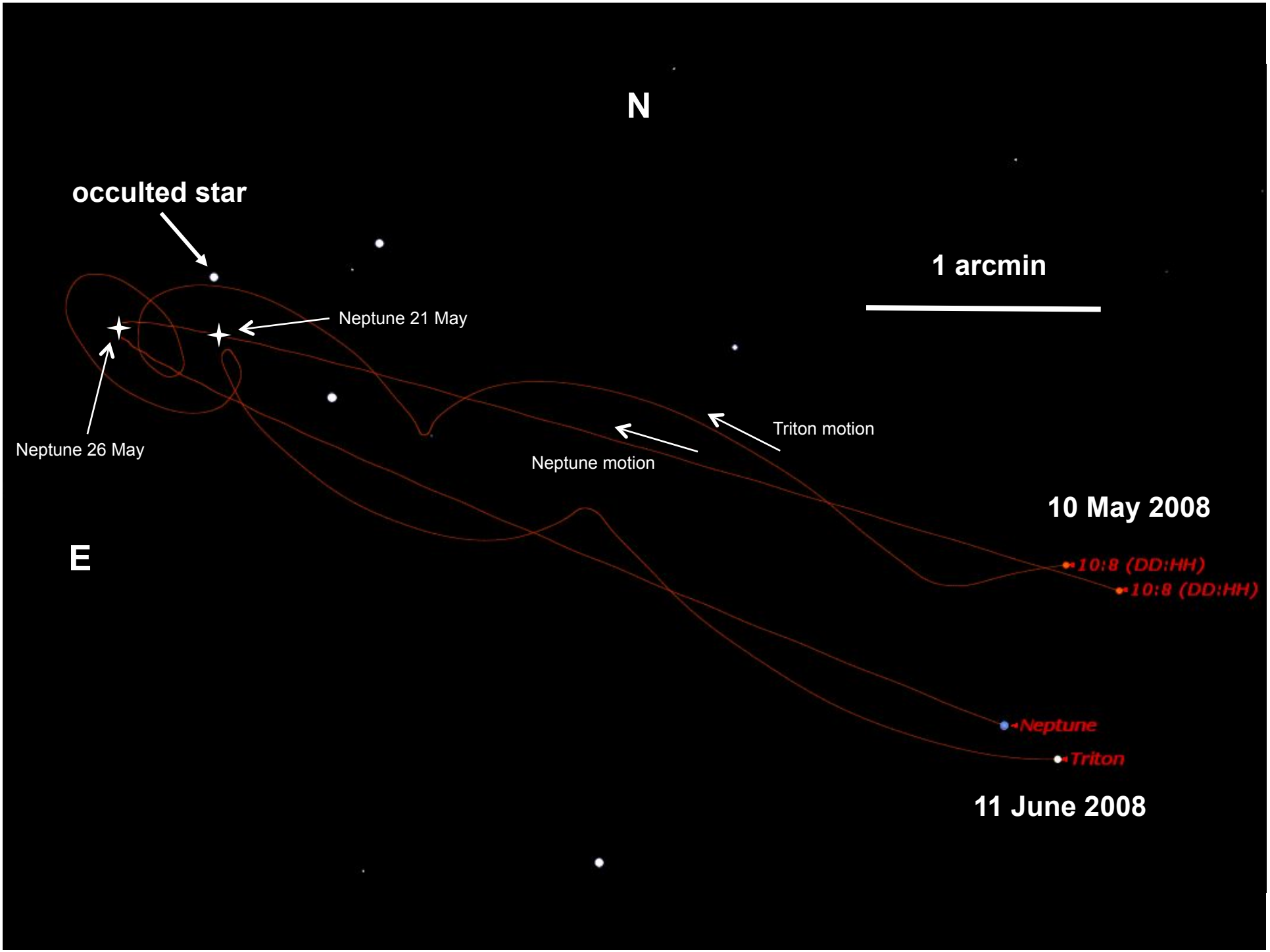
from www.imcce.fr/fr/observateur/support/Triton/

