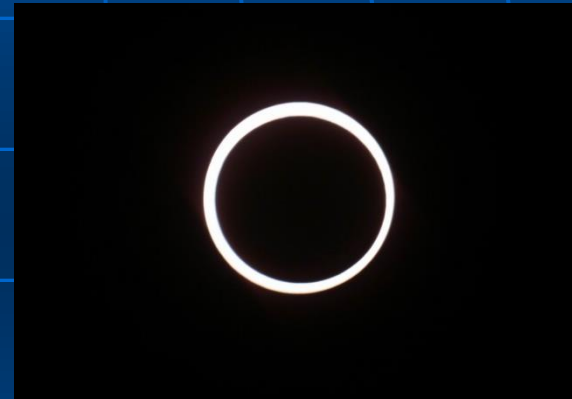


# Solar Eclipse Observation: My Experience



Jan Sladeczek

SEC 2014, 23<sup>rd</sup> October, NSO at Sacramento Peak  
Czech Republic, Prague, e-mail: [sladecclipse@seznam.cz](mailto:sladecclipse@seznam.cz)

# Solar Eclipse Observation: My Experience

- Solar Eclipse, especially Total Solar Eclipse is the beautiful natural phenomenon, when there is visible the external layer of Solar Atmosphere - Corona.
- I have observed also Annular Solar Eclipse, Transits of planets Mercury and Venus across the Solar Disc, Total Lunar Eclipse, but my great interest is the Total Solar Eclipse and visible Corona.

# Solar Eclipse Observation: My Experience

- My interest in the astronomy started in 1980.
- I studied geography, within geo. I studied meteorology and environment. I visited the lectures of astronomy.
- I graduated in 1986 and started to work at the Czech Hydrometeorological Institute of Air Quality Department.
- Since 1991 I have been member of CAS
- In 90<sup>th</sup> year my main interest was planetology and astronautics.
- Since 1999 I have started to observe Total Solar Eclipse.

# Solar Eclipse Observation: My Experience

## TSE (HSE)

1. 1999 Germany, fiasco, total cloud eclipse!
2. 2001 Zambia, first success! Solar Corona, video; Victoria Falls
3. 2002 SA, cloudy, half success, video; Krüger N.P.  
2003 Antarctica, my plan failed, skip
4. 2005 Pacific Ocean, success, video, first photos, Easter Island
5. 2006 Egypt, success, first serie of pictures, video; Asuan
6. 2008 Mongolia, success, scientific team, pictures, processing
7. 2009 China, unsuccess but good third contact
8. 2010 French Polynesia, Hikureu, unsuc., “bitter beads“; Moorea
9. 2012 Australia, success, pictures, processing; N.Z.
10. 2013 Uganda, chromosphere, pictures, processing



# Solar Eclipse Observation: My Experience

## ASE, PSE, Transits, SEC

1. 2005 ASE Tunisia, success, video
  2. 2006 ASE French Guiana, success, pictures; ESA centre
  3. 2012 ASE USA, success, pictures (part of chromosphere); Grand Canyon
- 
1. 1975 PSE CR, success
  2. 2003 PSE CR, success, video
  3. 2009 PSE SA, success, Tsitsikama N.P., pict.; SAAO, SALT; cape of g.h.
  4. 2011 PSE CR, success, Strahov, pictures
  5. *2014 PSE USA, N.S.O. at Sacramento Peak*
- 
1. 2003 TPM CR, success, Brno observatory
  2. 2004 TPV CR, success, Prague observatory, video, pictures
  3. 2012 TPV CR, success, Prague observatory, pictures
- 
1. 2004 SEC UK, Open University Milton Keynes; poster
  2. 2007 SEC USA, Cal., Griffith Observatory, Mt. Wilson Ob.; poster  
2010 SEC India, unsuitable date, skip
  3. 2014 SEC USA, N.M., Coudcroft, Sacramento P.O.; presentation, poster

# Solar Eclipse Observation: My Experience

- In the period 1999-2005 I specialized on the observation Solar Corona and recording by camcorder.
- Since 2005 I have started to photograph Solar Corona by camera
- I participated in the international scientific expedition to Mongolia to TSE 2008. My camera was on great parallactic mount and I could concentrate on the observation of Solar Corona.
- Since 2009 to this time I use parallactic mount with drive, optimal cameras and direction laptop, for later processing.

# Solar Eclipse Observation: My Experience

- The choice of the position for the Solar Eclipse observation is important from the point of view of security, and weather forecast.
- I travel to TSE (ASE) around the world.
- My last two journeys, Australia 2012 and Uganda 2013, were successful.
- Especially in 2013, our international team took the pictures of Solar Corona for later processing by Miloslav Druckmüller from Technical University of Brno in CR.
- Miloslav and his daughter Hana are the great experts for mathematical processing of images.

# Solar Eclipse Observation: My Experience

## PSE

- 2009 partial phase of ASE SA, success, pictures;  
main destination: visit to SAAO, SALT
- 2011 PSE CR, Prague, success, pictures
- *2014 PSE USA, NSO at Sacramento Peak*



# SAAO Sutherland, SALT



## Annular Solar Eclipse of 2009 Jan 26

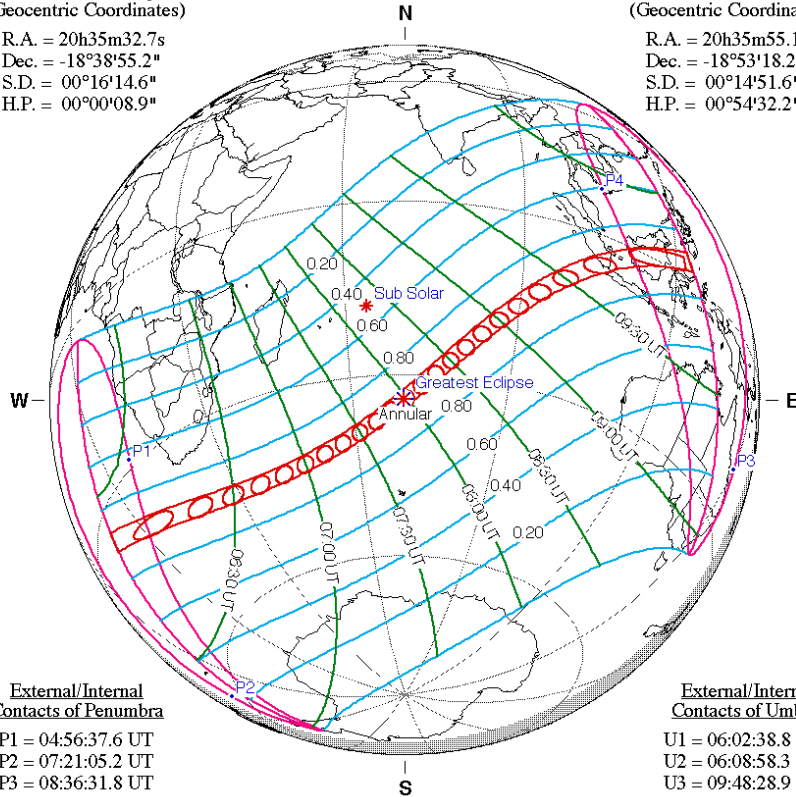
Geocentric Conjunction = 07:46:24.8 UT    J.D. = 2454857.823898  
 Greatest Eclipse = 07:58:39.0 UT    J.D. = 2454857.832395  
 Eclipse Magnitude = 0.9282    Gamma = -0.2819  
 Saros Series = 131    Member = 51 of 71

### Sun at Greatest Eclipse (Geocentric Coordinates)

R.A. = 20h35m32.7s  
 Dec. = -18°38'55.2"  
 S.D. = 00°16'14.6"  
 H.P. = 00°00'08.9"

### Moon at Greatest Eclipse (Geocentric Coordinates)

R.A. = 20h35m55.1s  
 Dec. = -18°53'18.2"  
 S.D. = 00°14'51.6"  
 H.P. = 00°54'32.2"



### External/Internal Contacts of Penumbra

P1 = 04:56:37.6 UT  
 P2 = 07:21:05.2 UT  
 P3 = 08:36:31.8 UT  
 P4 = 11:00:40.9 UT

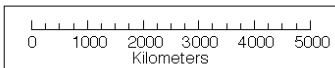
### Local Circumstances at Greatest Eclipse

Lat. = 34°04.2'S    Sun Alt. = 73.4°  
 Long. = 070°14.0'E    Sun Azm. = 337.0°

Path Width = 280.3 km    Duration = 07m53.7s

### Ephemeris & Constants

Eph. = Newcomb/ILE  
 $\Delta T = 65.7$  s  
 $k1 = 0.2724880$   
 $k2 = 0.2722810$   
 $\Delta b = 0.0''$      $\Delta l = 0.0''$



F. Espenak, NASA's GSFC - Fri, Jul 2,  
[sunearth.gsfc.nasa.gov/eclipse/eclipse.html](http://sunearth.gsfc.nasa.gov/eclipse/eclipse.html)

### External/Internal Contacts of Umbra

U1 = 06:02:38.8 UT  
 U2 = 06:08:58.3 UT  
 U3 = 09:48:28.9 UT  
 U4 = 09:54:44.1 UT

### Geocentric Libration (Optical + Physical)

$l = -2.99^\circ$   
 $b = 0.36^\circ$   
 $c = -12.94^\circ$

Brown Lun. No. = 1065

## Partial Solar Eclipse of 2011 Jan 04

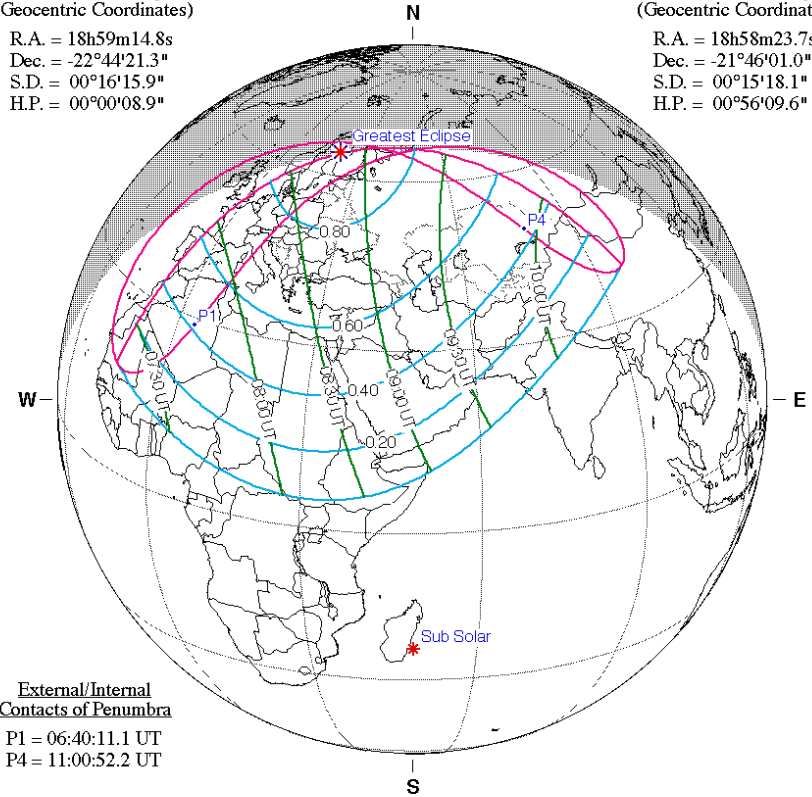
Geocentric Conjunction = 09:15:12.3 UT    J.D. = 2455565.885559  
 Greatest Eclipse = 08:50:34.0 UT    J.D. = 2455565.868449  
 Eclipse Magnitude = 0.8572    Gamma = 1.0628  
 Saros Series = 151    Member = 14 of 72

### Sun at Greatest Eclipse (Geocentric Coordinates)

R.A. = 18h59m14.8s  
 Dec. = -22°44'21.3"  
 S.D. = 00°16'15.9"  
 H.P. = 00°00'08.9"

### Moon at Greatest Eclipse (Geocentric Coordinates)

R.A. = 18h58m23.7s  
 Dec. = -21°46'01.0"  
 S.D. = 00°15'18.1"  
 H.P. = 00°56'09.6"

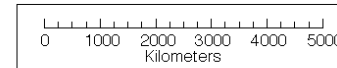


### External/Internal Contacts of Penumbra

P1 = 06:40:11.1 UT  
 P4 = 11:00:52.2 UT

### Ephemeris & Constants

Eph. = Newcomb/ILE  
 $\Delta T = 67.6$  s  
 $k1 = 0.2724880$   
 $k2 = 0.2722810$   
 $\Delta b = 0.0''$      $\Delta l = 0.0''$



F. Espenak, NASA's GSFC - Fri, Jul 2,  
[sunearth.gsfc.nasa.gov/eclipse/eclipse.html](http://sunearth.gsfc.nasa.gov/eclipse/eclipse.html)

### Geocentric Libration (Optical + Physical)

$l = 4.62^\circ$   
 $b = -1.33^\circ$   
 $c = -4.25^\circ$

Brown Lun. No. = 1089

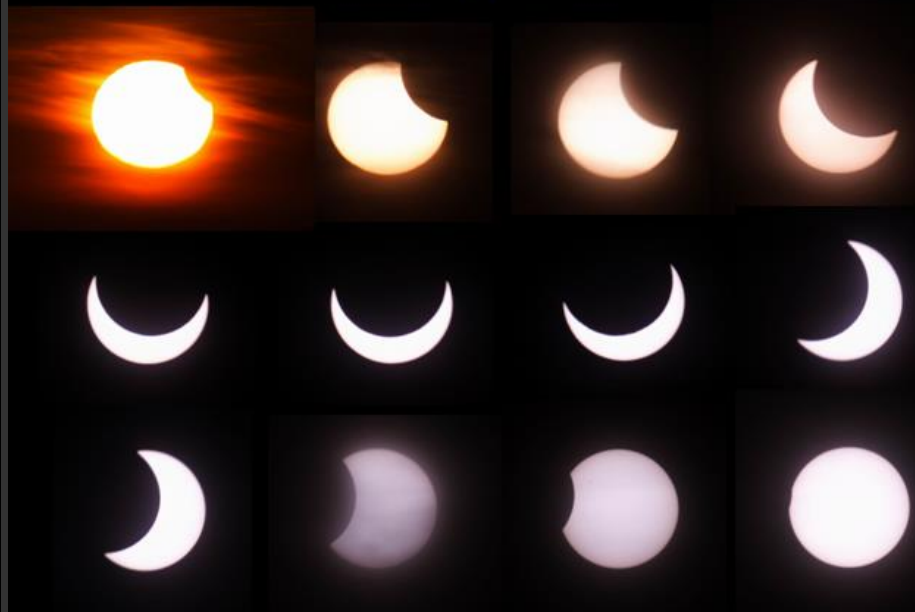


# Partial Phase of Annular Solar Eclipse 26 Jan, 2009



**Tsitsikamma National Park SA, 05:15 – 07:45 UT**  
Canon EOS 350D, Sigma MF 600/8 Jan Sladeczek CR

# Partial Solar Eclipse Jan 4, 2011



**Praha-Strahov, 08:12 – 10:50 CET**  
Canon EOS 350D, Sigma MF 600/8

Jan Sladeczek

# PSE 2011



Thomas Baader, Germany

# Partial Solar Eclipse of 2014 Oct 23

Ecliptic Conjunction = 21:57:47.2 TD (= 21:56:39.8 UT)

Greatest Eclipse = 21:45:39.2 TD (= 21:44:31.7 UT)

Eclipse Magnitude = 0.8114      Gamma = 1.0908

Saros Series = 153      Member = 9 of 70

## Sun at Greatest Eclipse (Geocentric Coordinates)

R.A. = 13h53m11.9s

Dec. = -11°36'45.1"

S.D. = 00°16'04.6"

H.P. = 00°00'08.8"

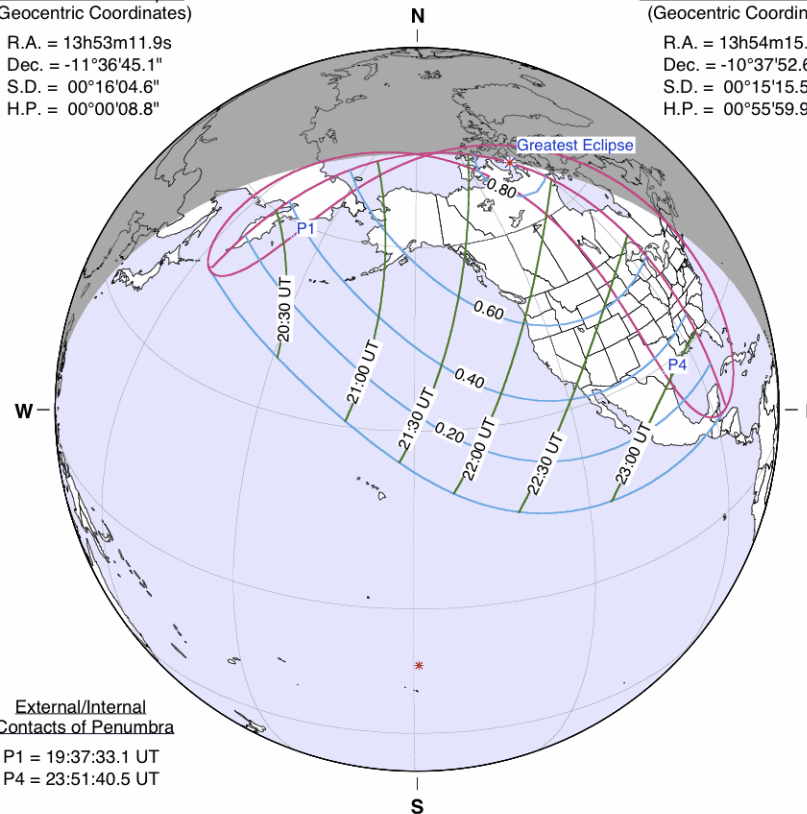
## Moon at Greatest Eclipse (Geocentric Coordinates)

R.A. = 13h54m15.8s

Dec. = -10°37'52.6"

S.D. = 00°15'15.5"

H.P. = 00°55'59.9"



## External/Internal Contacts of Penumbra

P1 = 19:37:33.1 UT

P4 = 23:51:40.5 UT

## Constants & Ephemeris

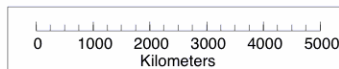
$\Delta T = 67.5$  s

$k1 = 0.2725076$

$k2 = 0.2722810$

$\Delta b = 0.0''$      $\Delta l = 0.0''$

Eph. = JPL DE405



## Geocentric Libration (Optical + Physical)

$l = -4.52^\circ$

$b = -1.28^\circ$

$c = 21.96^\circ$

Brown Lun. No. = 1136

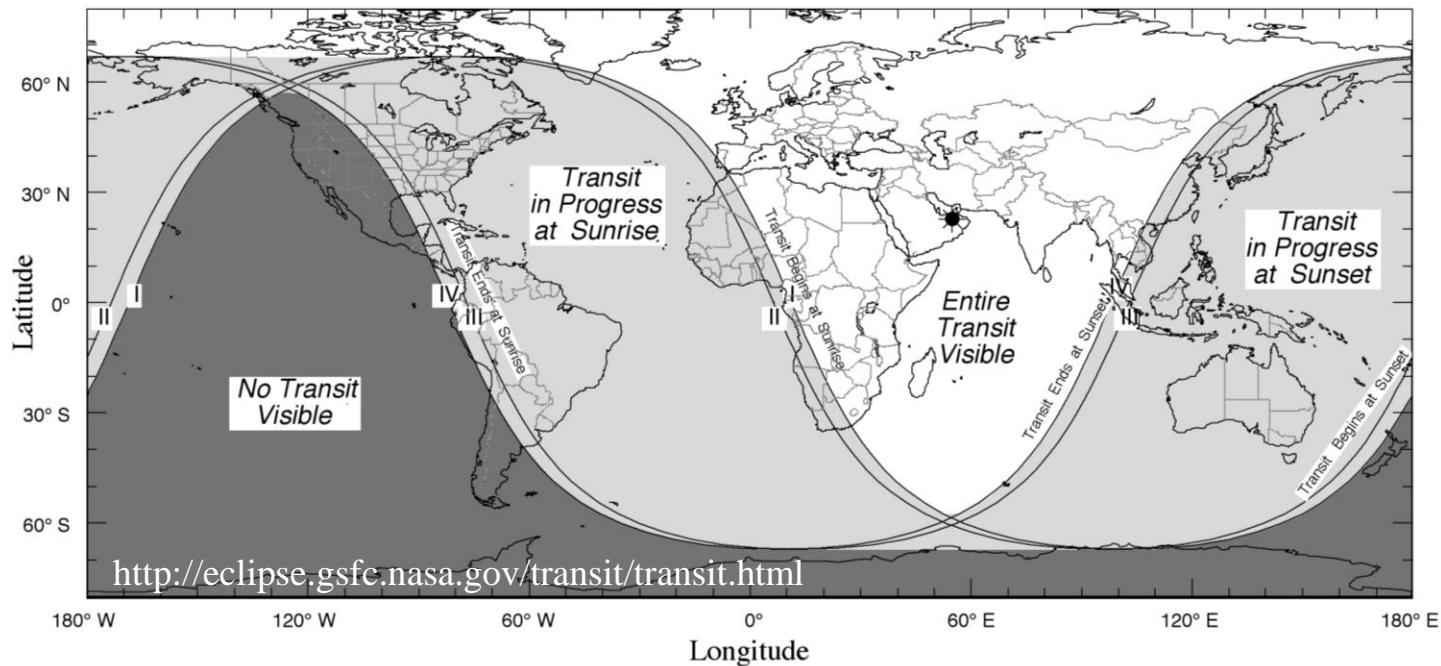
F. Espenak, NASA's GSFC  
eclipse.gsfc.nasa.gov  
2014 Feb 22