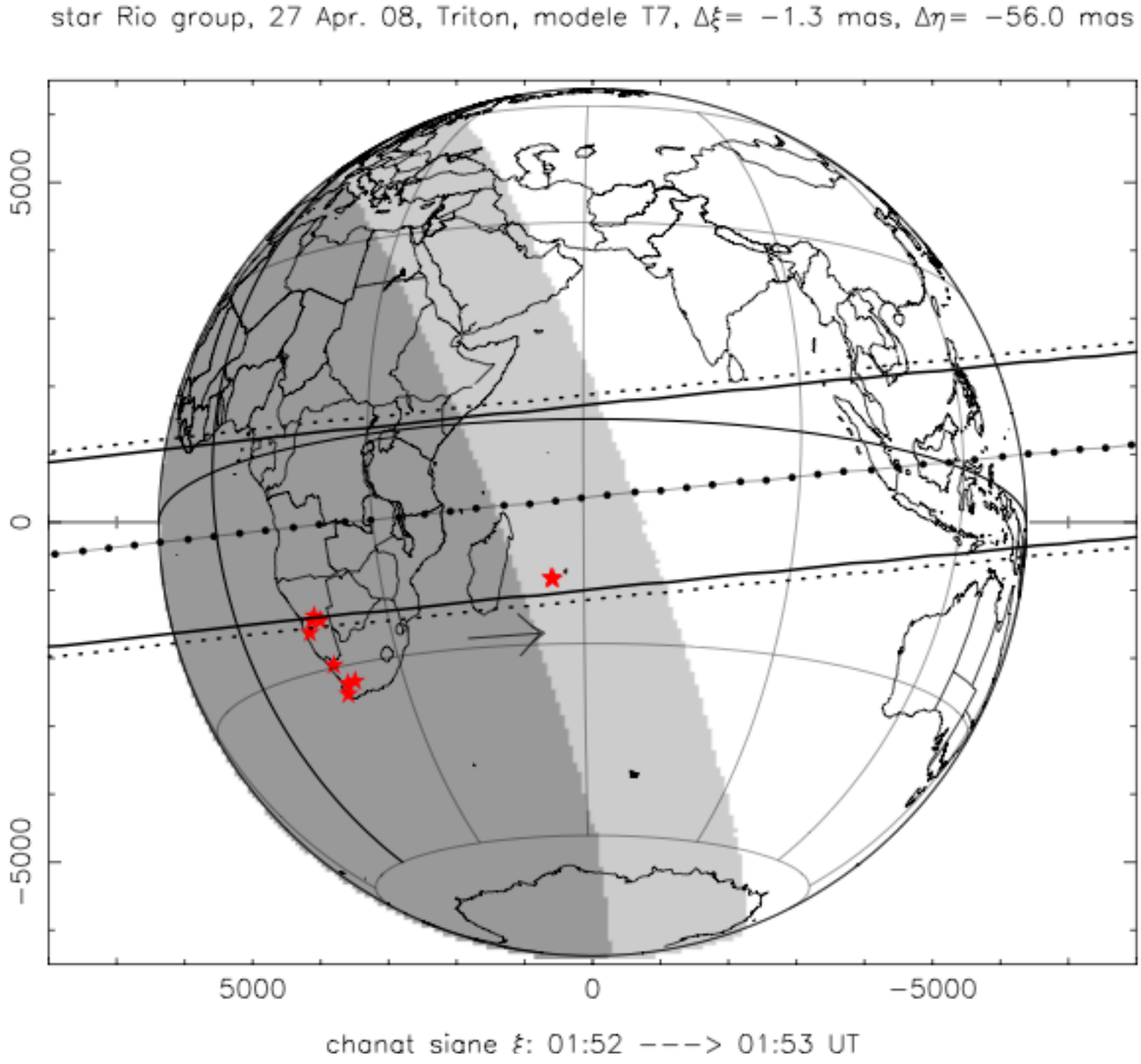
le solstice "extrême" Triton de 2000

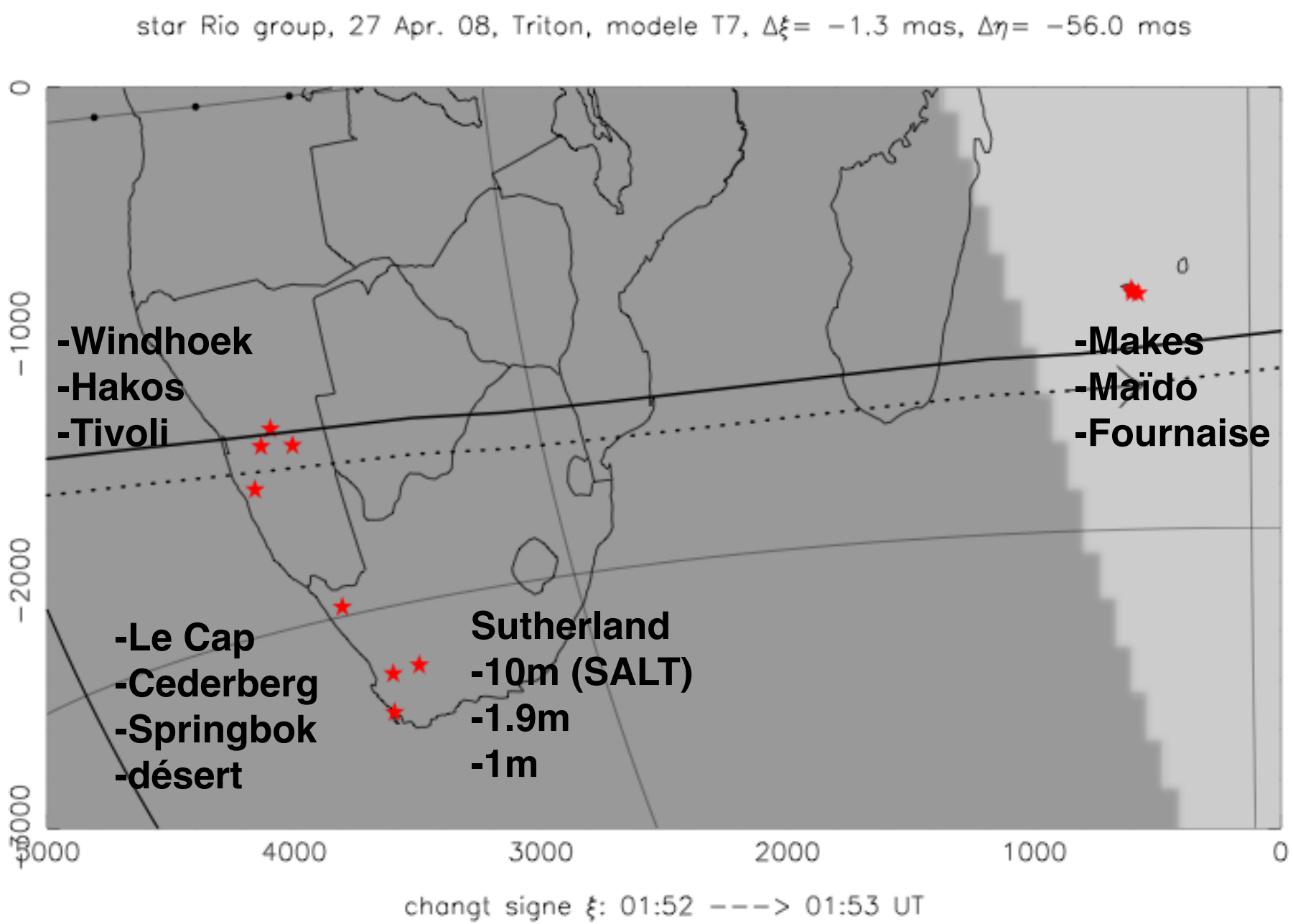




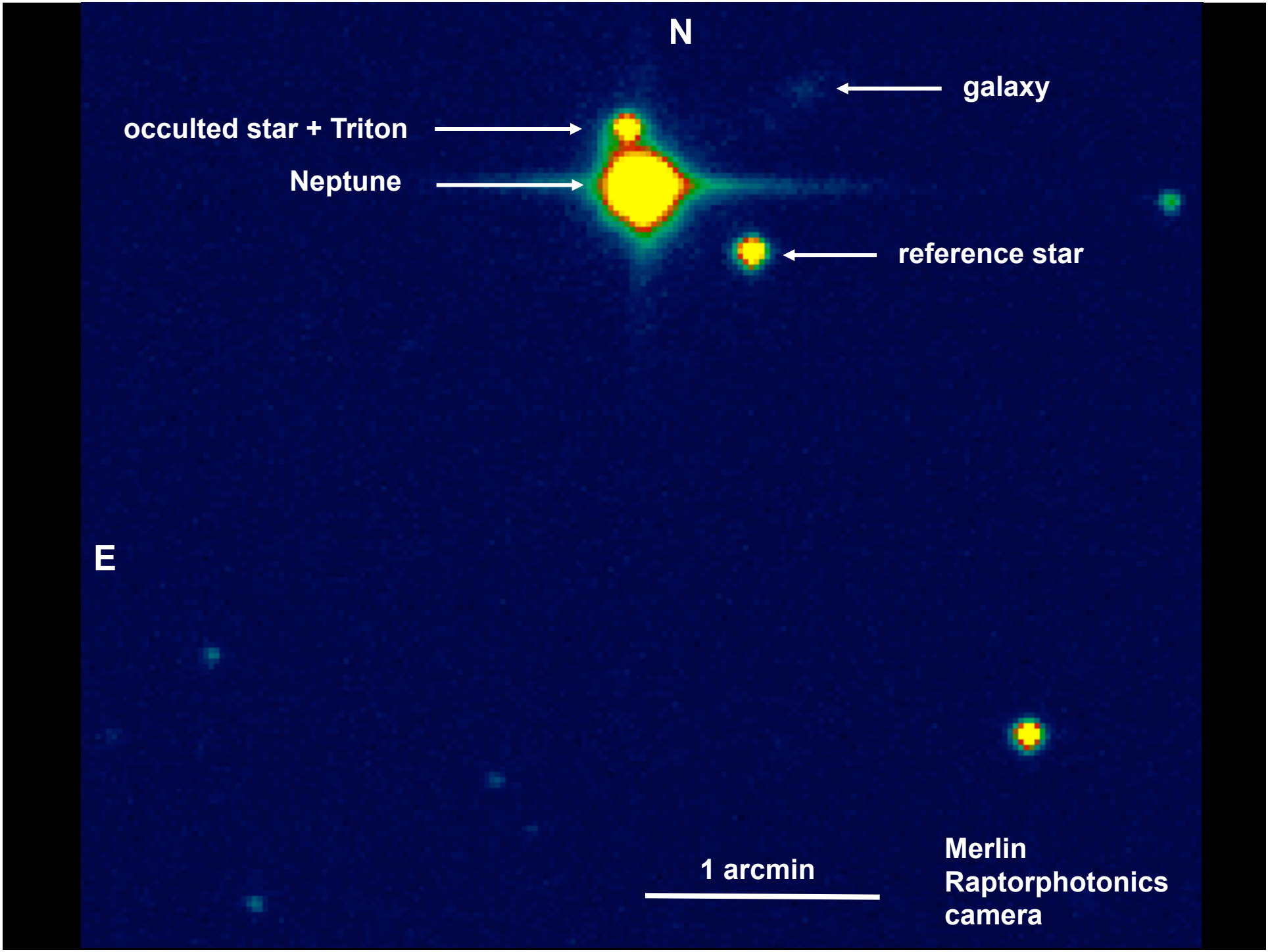
"Global warming on Triton" (?)
Elliot *et al., Nature* **393,** 765 (1998)

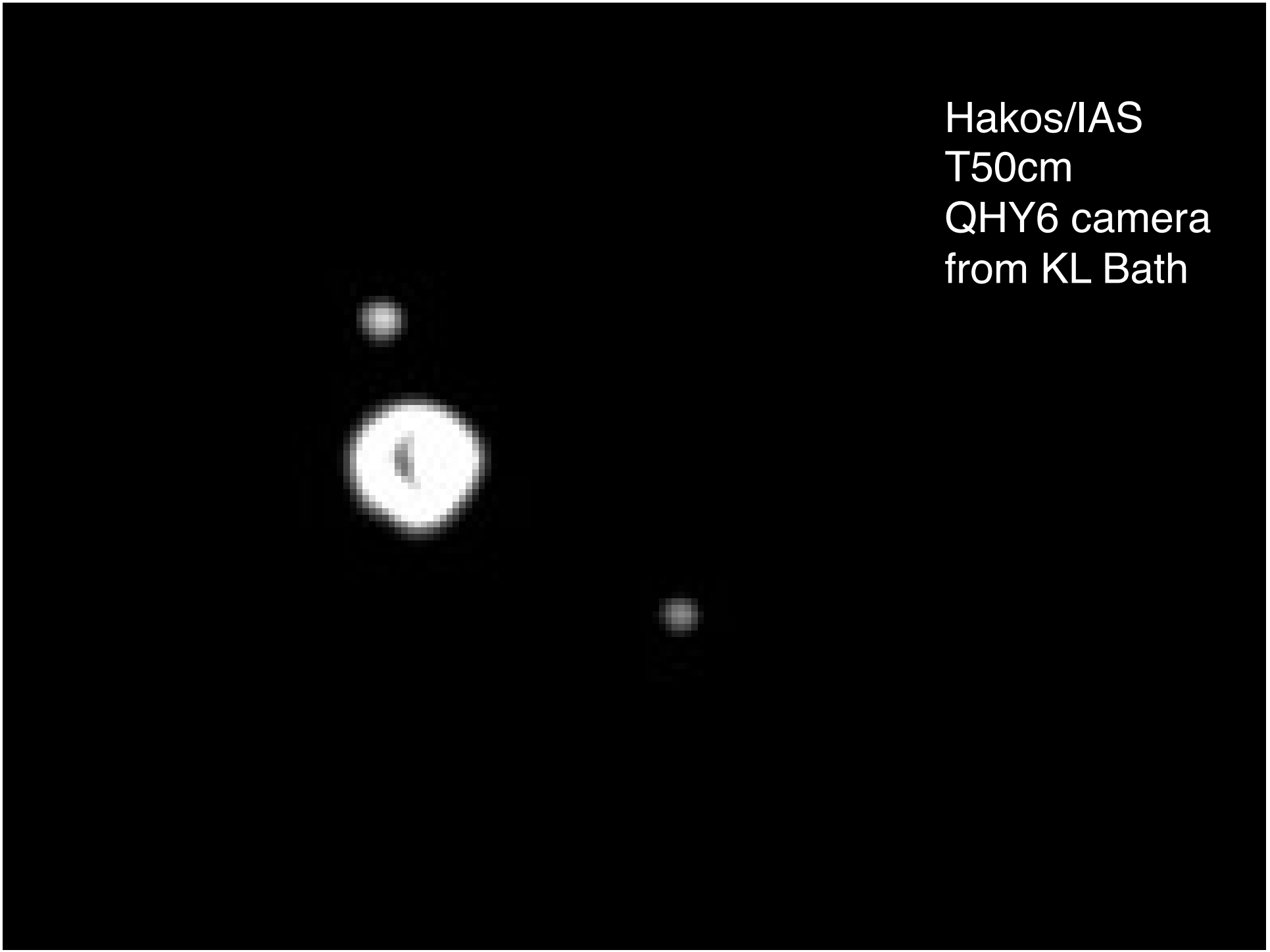

N
occulted star
1 arcmin
Neptune 21 May
Neptune 26 May
Triton motion
Neptune motion
10 May 2008
E
10:8 (DD:HH)
10:8 (DD:HH)
Neptune
Triton
11 June 2008

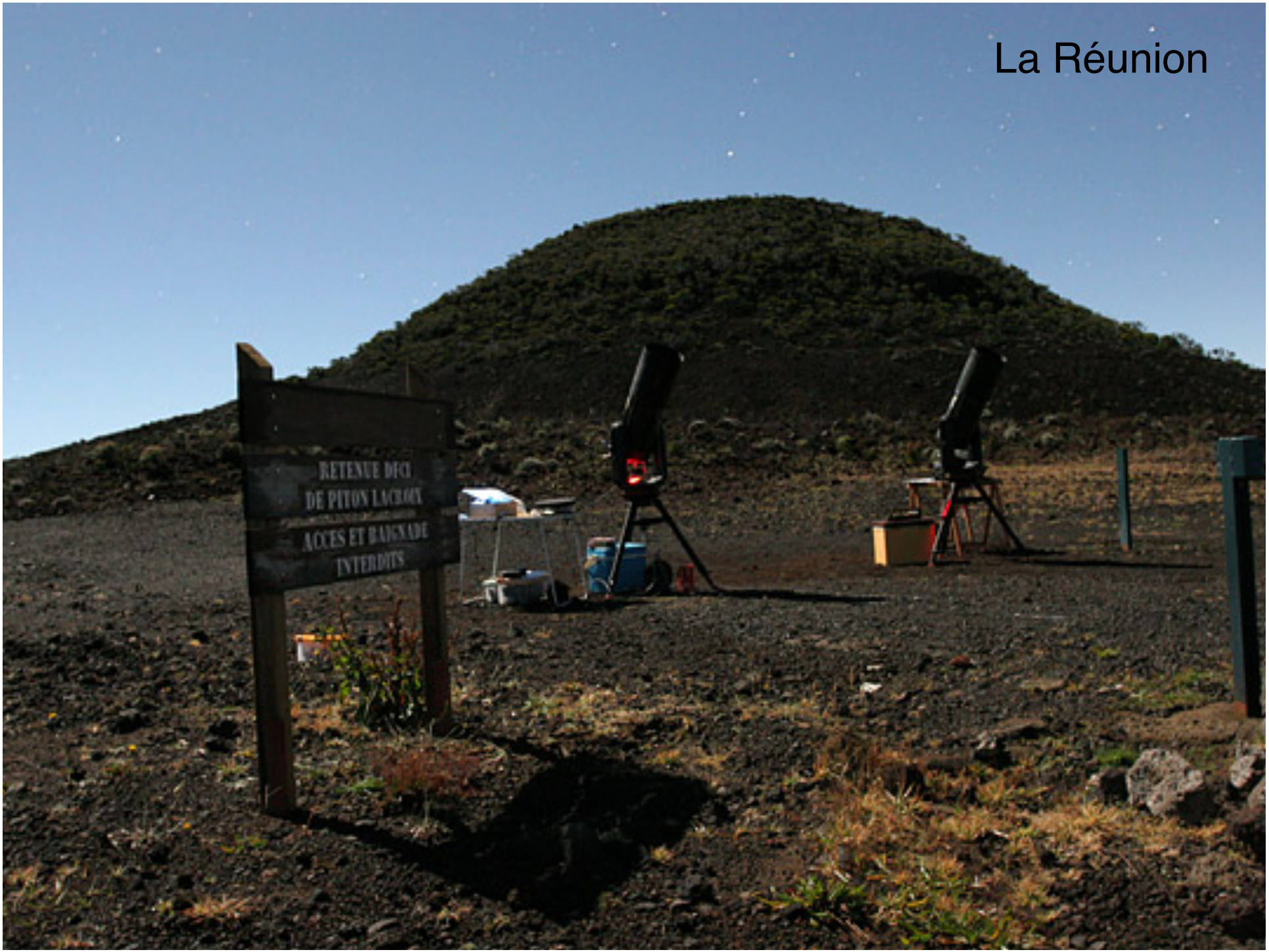

star Rio group, 27 Apr. 08, Triton, modele T7, Δξ= −1.3 mas, Δη= −56.0 mas
5000
0
−5000
5000
0
−5000
chanat siane ξ: 01:52 ---> 01:53 UT

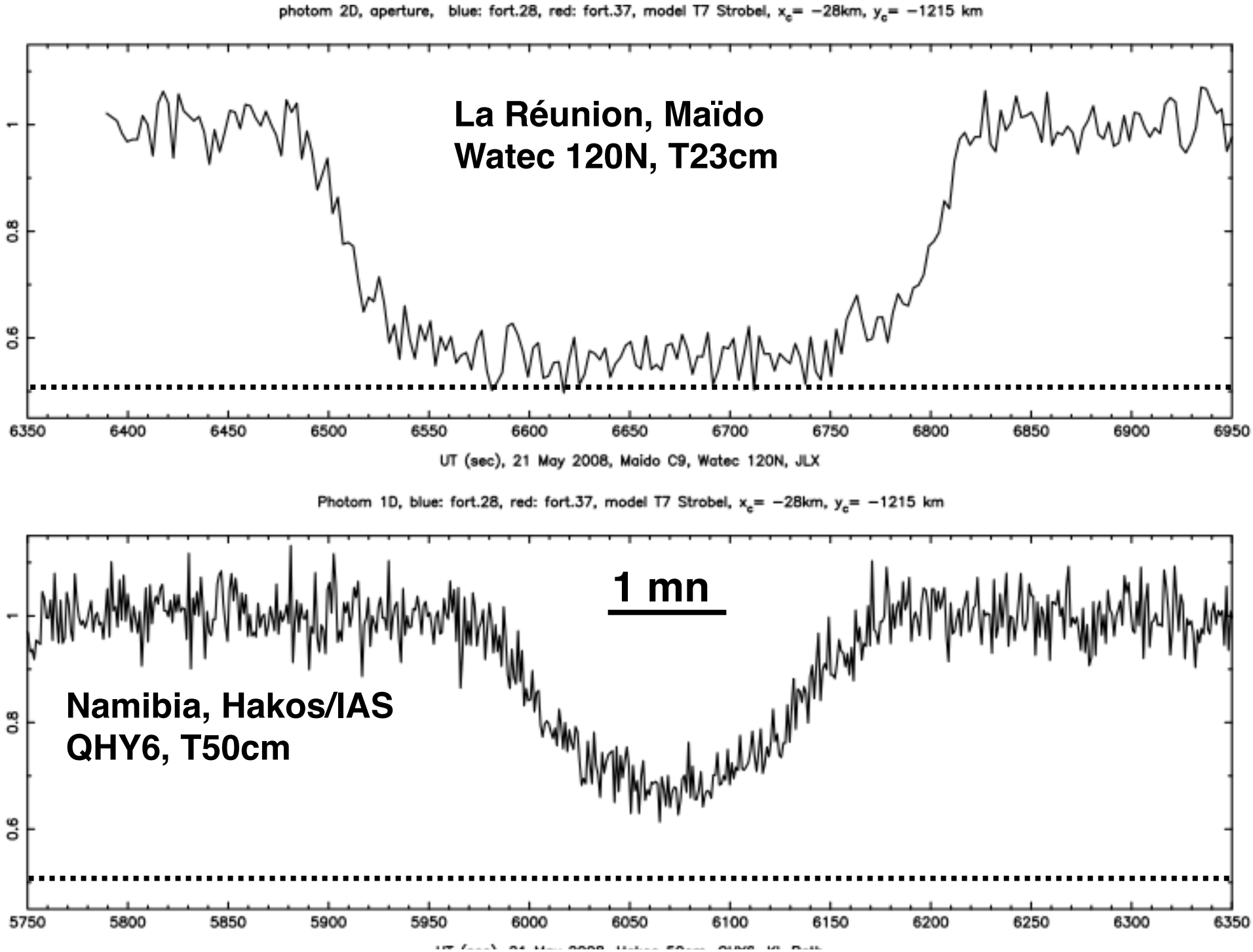

star Rio group, 27 Apr. 08, Triton, modele T7, Δξ= −1.3 mas, Δη= −56.0 mas
0
−1000
−2000
−3000
-Windhoek
-Hakos
-Tivoli
-Le Cap
-Cederberg
-Springbok
-désert
Sutherland
-10m (SALT)
-1.9m
-1m
-Makes
-Maïdo
-Fournaise
0
5000
4000
3000
2000
1000
0
changt signe ξ: 01:52 ---> 01:53 UT