# Solar Eclipse Observation: My Experience

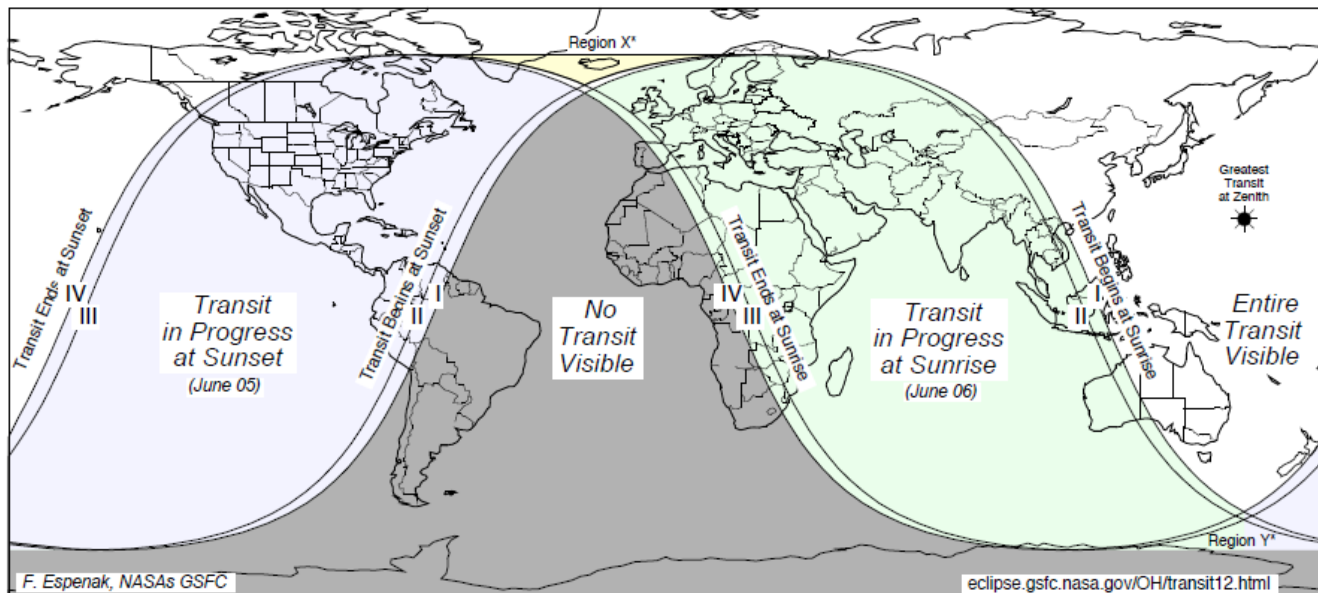
## Transits, ASE

- 2004 TPV CR, success, Prague observatory, video
- 2012 TPV CR, success, Prague observatory, pictures
  
- 2006 ASE French Guiana, success, pictures; ESA
- 2012 ASE USA, success, pictures

# World Visibility of 2004 Transit of Venus



# Global Visibility of the Transit of Venus of 2012 June 05/06



\* Region X - Beginning and end of Transit are visible, but the Sun sets for a short period around maximum transit.

\* Region Y - Beginning and end of Transit are NOT visible, but the Sun rises for a short period around maximum transit.

# 2004 and 2012 Transits of Venus

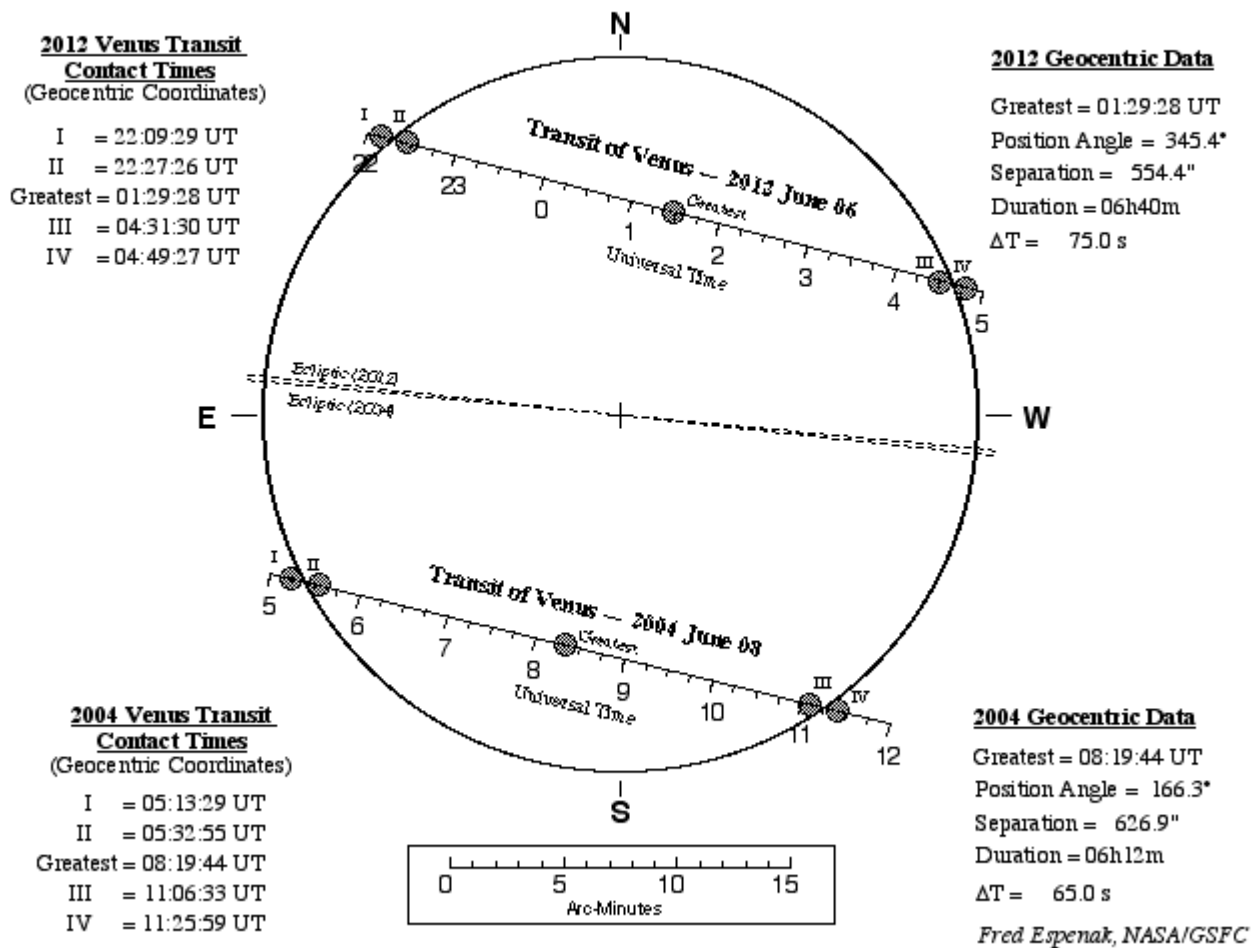


Figure 1 - Path of Venus across the Sun's disk on 2004 June 08 and 2012 June 06



# Transit planet Venus across Solar Disc 2012



# Transit planet Venus across Solar Disc 2012



# CNES/ESA Space centre, French Guiana, Kourou



## Annular Solar Eclipse of 2006 Sep 22

Geocentric Conjunction = 12:07:11.4 UT J.D. = 2454001.004993

Greatest Eclipse = 11:40:11.3 UT J.D. = 2454000.986242

Eclipse Magnitude = 0.9352 Gamma = -0.4064

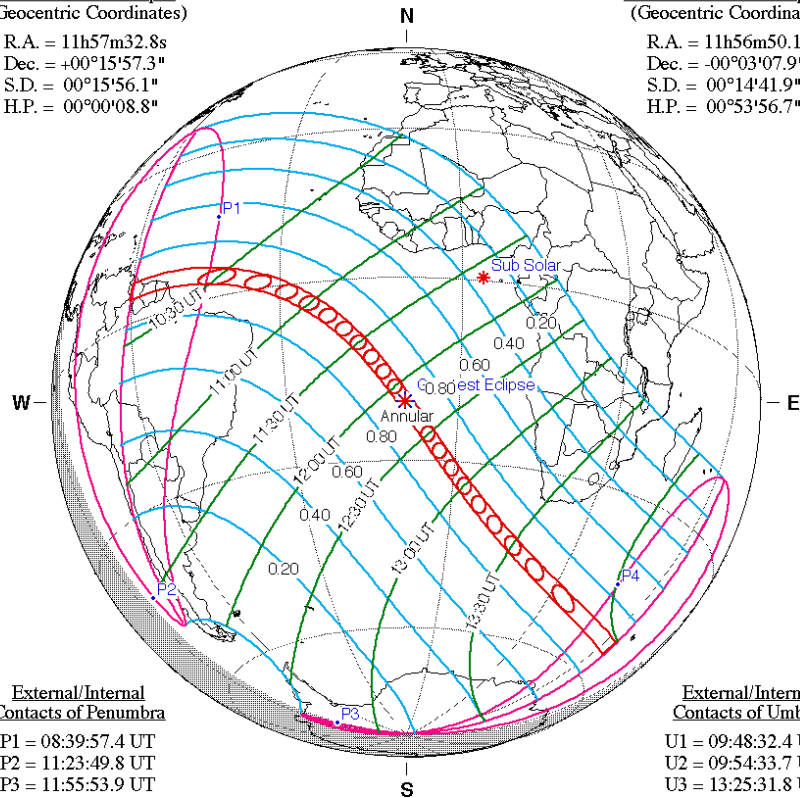
Saros Series = 144 Member = 16 of 70

### Sun at Greatest Eclipse (Geocentric Coordinates)

R.A. = 11h57m32.8s  
Dec. = +00°15'57.3"  
S.D. = 00°15'56.1"  
H.P. = 00°00'08.8"

### Moon at Greatest Eclipse (Geocentric Coordinates)

R.A. = 11h56m50.1s  
Dec. = -00°03'07.9"  
S.D. = 00°14'41.9"  
H.P. = 00°53'56.7"



### External/Internal Contacts of Penumbra

P1 = 08:39:57.4 UT  
P2 = 11:23:49.8 UT  
P3 = 11:55:53.9 UT  
P4 = 14:40:14.4 UT

### External/Internal Contacts of Umbra

U1 = 09:48:32.4 UT  
U2 = 09:54:33.7 UT  
U3 = 13:25:31.8 UT  
U4 = 13:31:33.8 UT

### Local Circumstances at Greatest Eclipse

Lat. = 20°39.3'S Sun Alt. = 65.9°  
Long. = 009°05.0'W Sun Azm. = 31.2°  
Path Width = 261.0 km Duration = 07m09.3s

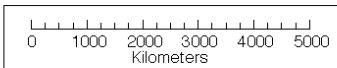
### Ephemeris & Constants

Eph. = Newcomb/ILE  
 $\Delta T = 65.0$  s  
k1 = 0.2724880  
k2 = 0.2722810  
 $\Delta b = 0.0''$   $\Delta l = 0.0''$