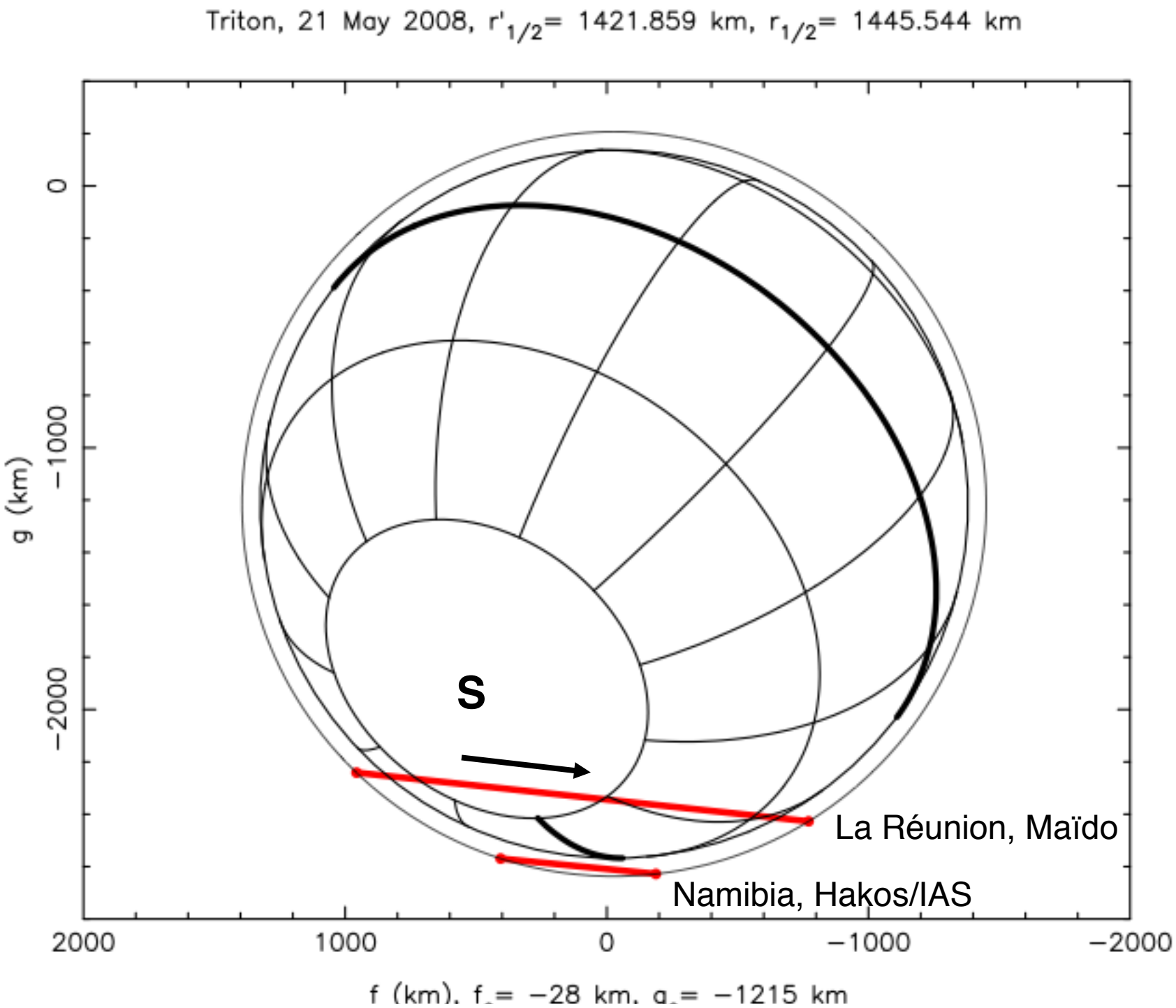

Namibia


N
galaxy
occulted star + Triton
Neptune
reference star
E
1 arcmin
Merlin
Raptorphotonics
camera


Hakos/IAS
T50cm
QHY6 camera
from KL Bath


La Réunion
RETENUE DCI
DE PITON LACROIX
ACCES ET BAIGNADE
INTERDITS


photom 2D, aperture, blue: fort.28, red: fort.37, model T7 Strobel, x_c= −28km, y_c= −1215 km
La Réunion, Maïdo
Watec 120N, T23cm
1
0.8
0.6
6350
6400
6450
6500
6550
6600
6650
6700
6750
6800
6850
6900
6950
UT (sec), 21 May 2008, Maido C9, Watec 120N, JLX
Photom 1D, blue: fort.28, red: fort.37, model T7 Strobel, x_c= −28km, y_c= −1215 km
1 mn
Namibia, Hakos/IAS
QHY6, T50cm
1
0.8
0.6
5750
5800
5850
5900
5950
6000
6050
6100
6150
6200
6250
6300
6350


Triton, 21 May 2008, r'1/2= 1421.859 km, r1/2= 1445.544 km
0
−1000
−2000
g (km)
S
La Réunion, Maïdo
Namibia, Hakos/IAS
2000
1000
0
−1000
−2000
f (km), f0= −28 km, g0= −1215 km

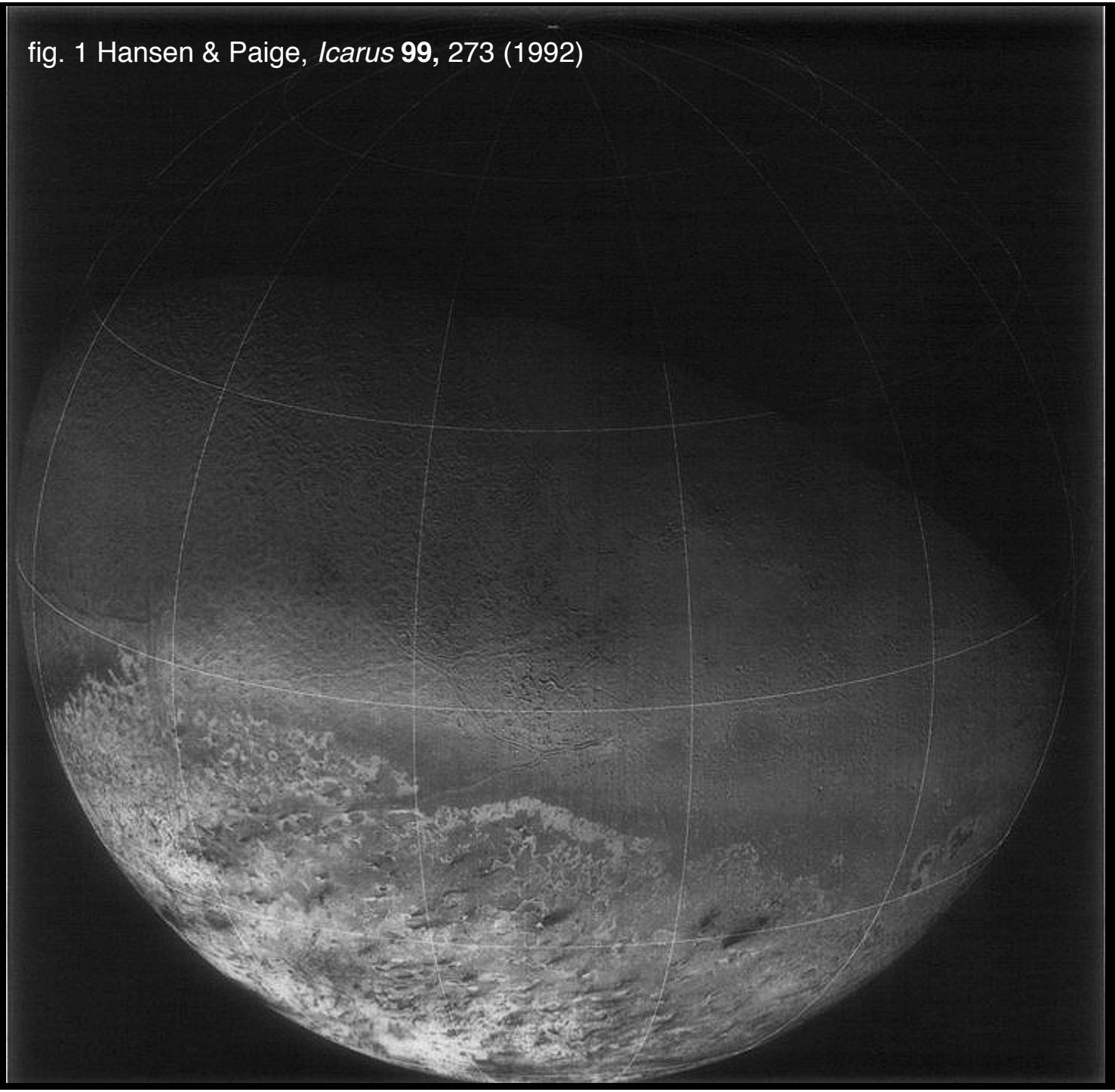


fig. 1 Hansen & Paige, *Icarus* **99,** 273 (1992)

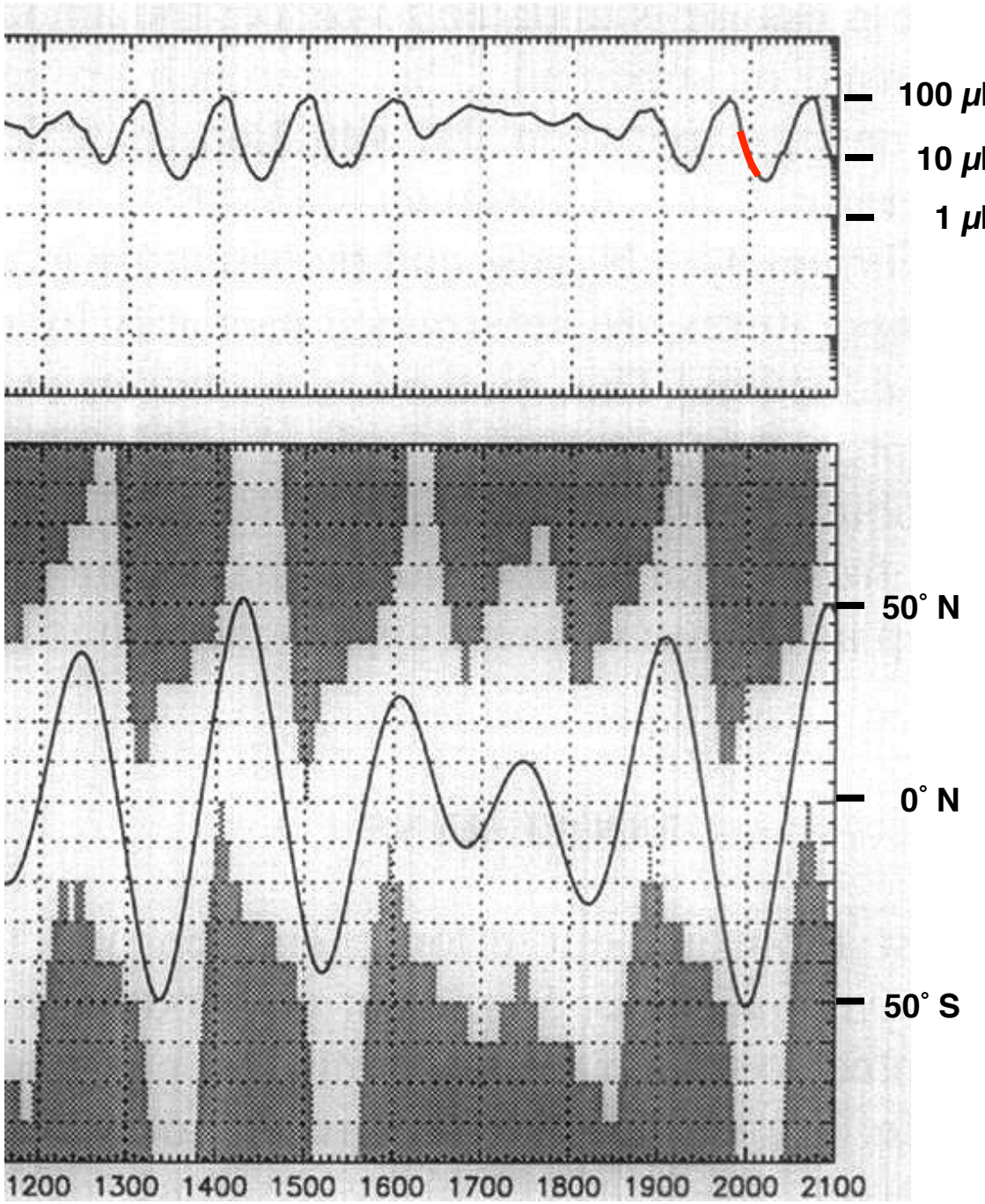
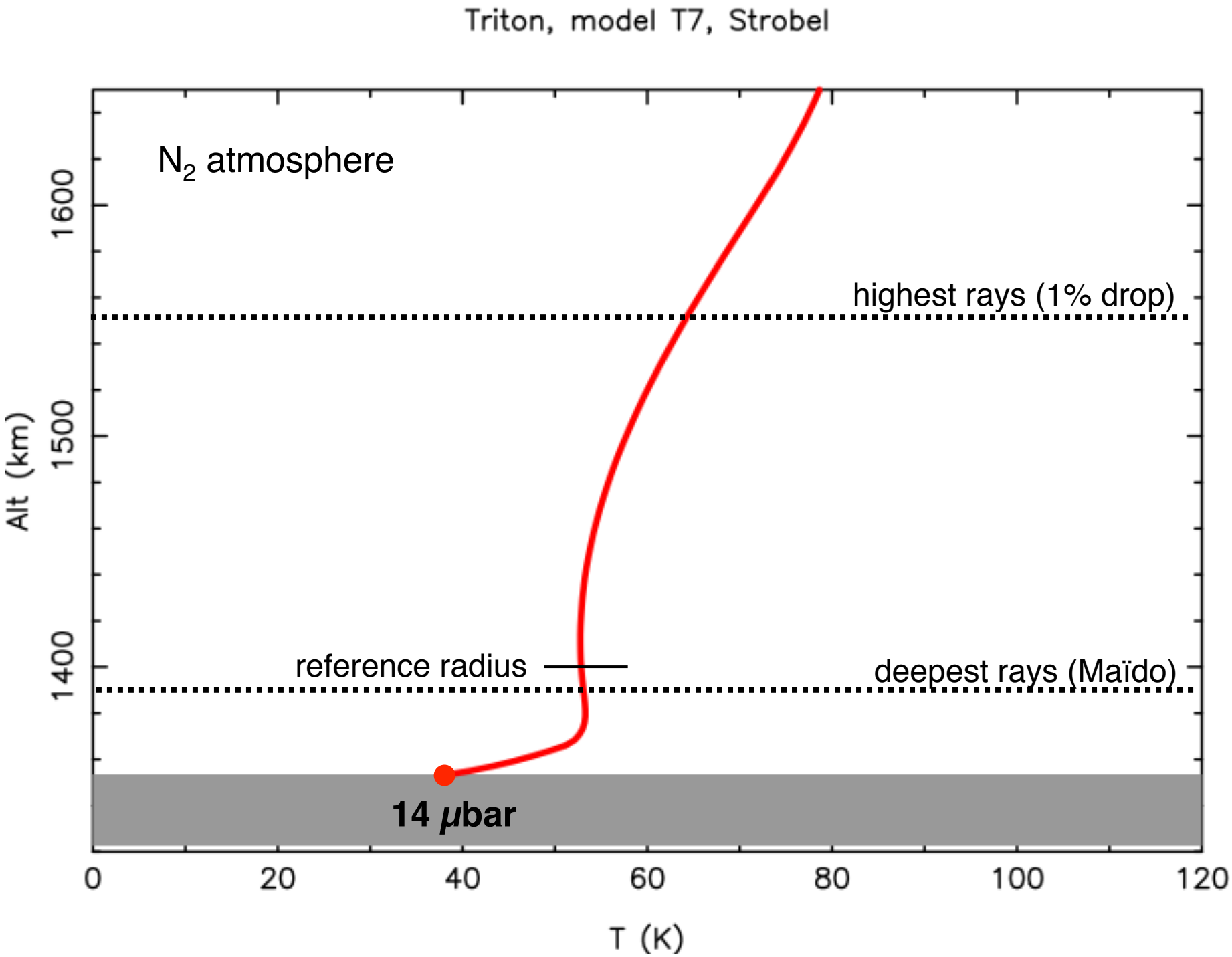
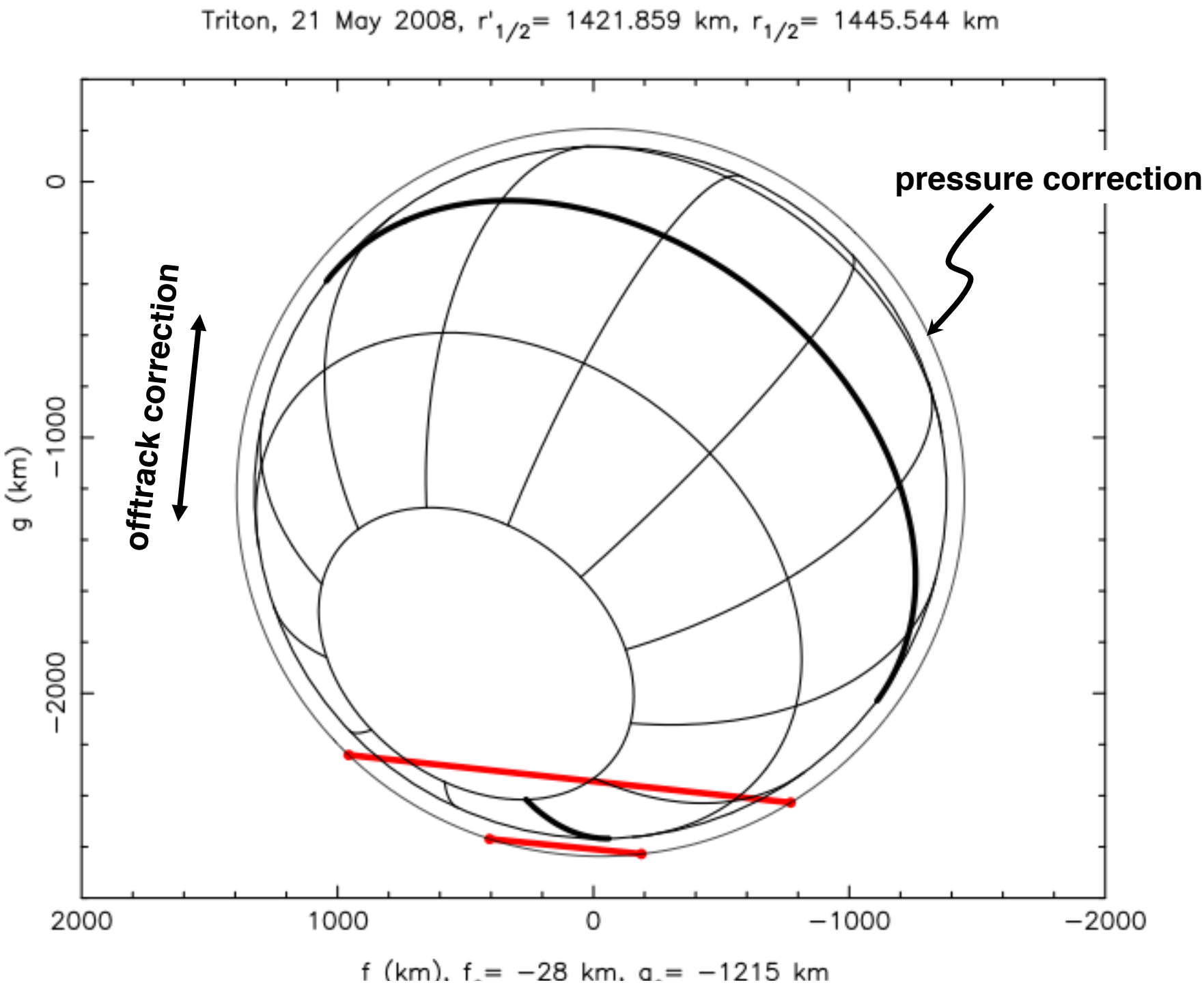
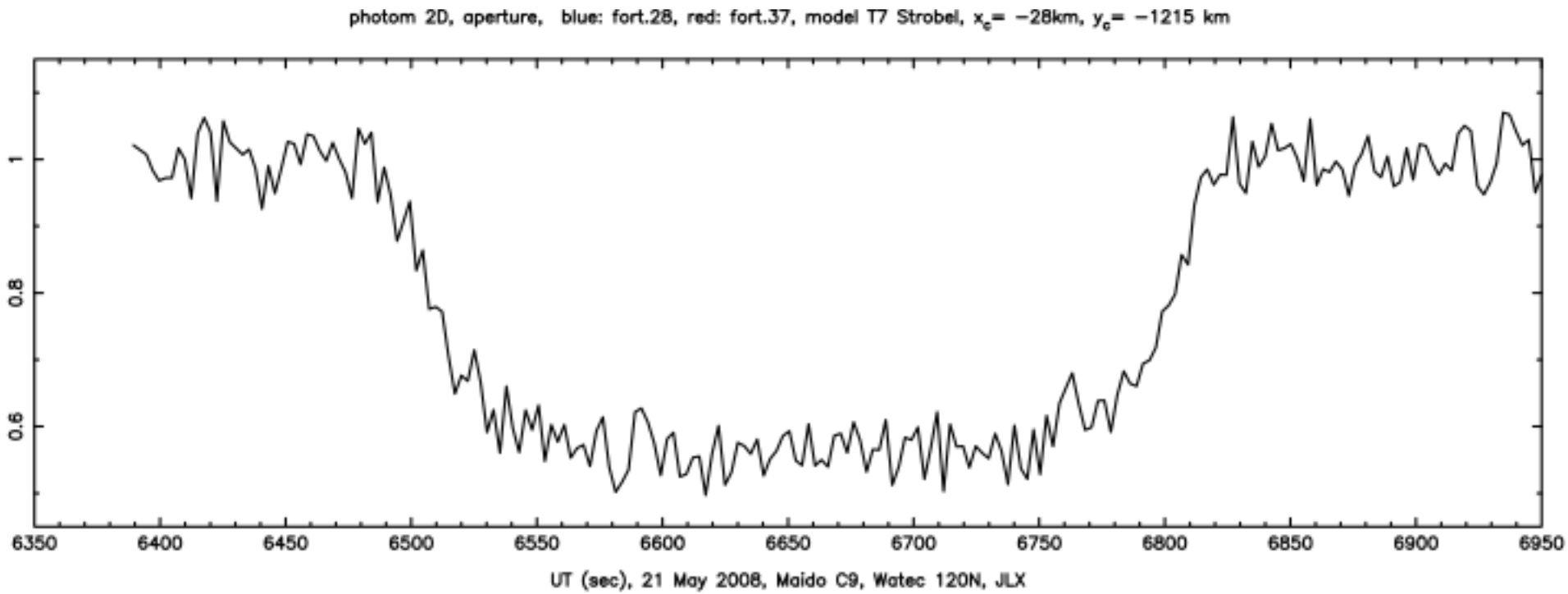
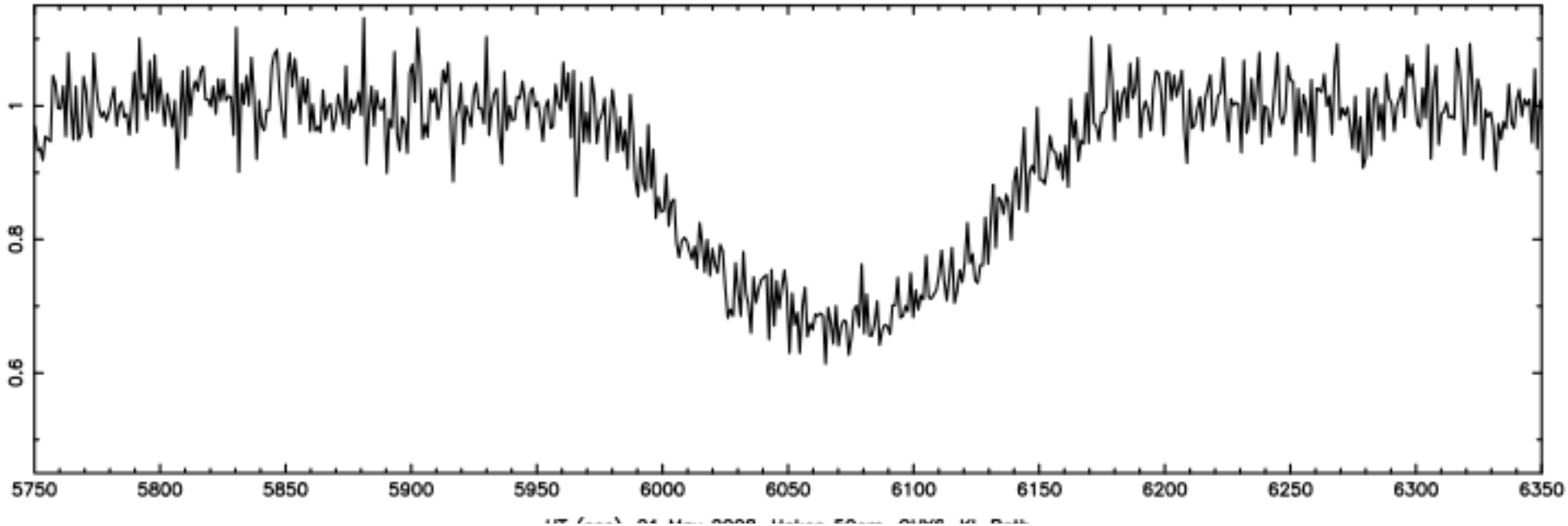