### Geocentric Libration (Optical + Physical)

l = -0.09°  
b = 0.48°  
c = 21.89°

Brown Lun. No. = 1036



F. Espenak, NASA's GSFC - Fri, Jul 2,  
[sunearth.gsfc.nasa.gov/eclipse/eclipse.html](http://sunearth.gsfc.nasa.gov/eclipse/eclipse.html)

## Annular Solar Eclipse of 2012 May 20

Geocentric Conjunction = 23:59:09.1 UT J.D. = 2456068.499411

Greatest Eclipse = 23:52:46.6 UT J.D. = 2456068.494984

Eclipse Magnitude = 0.9439 Gamma = 0.4827

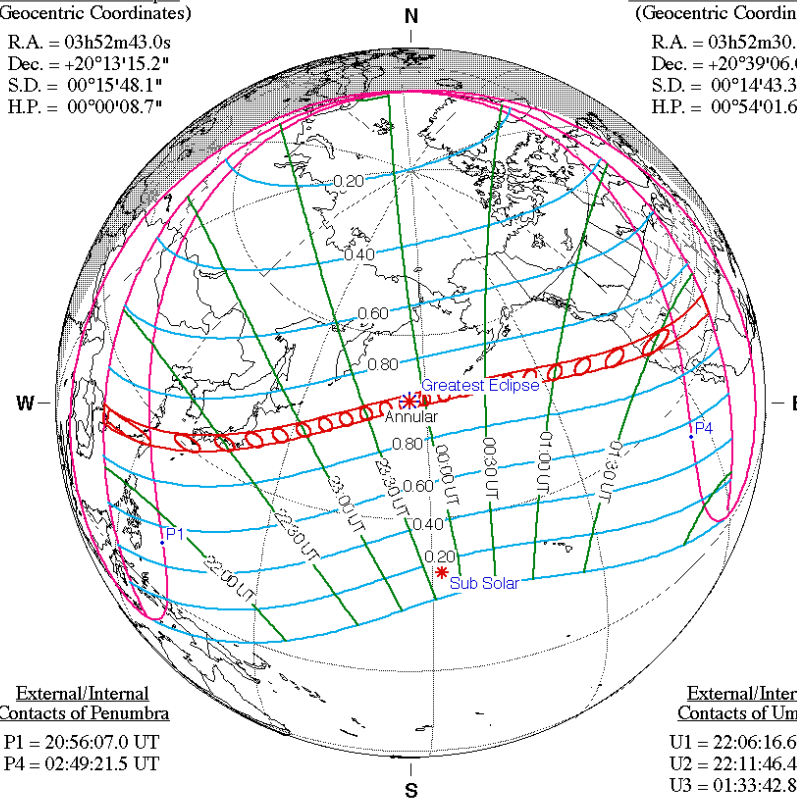
Saros Series = 128 Member = 58 of 73

### Sun at Greatest Eclipse (Geocentric Coordinates)

R.A. = 03h52m43.0s  
Dec. = +20°13'15.2"  
S.D. = 00°15'48.1"  
H.P. = 00°00'08.7"

### Moon at Greatest Eclipse (Geocentric Coordinates)

R.A. = 03h52m30.7s  
Dec. = +20°39'06.0"  
S.D. = 00°14'43.3"  
H.P. = 00°54'01.6"



### External/Internal Contacts of Penumbra

P1 = 20:56:07.0 UT  
P4 = 02:49:21.5 UT

### External/Internal Contacts of Umbra

U1 = 22:06:16.6 UT  
U2 = 22:11:46.4 UT  
U3 = 01:33:42.8 UT  
U4 = 01:39:11.2 UT

### Local Circumstances at Greatest Eclipse

Lat. = 49°05.3'N Sun Alt. = 60.9°  
Long. = 176°16.8'E Sun Azm. = 171.0°  
Path Width = 236.9 km Duration = 05m46.4s

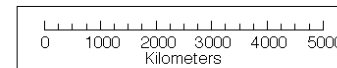
### Ephemeris & Constants

Eph. = Newcomb/ILE  
 $\Delta T = 69.0$  s  
k1 = 0.2724880  
k2 = 0.2722810  
 $\Delta b = 0.0''$   $\Delta l = 0.0''$

### Geocentric Libration (Optical + Physical)

l = -1.29°  
b = -0.58°  
c = -13.67°

Brown Lun. No. = 1106



F. Espenak, NASA's GSFC - Fri, Jul 2,  
[sunearth.gsfc.nasa.gov/eclipse/eclipse.html](http://sunearth.gsfc.nasa.gov/eclipse/eclipse.html)

# ASE 2006 French Guiana, Kourou





# ASE 2012 USA, Nevada, Overton, near Las Vegas



Photo Jan Bartos

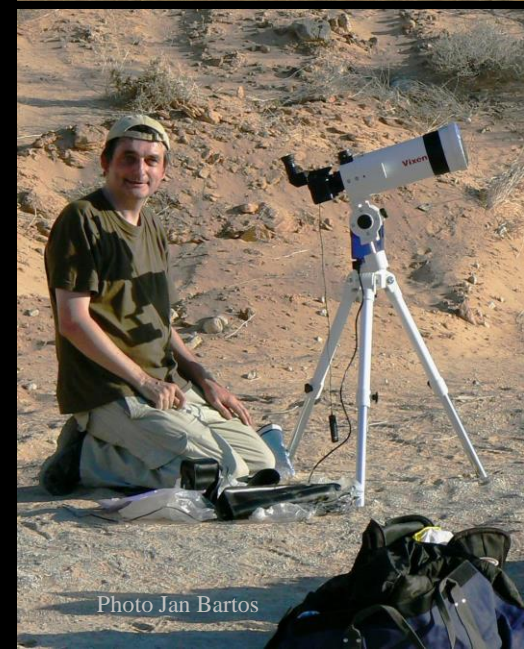


Photo Jan Bartos



ASE 2006 French Guiana, Kourou



ASE 2012 USA, Nevada, Overton



ASE 2012 USA, Nevada, Overton



## Total Solar Eclipse of 2001 Jun 21

Geocentric Conjunction = 11:57:53.7 UT J.D. = 2452081.998538  
 Greatest Eclipse = 12:03:45.9 UT J.D. = 2452082.002614  
 Eclipse Magnitude = 1.0495 Gamma = -0.5701

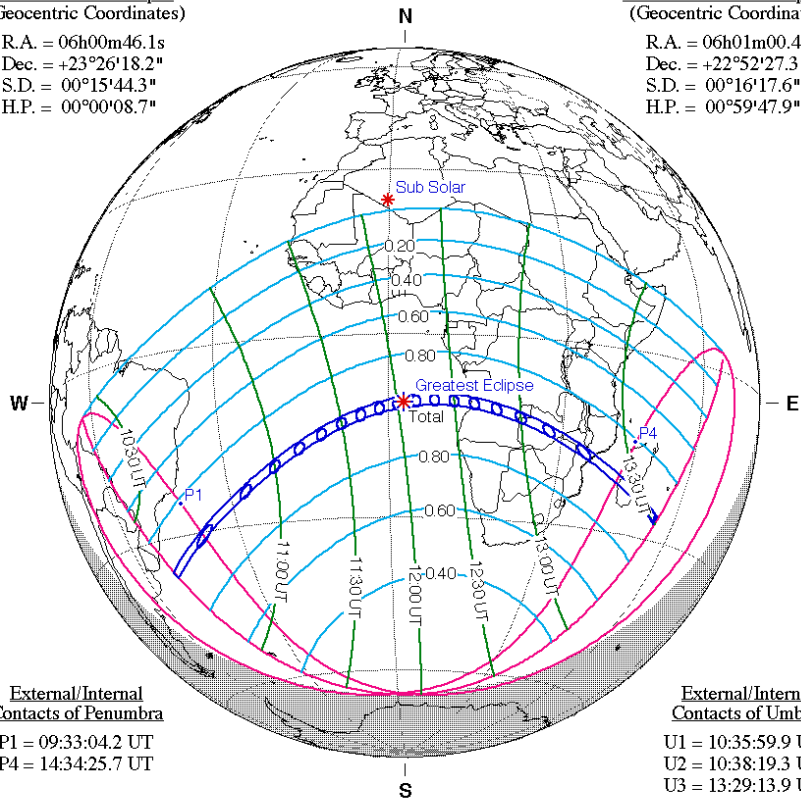
Saros Series = 127 Member = 57 of 82

### Sun at Greatest Eclipse (Geocentric Coordinates)

R.A. = 06h00m46.1s  
 Dec. = +23°26'18.2"  
 S.D. = 00°15'44.3"  
 H.P. = 00°00'08.7"

### Moon at Greatest Eclipse (Geocentric Coordinates)

R.A. = 06h01m00.4s  
 Dec. = +22°52'27.3"  
 S.D. = 00°16'17.6"  
 H.P. = 00°59'47.9"



### External/Internal Contacts of Penumbra

P1 = 09:33:04.2 UT  
 P4 = 14:34:25.7 UT

### External/Internal Contacts of Umbra

U1 = 10:35:59.9 UT  
 U2 = 10:38:19.3 UT  
 U3 = 13:29:13.9 UT  
 U4 = 13:31:37.5 UT

### Local Circumstances at Greatest Eclipse

Lat. = 11°15.1'S Sun Alt. = 55.2°  
 Long. = 002°43.7'E Sun Azm. = 354.8°  
 Path Width = 200.0 km Duration = 04m56.5s

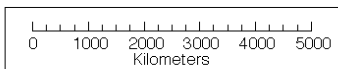
### Ephemeris & Constants

Eph. = Newcomb/ILE  
 $\Delta T = 64.2$  s  
 $k1 = 0.2724880$   
 $k2 = 0.2722810$   
 $\Delta b = 0.0'' \Delta l = 0.0''$

### Geocentric Libration (Optical + Physical)

$l = -3.83^\circ$   
 $b = 0.76^\circ$   
 $c = 1.61^\circ$

Brown Lun. No. = 971



F. Espenak, NASA's GSFC - Fri, Jul 2,  
[sunearth.gsfc.nasa.gov/eclipse/eclipse.html](http://sunearth.gsfc.nasa.gov/eclipse/eclipse.html)

## Hybrid Solar Eclipse of 2005 Apr 08

Geocentric Conjunction = 20:15:41.4 UT J.D. = 2453469.344230  
 Greatest Eclipse = 20:35:47.3 UT J.D. = 2453469.358186

Eclipse Magnitude = 1.0074 Gamma = -0.3473

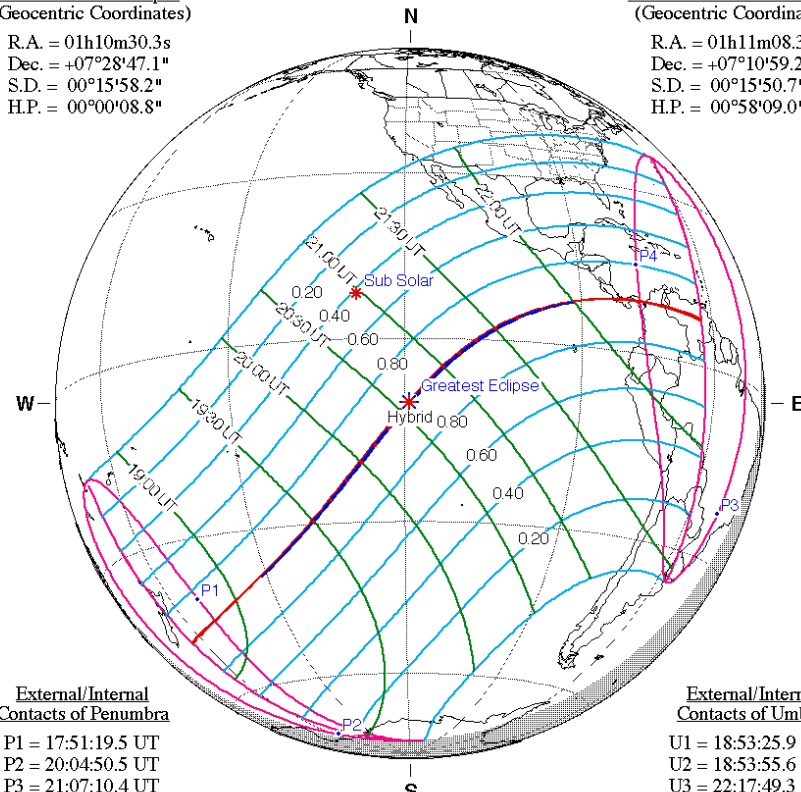
Saros Series = 129 Member = 51 of 80

### Sun at Greatest Eclipse (Geocentric Coordinates)

R.A. = 01h10m30.3s  
 Dec. = +07°28'47.1"  
 S.D. = 00°15'58.2"  
 H.P. = 00°00'08.8"

### Moon at Greatest Eclipse (Geocentric Coordinates)

R.A. = 01h11m08.3s  
 Dec. = +07°10'59.2"  
 S.D. = 00°15'50.7"  
 H.P. = 00°58'09.0"



### External/Internal Contacts of Penumbra

P1 = 17:51:19.5 UT  
 P2 = 20:04:50.5 UT  
 P3 = 21:07:10.4 UT  
 P4 = 23:20:28.9 UT

### External/Internal Contacts of Umbra

U1 = 18:53:25.9 UT  
 U2 = 18:53:55.6 UT  
 U3 = 22:17:49.3 UT  
 U4 = 22:18:24.4 UT

### Local Circumstances at Greatest Eclipse

Lat. = 10°33.9'S Sun Alt. = 69.6°  
 Long. = 118°59.6'W Sun Azm. = 331.9°  
 Path Width = 27.0 km Duration = 00m42.1s

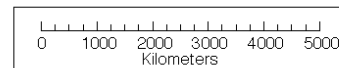
### Ephemeris & Constants

Eph. = Newcomb/ILE  
 $\Delta T = 64.8$  s  
 $k1 = 0.2724880$   
 $k2 = 0.2722810$   
 $\Delta b = 0.0'' \Delta l = 0.0''$

### Geocentric Libration (Optical + Physical)

$l = 4.71^\circ$   
 $b = 0.40^\circ$   
 $c = -20.73^\circ$

Brown Lun. No. = 1018



F. Espenak, NASA's GSFC - Fri, Jul 2,  
[sunearth.gsfc.nasa.gov/eclipse/eclipse.html](http://sunearth.gsfc.nasa.gov/eclipse/eclipse.html)

# TSE 2001 Zambia, North Kafue N.P.



21 6 2001  
15:05:55



21 6 2001  
15:06:07



21 6 2001  
15:06:14





# TSE 2001 Zambia, North Kafue N.P.

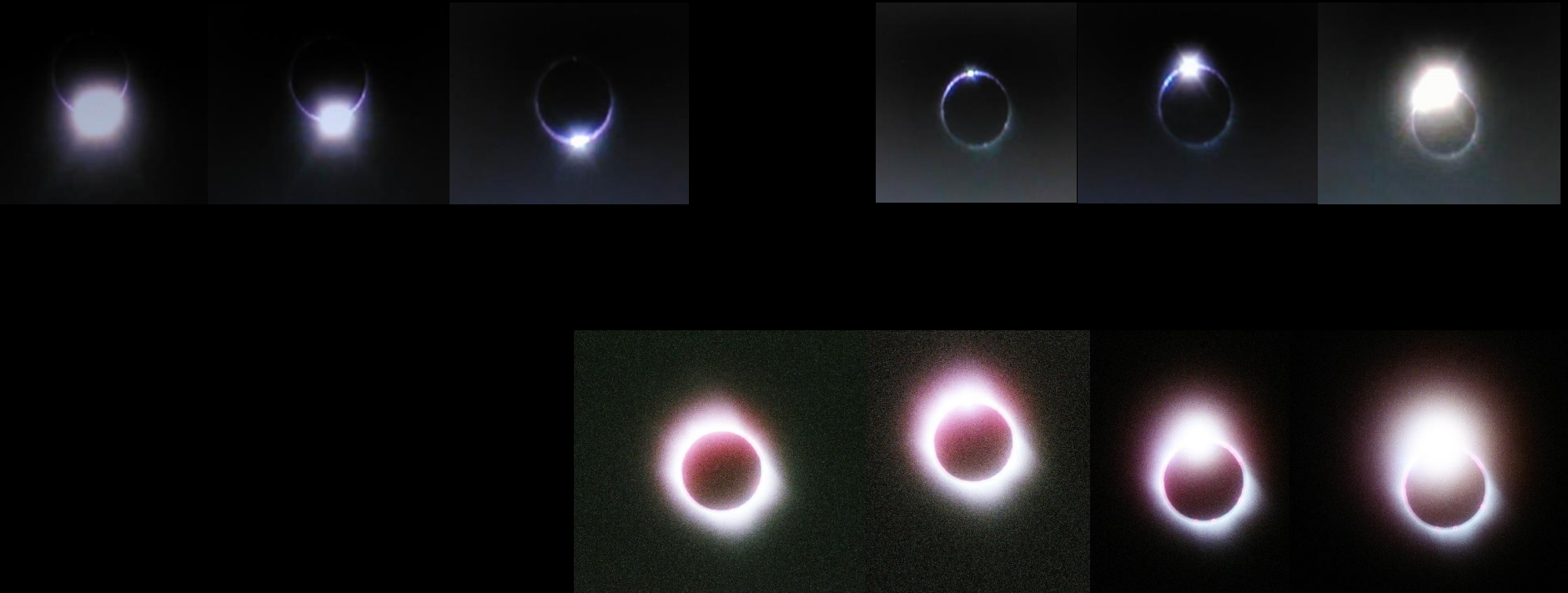


## HSE 2005 Pacific Ocean, near Pitcairn island





HSE 2005 Pacific Ocean, near Pitcairn island



# HSE 2005 Pacific Ocean, near Pitcairn island



## Total Solar Eclipse of 2006 Mar 29

Geocentric Conjunction = 10:33:21.8 UT J.D. = 2453823.939836  
 Greatest Eclipse = 10:11:22.1 UT J.D. = 2453823.924561

Eclipse Magnitude = 1.0515 Gamma = 0.3843

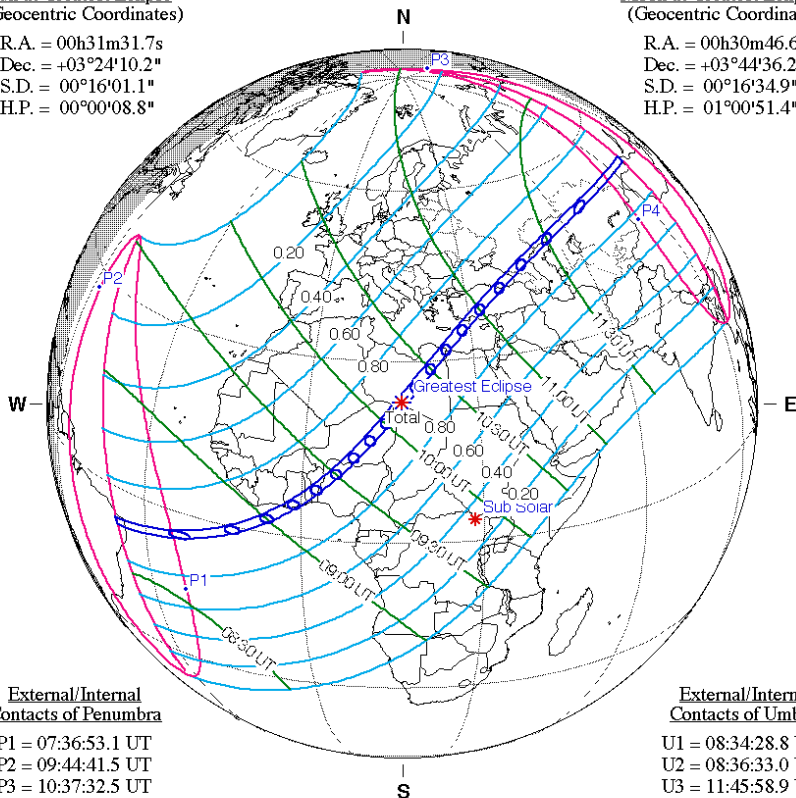
Saros Series = 139 Member = 29 of 71

### Sun at Greatest Eclipse (Geocentric Coordinates)

R.A. = 00h31m31.7s  
 Dec. = +03°24'10.2"  
 S.D. = 00°16'01.1"  
 H.P. = 00°00'08.8"

### Moon at Greatest Eclipse (Geocentric Coordinates)

R.A. = 00h30m46.6s  
 Dec. = +03°44'36.2"  
 S.D. = 00°16'34.9"  
 H.P. = 01°00'51.4"



### External/Internal Contacts of Penumbra

P1 = 07:36:53.1 UT  
 P2 = 09:44:41.5 UT  
 P3 = 10:37:32.5 UT  
 P4 = 12:45:44.8 UT

### External/Internal Contacts of Umbra

U1 = 08:34:28.8 UT  
 U2 = 08:36:33.0 UT  
 U3 = 11:45:58.9 UT  
 U4 = 11:48:00.8 UT

### Local Circumstances at Greatest Eclipse

Lat. = 23°09.2'N Sun Alt. = 67.3°  
 Long. = 016°43.7'E Sun Azm. = 148.6°

Path Width = 183.5 km Duration = 04m06.7s

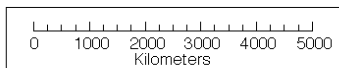
### Ephemeris & Constants

Eph. = Newcomb/ILE  
 $\Delta T = 64.9$  s  
 $k1 = 0.2724880$   
 $k2 = 0.2722810$   
 $\Delta b = 0.0'' \quad \Delta l = 0.0''$

### Geocentric Libration (Optical + Physical)

$l = 2.19^\circ$   
 $b = -0.52^\circ$   
 $c = -21.71^\circ$

Brown Lun. No. = 1030



F. Espenak, NASA's GSFC - Fri, Jul 2,  
[sunearth.gsfc.nasa.gov/eclipse/eclipse.html](http://sunearth.gsfc.nasa.gov/eclipse/eclipse.html)

## Total Solar Eclipse of 2008 Aug 01

Geocentric Conjunction = 09:47:22.9 UT J.D. = 2454679.907903  
 Greatest Eclipse = 10:21:08.1 UT J.D. = 2454679.931343