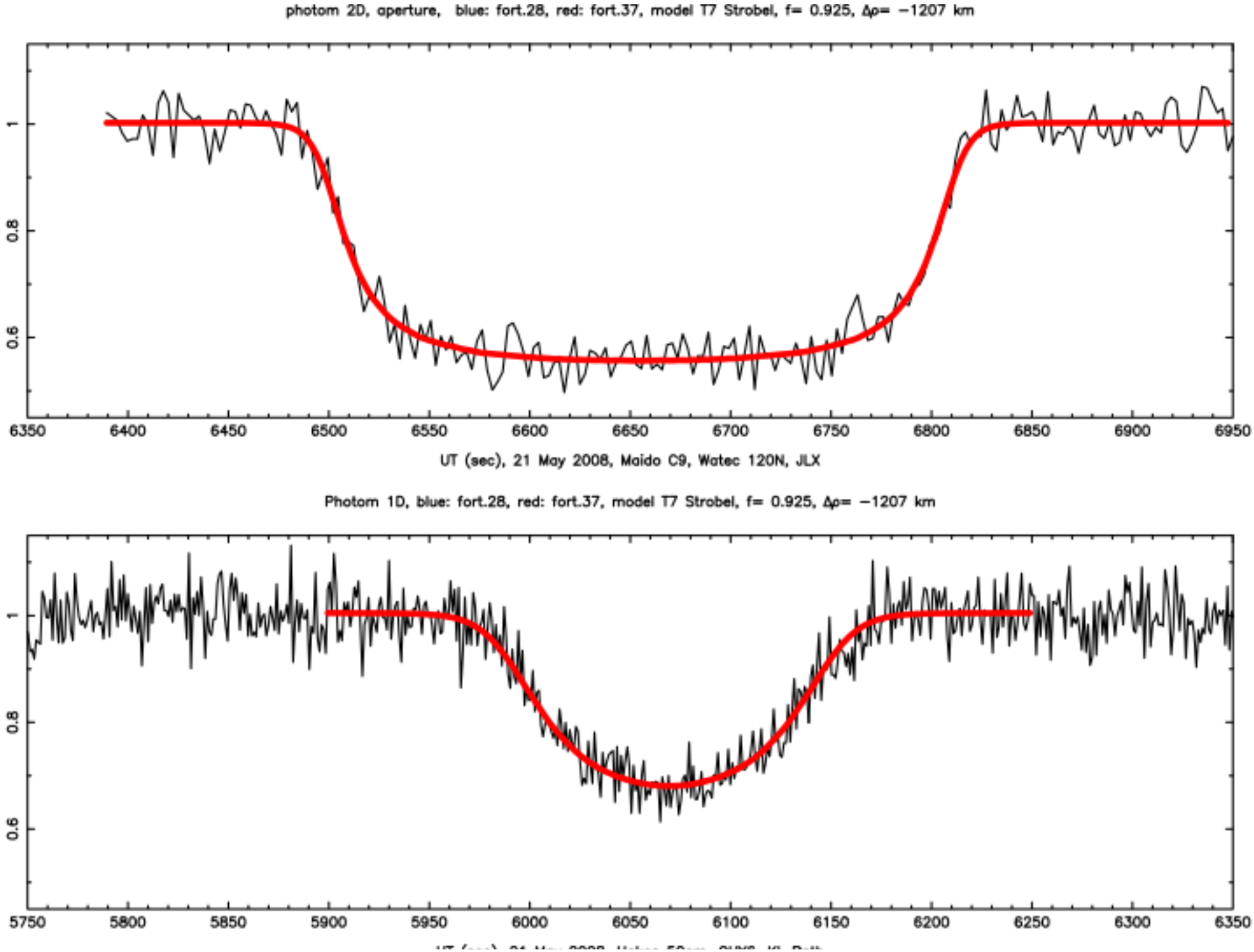
fig. 3 Hansen & Paige
Icarus **99,** 273 (1992)

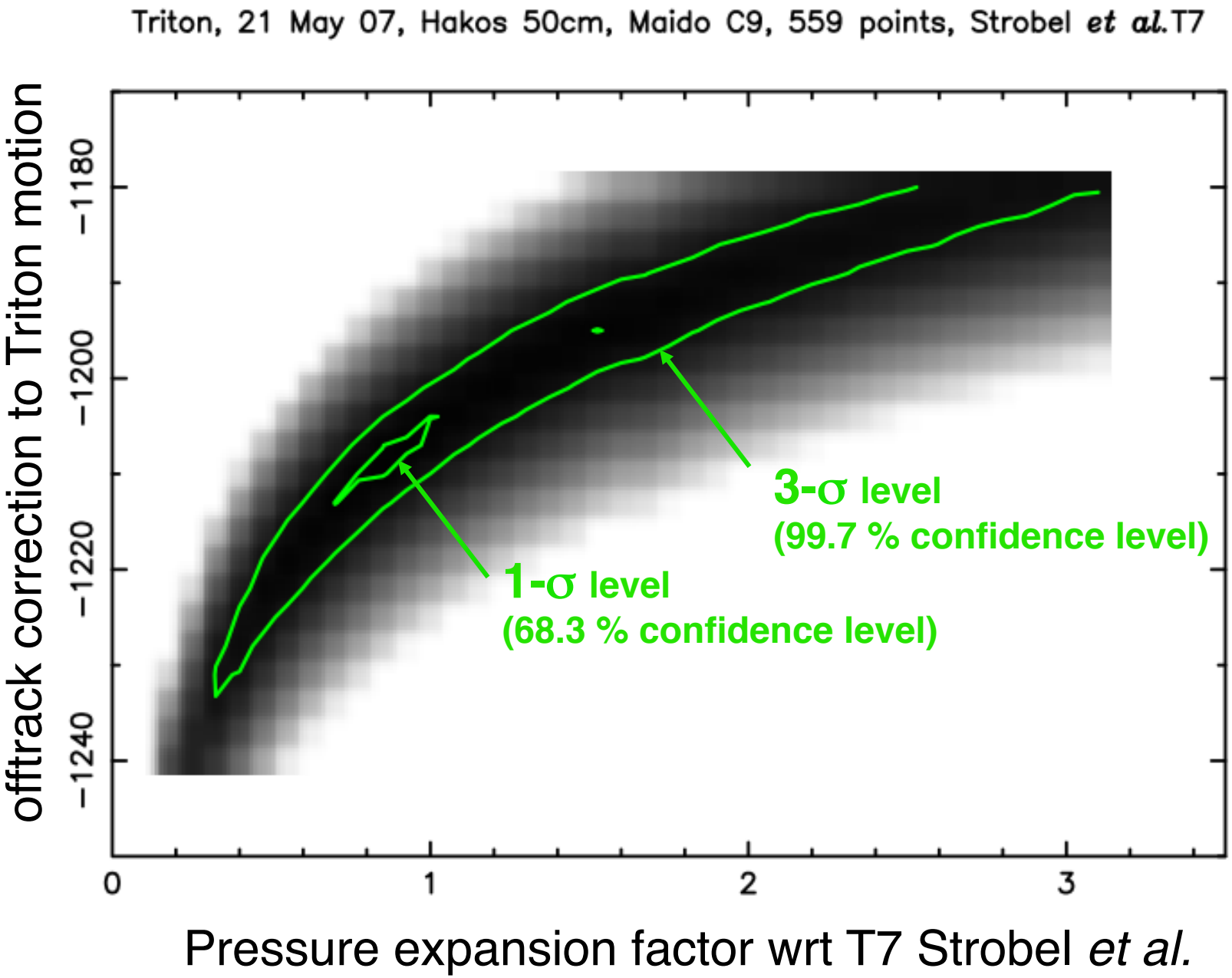

Triton, model T7, Strobel
N_2 atmosphere
highest rays (1% drop)
reference radius
deepest rays (Maïdo)
14 μbar
Alt (km)
1600
1500
1400
0
20
40
60
80
100
120
T (K)