Eclipse Magnitude = 1.0394 Gamma = 0.8306

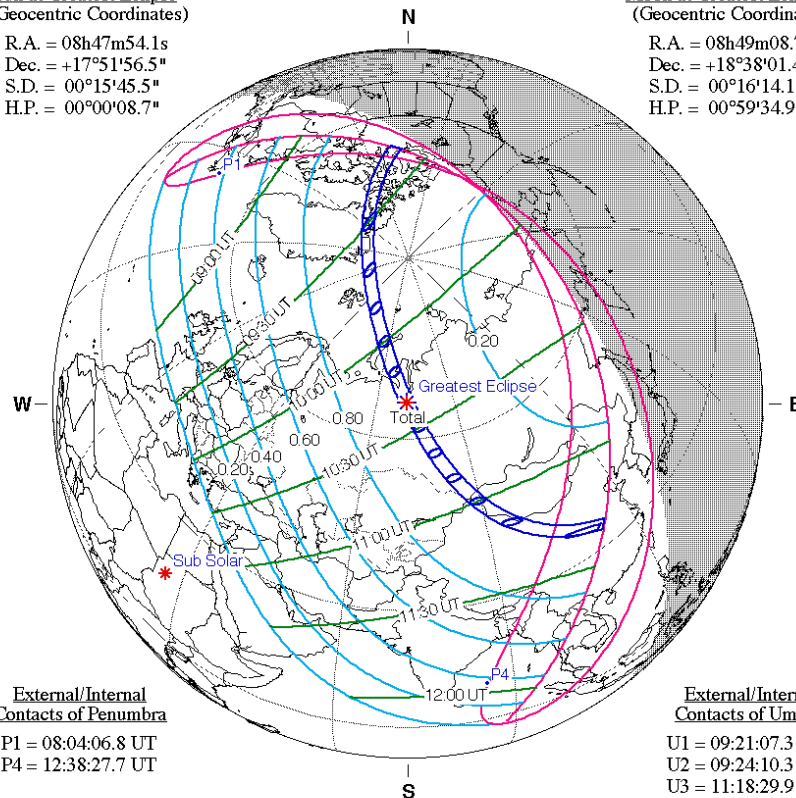
Saros Series = 126 Member = 47 of 72

### Sun at Greatest Eclipse (Geocentric Coordinates)

R.A. = 08h47m54.1s  
 Dec. = +17°51'56.5"  
 S.D. = 00°15'45.5"  
 H.P. = 00°00'08.7"

### Moon at Greatest Eclipse (Geocentric Coordinates)

R.A. = 08h49m08.7s  
 Dec. = +18°38'01.4"  
 S.D. = 00°16'14.1"  
 H.P. = 00°59'34.9"



### External/Internal Contacts of Penumbra

P1 = 08:04:06.8 UT  
 P4 = 12:38:27.7 UT

### External/Internal Contacts of Umbra

U1 = 09:21:07.3 UT  
 U2 = 09:24:10.3 UT  
 U3 = 11:18:29.9 UT  
 U4 = 11:21:28.0 UT

### Local Circumstances at Greatest Eclipse

Lat. = 65°38.8'N Sun Alt. = 33.5°  
 Long. = 072°16.4'E Sun Azm. = 235.2°

Path Width = 236.9 km Duration = 02m27.2s

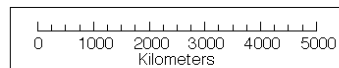
### Ephemeris & Constants

Eph. = Newcomb/ILE  
 $\Delta T = 65.4$  s  
 $k1 = 0.2724880$   
 $k2 = 0.2722810$   
 $\Delta b = 0.0'' \quad \Delta l = 0.0''$

### Geocentric Libration (Optical + Physical)

$l = 4.21^\circ$   
 $b = -1.03^\circ$   
 $c = 14.02^\circ$

Brown Lun. No. = 1059



F. Espenak, NASA's GSFC - Fri, Jul 2,  
[sunearth.gsfc.nasa.gov/eclipse/eclipse.html](http://sunearth.gsfc.nasa.gov/eclipse/eclipse.html)

# TSE 2006 Egypt, As Sallum



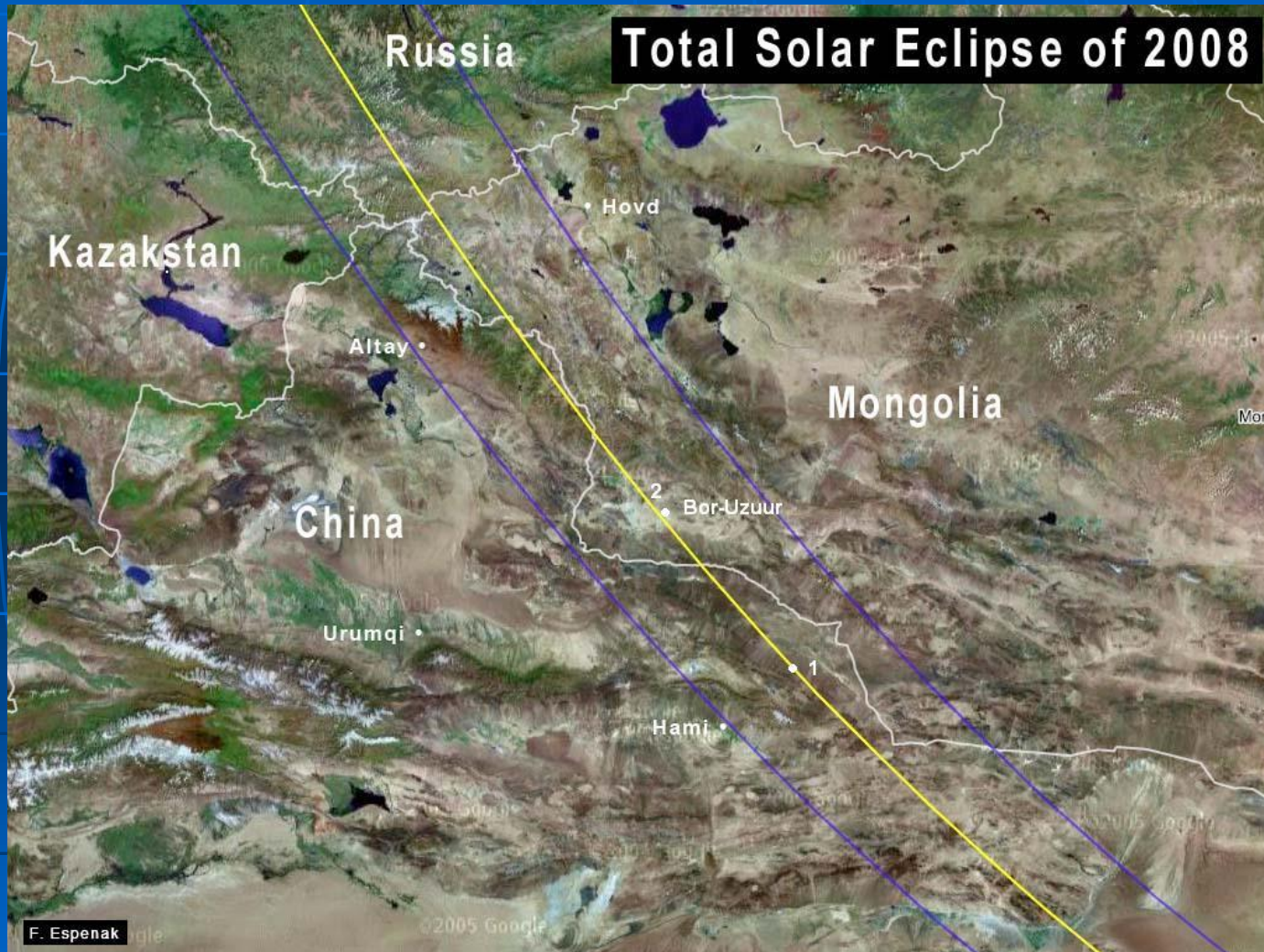
Canon EOS 350D, Sigma MF 600/8



# TSE 2006 Egypt, As Sallum



# TSE 2008 Mongolia



<http://eclipse.gsfc.nasa.gov/SEmono/TSE2008/TSE2008.html>



# TSE 2008 Mongolia, Bor-Uzuur



Photo © Miloslav Druckmüller



# TSE 2008 Mongolia, Bor-Uzuur





# TSE 2008 Mongolia, Bor-Uzuur



# TSE 2008 Mongolia, Bor-Uzuur





TSE 2008 Mongolia, Bor-Uzuur





# TSE 2008 Mongolia, Bor-Uzuur





# Ulaanbaatar Astronomical observatory (UAO)



## Total Solar Eclipse of 2009 Jul 22

Geocentric Conjunction = 02:33:04.4 UT J.D. = 2455034.606301  
 Greatest Eclipse = 02:35:21.1 UT J.D. = 2455034.607884

Eclipse Magnitude = 1.0799 Gamma = 0.0696

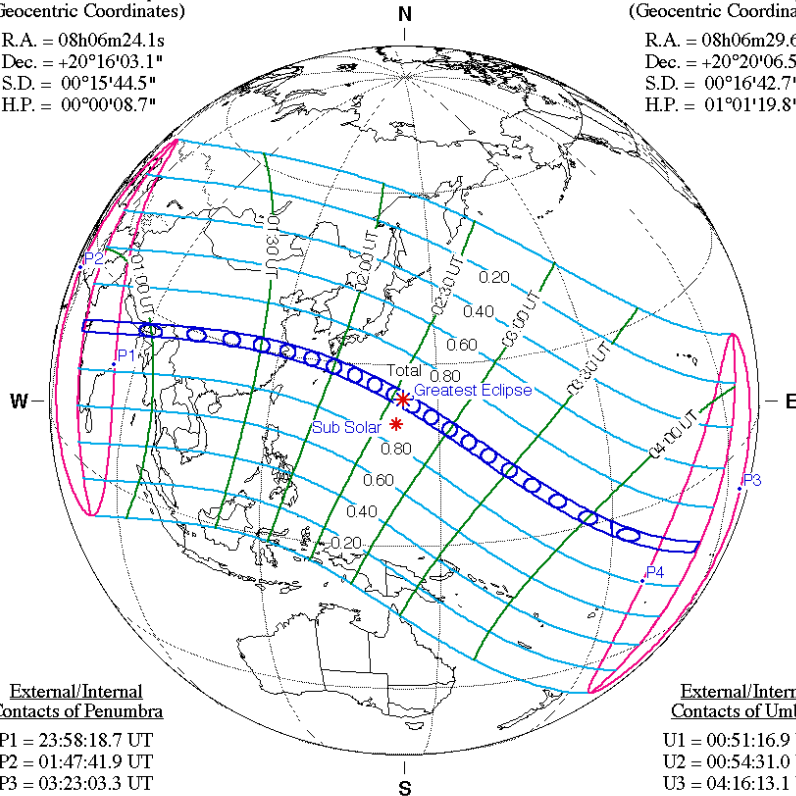
Saros Series = 136 Member = 37 of 71

### Sun at Greatest Eclipse (Geocentric Coordinates)

R.A. = 08h06m24.1s  
 Dec. = +20°16'03.1"  
 S.D. = 00°15'44.5"  
 H.P. = 00°00'08.7"

### Moon at Greatest Eclipse (Geocentric Coordinates)

R.A. = 08h06m29.6s  
 Dec. = +20°20'06.5"  
 S.D. = 00°16'42.7"  
 H.P. = 01°01'19.8"



### External/Internal Contacts of Penumbra

P1 = 23:58:18.7 UT  
 P2 = 01:47:41.9 UT  
 P3 = 03:23:03.3 UT  
 P4 = 05:12:25.1 UT

### External/Internal Contacts of Umbra

U1 = 00:51:16.9 UT  
 U2 = 00:54:31.0 UT  
 U3 = 04:16:13.1 UT  
 U4 = 04:19:26.5 UT

### Local Circumstances at Greatest Eclipse

Lat. = 24°12.6'N Sun Alt. = 85.9°  
 Long. = 144°06.4'E Sun Azm. = 197.6°  
 Path Width = 258.4 km Duration = 06m38.8s

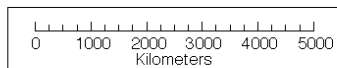
### Ephemeris & Constants

Eph. = Newcomb/ILE  
 $\Delta T = 66.2$  s  
 $k1 = 0.2724880$   
 $k2 = 0.2722810$   
 $\Delta b = 0.0'' \Delta l = 0.0''$

### Geocentric Libration (Optical + Physical)

$l = 0.66^\circ$   
 $b = -0.09^\circ$   
 $c = 10.53^\circ$

Brown Lun. No. = 1071



F. Espenak, NASA's GSFC - Fri, Jul 2,  
[sunearth.gsfc.nasa.gov/eclipse/eclipse.html](http://sunearth.gsfc.nasa.gov/eclipse/eclipse.html)

## Total Solar Eclipse of 2010 Jul 11

Geocentric Conjunction = 19:50:57.5 UT J.D. = 2455389.327055  
 Greatest Eclipse = 19:33:33.6 UT J.D. = 2455389.314973

Eclipse Magnitude = 1.0580 Gamma = -0.6789

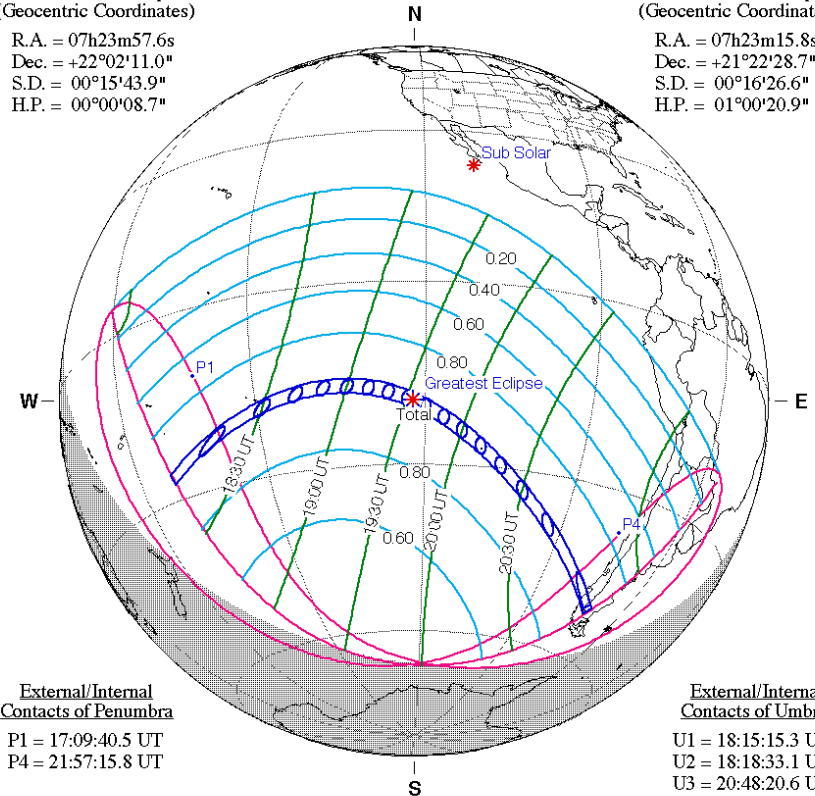
Saros Series = 146 Member = 27 of 76

### Sun at Greatest Eclipse (Geocentric Coordinates)

R.A. = 07h23m57.6s  
 Dec. = +22°02'11.0"  
 S.D. = 00°15'43.9"  
 H.P. = 00°00'08.7"

### Moon at Greatest Eclipse (Geocentric Coordinates)

R.A. = 07h23m15.8s  
 Dec. = +21°22'28.7"  
 S.D. = 00°16'26.6"  
 H.P. = 01°00'20.9"



### External/Internal Contacts of Penumbra

P1 = 17:09:40.5 UT  
 P4 = 21:57:15.8 UT

### External/Internal Contacts of Umbra

U1 = 18:15:15.3 UT  
 U2 = 18:18:33.1 UT  
 U3 = 20:48:20.6 UT  
 U4 = 20:51:42.2 UT

### Local Circumstances at Greatest Eclipse

Lat. = 19°45.7'S Sun Alt. = 47.1°  
 Long. = 121°52.9'W Sun Azm. = 13.5°  
 Path Width = 258.7 km Duration = 05m20.2s

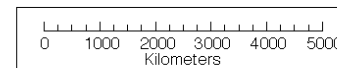
### Ephemeris & Constants

Eph. = Newcomb/ILE  
 $\Delta T = 67.1$  s  
 $k1 = 0.2724880$   
 $k2 = 0.2722810$   
 $\Delta b = 0.0'' \Delta l = 0.0''$

### Geocentric Libration (Optical + Physical)

$l = -3.24^\circ$   
 $b = 0.86^\circ$   
 $c = 6.62^\circ$

Brown Lun. No. = 1083



F. Espenak, NASA's GSFC - Fri, Jul 2,  
[sunearth.gsfc.nasa.gov/eclipse/eclipse.html](http://sunearth.gsfc.nasa.gov/eclipse/eclipse.html)