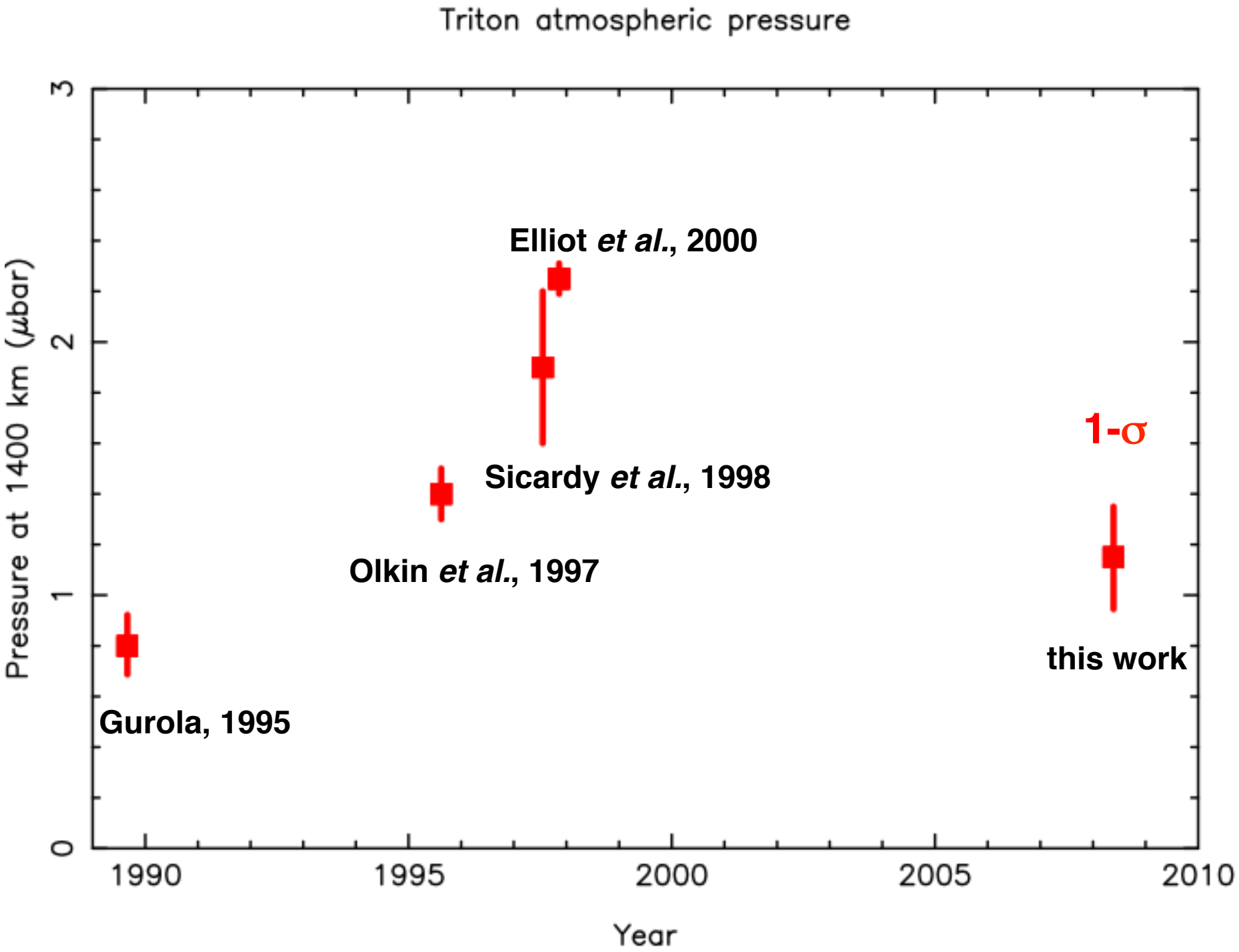

Triton, 21 May 2008, r'1/2= 1421.859 km, r1/2= 1445.544 km
pressure correction
offtrack correction
0
−1000
−2000
g (km)
2000
1000
0
−1000
−2000
f (km), f0= −28 km, g0= −1215 km

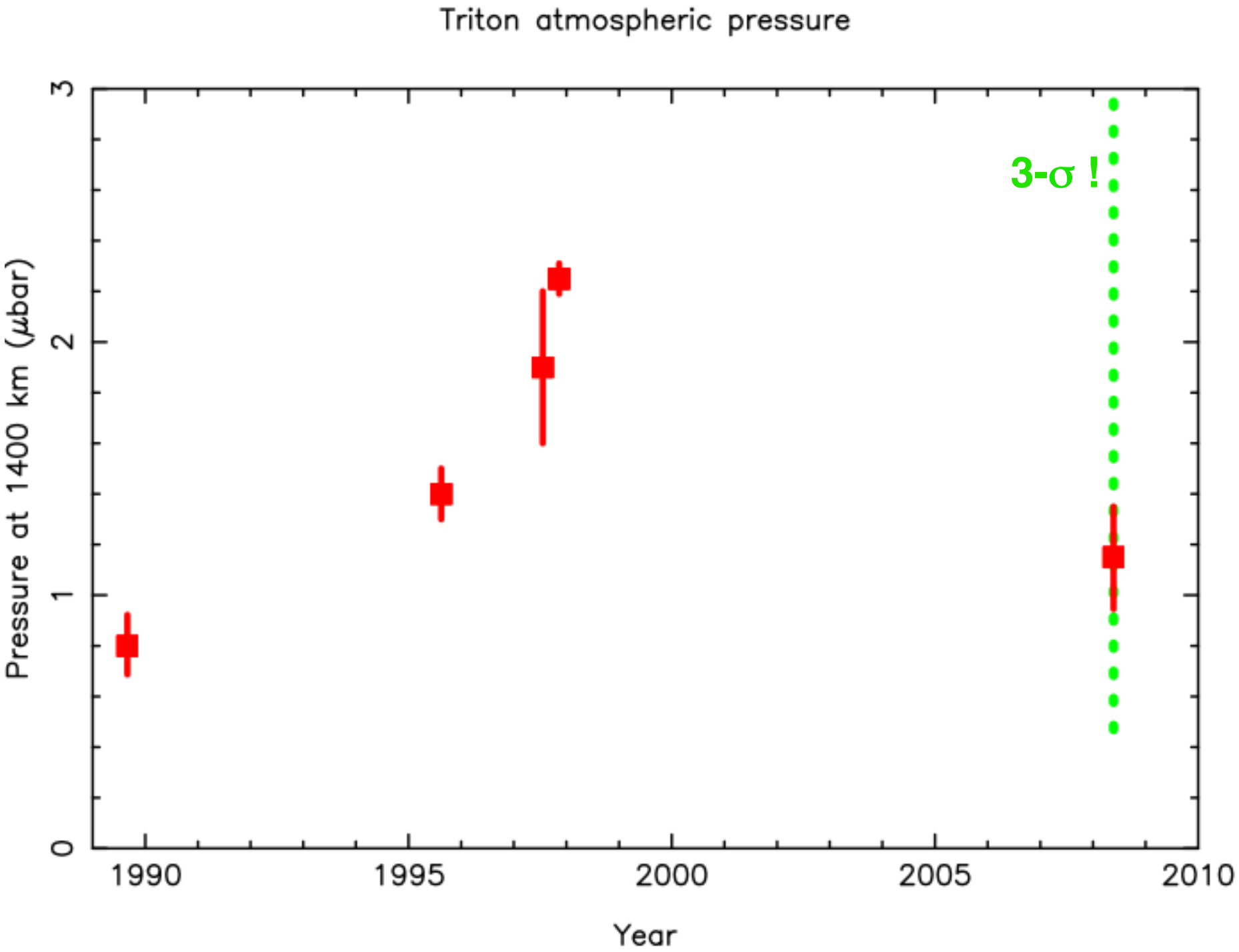

photom 2D, aperture, blue: fort.28, red: fort.37, model T7 Strobel, x_c= −28km, y_c= −1215 km
1
0.8
0.6
6350
6400
6450
6500
6550
6600
6650
6700
6750
6800
6850
6900
6950
UT (sec), 21 May 2008, Maido C9, Watec 120N, JLX

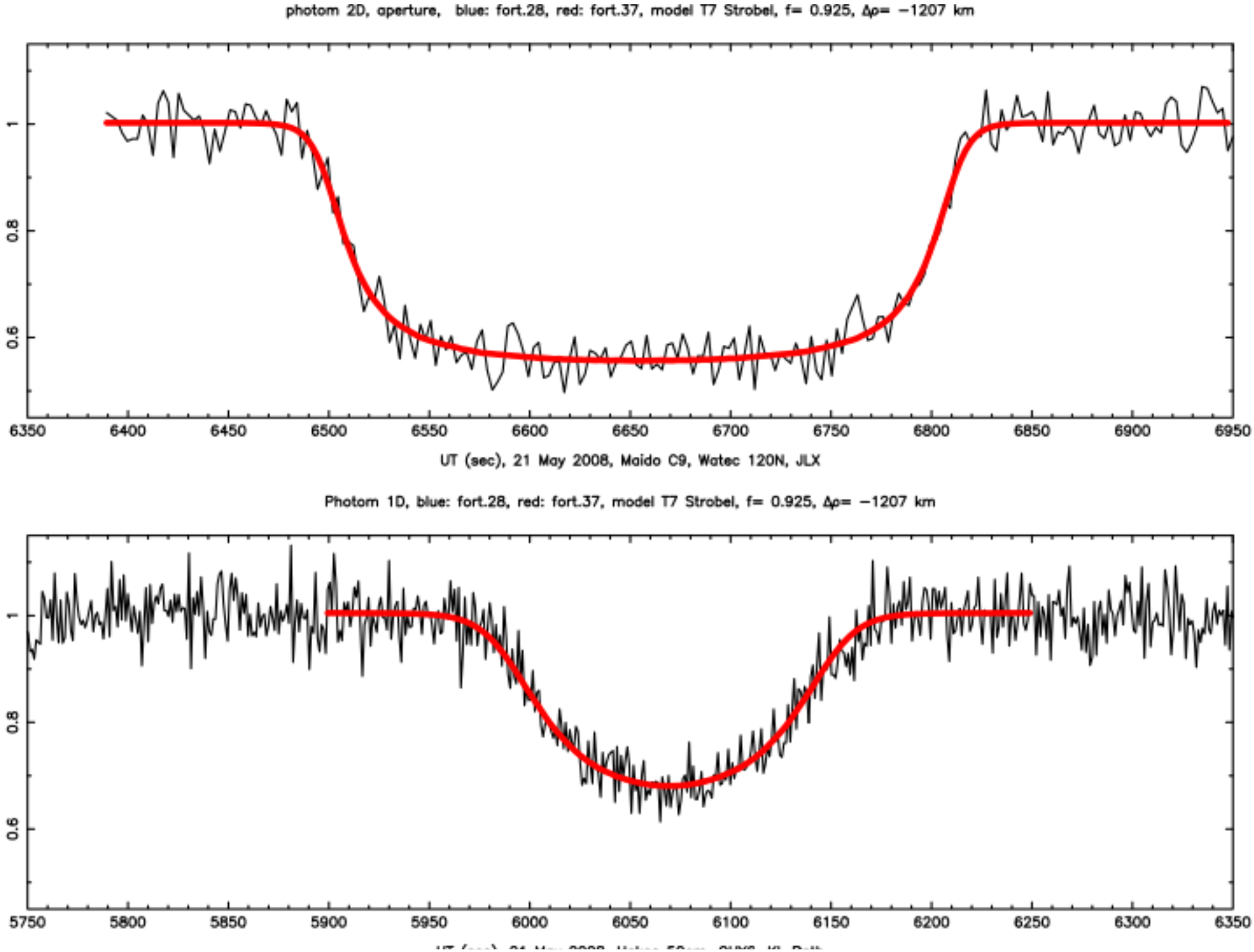

Photom 1D, blue: fort.28, red: fort.37, model T7 Strobel, x_c= −28km, y_c= −1215 km
1
0.8
0.6
5750
5800
5850
5900
5950
6000
6050
6100
6150
6200
6250
6300
6350

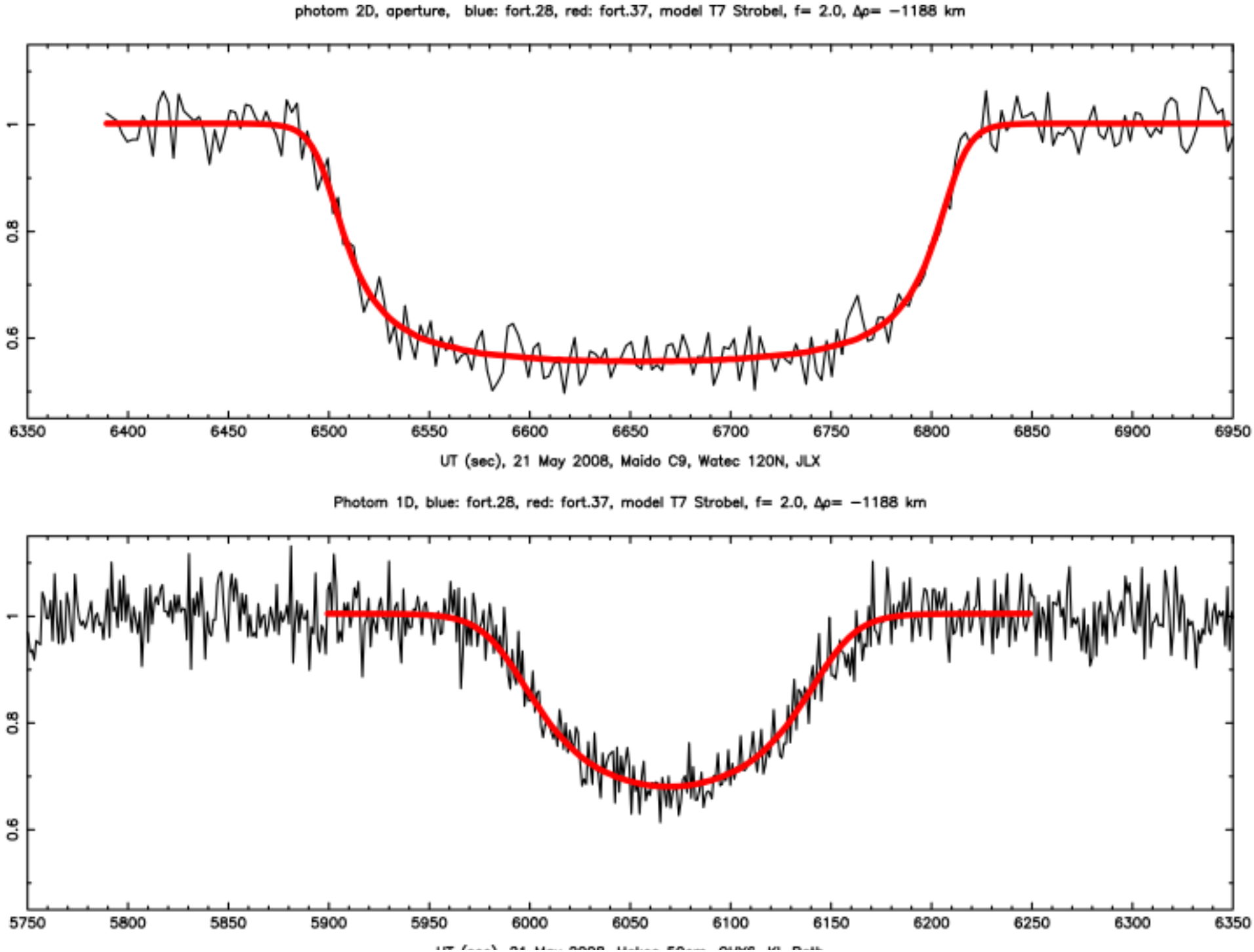

photom 2D, aperture, blue: fort.28, red: fort.37, model T7 Strobel, f= 0.925, Δρ= −1207 km
1
0.8
0.6
6350
6400
6450
6500
6550
6600
6650
6700
6750
6800
6850
6900
6950
UT (sec), 21 May 2008, Maido C9, Watec 120N, JLX
Photom 1D, blue: fort.28, red: fort.37, model T7 Strobel, f= 0.925, Δρ= −1207 km
1
0.8
0.6
5750
5800
5850
5900
5950
6000
6050
6100
6150
6200
6250
6300
6350


Triton, 21 May 07, Hakos 50cm, Maido C9, 559 points, Strobel *et al.*T7
offtrack correction to Triton motion
−1180
−1200
−1220
−1240
0
1
2
3
Pressure expansion factor wrt T7 Strobel *et al.*
3-σ level
(99.7 % confidence level)
1-σ level
(68.3 % confidence level)


Triton atmospheric pressure
Pressure at 1400 km (μbar)
0
1
2
3
1990
1995
2000
2005
2010
Year
Elliot et al., 2000
Sicardy et al., 1998
Olkin et al., 1997
Gurola, 1995
1-σ
this work


Triton atmospheric pressure
Pressure at 1400 km (μbar)
0
1
2
3
1990
1995
2000
2005
2010
Year
3-σ !


photom 2D, aperture, blue: fort.28, red: fort.37, model T7 Strobel, f= 0.925, Δρ= −1207 km
1
0.8
0.6
6350
6400
6450
6500
6550
6600
6650
6700
6750
6800
6850
6900
6950
UT (sec), 21 May 2008, Maido C9, Watec 120N, JLX
Photom 1D, blue: fort.28, red: fort.37, model T7 Strobel, f= 0.925, Δρ= −1207 km
1
0.8
0.6
5750
5800
5850
5900
5950
6000
6050
6100
6150
6200
6250
6300
6350


photom 2D, aperture, blue: fort.28, red: fort.37, model T7 Strobel, f= 2.0, Δρ= −1188 km
1
0.8
0.6
6350
6400
6450
6500
6550
6600
6650
6700
6750
6800
6850
6900
6950
UT (sec), 21 May 2008, Maido C9, Watec 120N, JLX
Photom 1D, blue: fort.28, red: fort.37, model T7 Strobel, f= 2.0, Δρ= −1188 km
1
0.8
0.6
5750
5800
5850
5900
5950
6000
6050
6100
6150
6200
6250
6300
6350

conclusions

- 21 May 2008: first stellar occultation by Triton since 1997

- back to 1995 situation at 1-σ level

- large error bars, however, due to grazing geometry. Better results with + light curves and improves zero stellar flux calibration

- Triton offset wrt DE405: -1 ± 30 mas in α and -56 ± 30 in δ

we'll be back…