TSE 2009 China, Xianren Tancun, Yellow Mountain



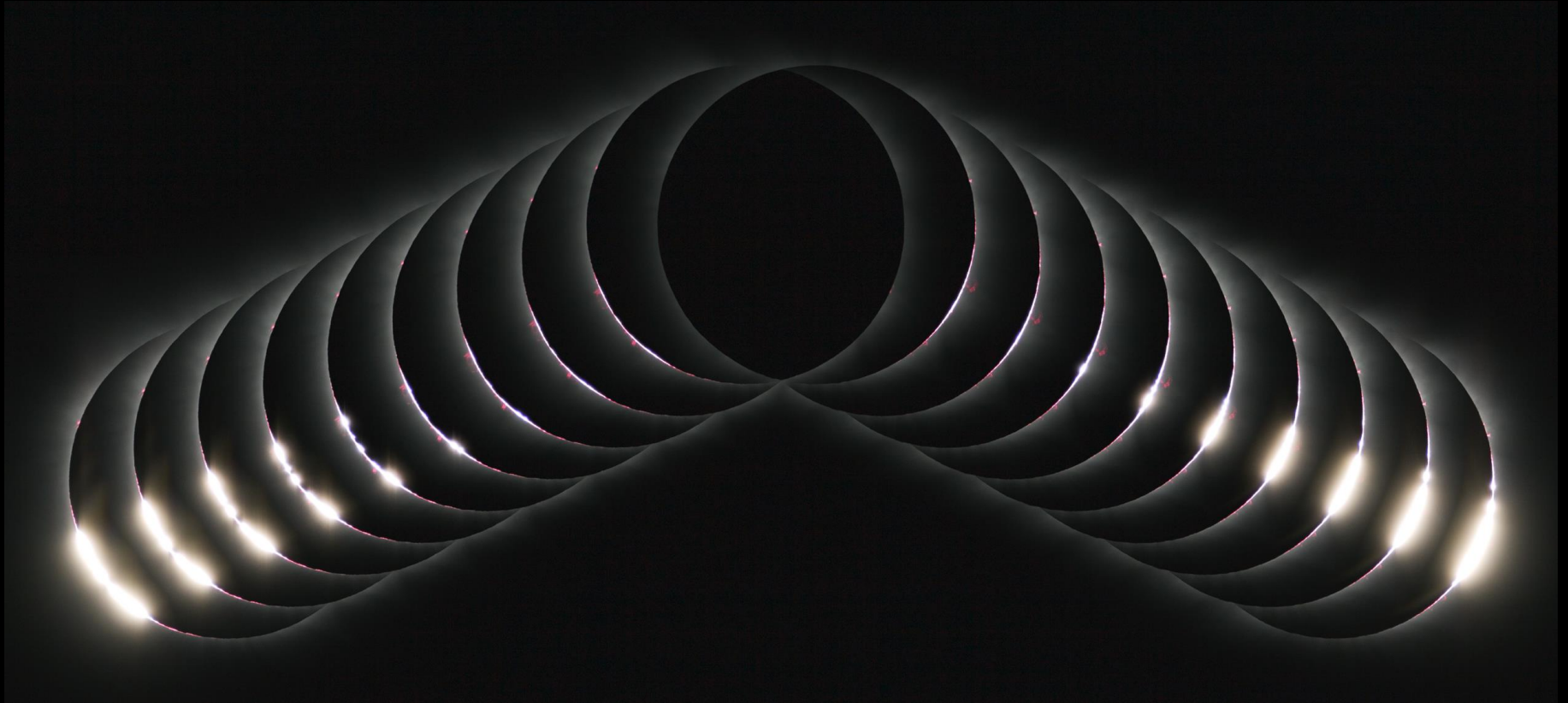


TSE 2009 China, Xianren Tancun / TSE 2010 French Polynesia, Hikueru



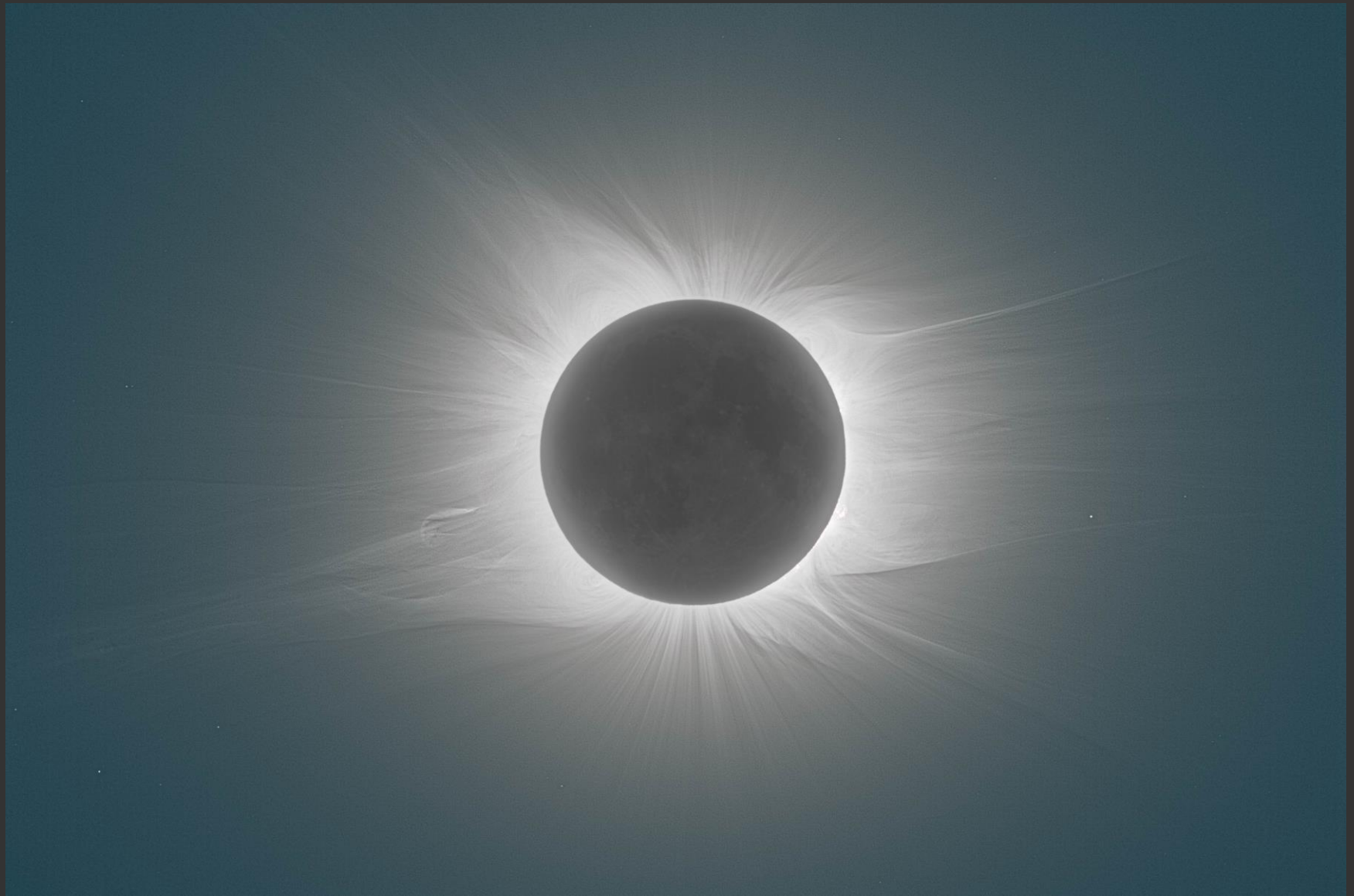


# TSE 2010 French Polynesia, Hao



Thomas Baader, Germany

# TSE 2010 French Polynesia, Hao



Thomas Baader, Germany

## Total Solar Eclipse of 2012 Nov 13

Geocentric Conjunction = 22:18:04.3 UT J.D. = 2456245.429217  
 Greatest Eclipse = 22:11:48.0 UT J.D. = 2456245.424861

Eclipse Magnitude = 1.0500 Gamma = -0.3718

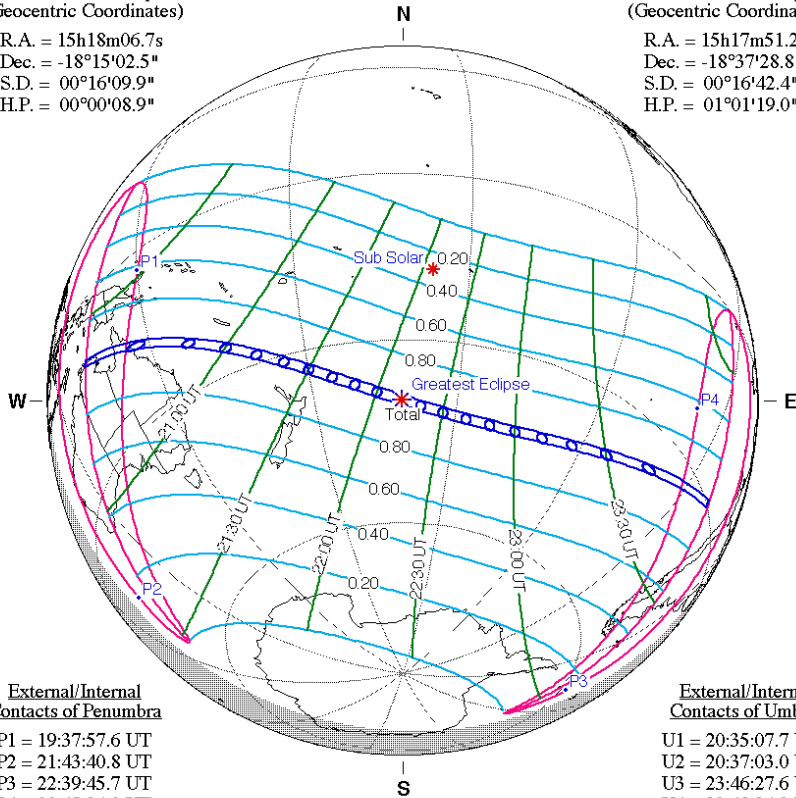
Saros Series = 133 Member = 45 of 72

### Sun at Greatest Eclipse (Geocentric Coordinates)

R.A. = 15h18m06.7s  
 Dec. = -18°15'02.5"  
 S.D. = 00°16'09.9"  
 H.P. = 00°00'08.9"

### Moon at Greatest Eclipse (Geocentric Coordinates)

R.A. = 15h17m51.2s  
 Dec. = -18°37'28.8"  
 S.D. = 00°16'42.4"  
 H.P. = 01°01'19.0"



### External/Internal Contacts of Penumra

P1 = 19:37:57.6 UT  
 P2 = 21:43:40.8 UT  
 P3 = 22:39:45.7 UT  
 P4 = 00:45:34.0 UT

### Local Circumstances at Greatest Eclipse

Lat. = 39°56.9'S Sun Alt. = 68.0°  
 Long. = 161°19.8'W Sun Azm. = 11.4°

### Ephemeris & Constants

Eph. = Newcomb/ILE  
 $\Delta T = 69.5$  s  
 $k1 = 0.2724880$   
 $k2 = 0.2722810$   
 $\Delta b = 0.0'' \Delta l = 0.0''$

Path Width = 178.9 km Duration = 04m02.2s

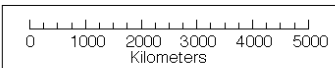
### External/Internal Contacts of Umbra

U1 = 20:35:07.7 UT  
 U2 = 20:37:03.0 UT  
 U3 = 23:46:27.6 UT  
 U4 = 23:48:24.2 UT

### Geocentric Libration (Optical + Physical)

$l = -1.00^\circ$   
 $b = 0.50^\circ$   
 $c = 16.49^\circ$

Brown Lun. No. = 1112



F. Espenak, NASA's GSFC - Fri, Jul 2,  
[sunearth.gsfc.nasa.gov/eclipse/eclipse.html](http://sunearth.gsfc.nasa.gov/eclipse/eclipse.html)

## Hybrid Solar Eclipse of 2013 Nov 03

Geocentric Conjunction = 12:38:46.1 UT J.D. = 2456600.026923  
 Greatest Eclipse = 12:46:28.3 UT J.D. = 2456600.032272

Eclipse Magnitude = 1.0159 Gamma = 0.3273

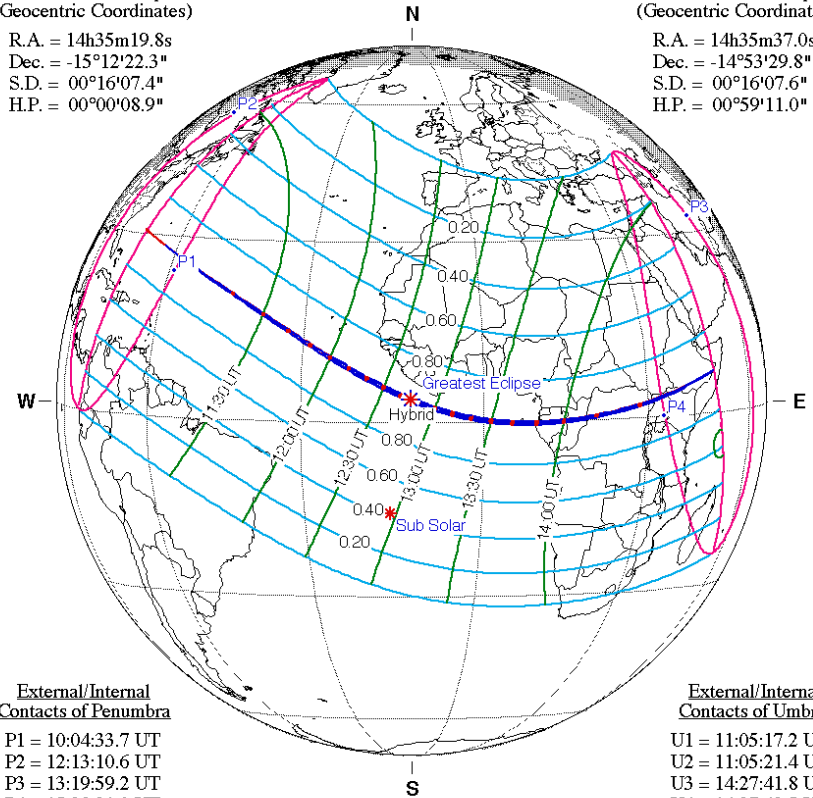
Saros Series = 143 Member = 23 of 72

### Sun at Greatest Eclipse (Geocentric Coordinates)

R.A. = 14h35m19.8s  
 Dec. = -15°12'22.3"  
 S.D. = 00°16'07.4"  
 H.P. = 00°00'08.9"

### Moon at Greatest Eclipse (Geocentric Coordinates)

R.A. = 14h35m37.0s  
 Dec. = -14°53'29.8"  
 S.D. = 00°16'07.6"  
 H.P. = 00°59'11.0"



### External/Internal Contacts of Penumra

P1 = 10:04:33.7 UT  
 P2 = 12:13:10.6 UT  
 P3 = 13:19:59.2 UT  
 P4 = 15:28:21.0 UT

### Local Circumstances at Greatest Eclipse

Lat. = 03°30.1'N Sun Alt. = 70.9°  
 Long. = 011°41.5'W Sun Azm. = 192.0°

### Ephemeris & Constants

Eph. = Newcomb/ILE  
 $\Delta T = 70.4$  s  
 $k1 = 0.2724880$   
 $k2 = 0.2722810$   
 $\Delta b = 0.0'' \Delta l = 0.0''$

Path Width = 57.5 km Duration = 01m39.6s

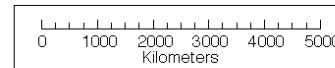
### External/Internal Contacts of Umbra

U1 = 11:05:17.2 UT  
 U2 = 11:05:21.4 UT  
 U3 = 14:27:41.8 UT  
 U4 = 14:27:42.5 UT

### Geocentric Libration (Optical + Physical)

$l = -4.22^\circ$   
 $b = -0.39^\circ$   
 $c = 19.55^\circ$

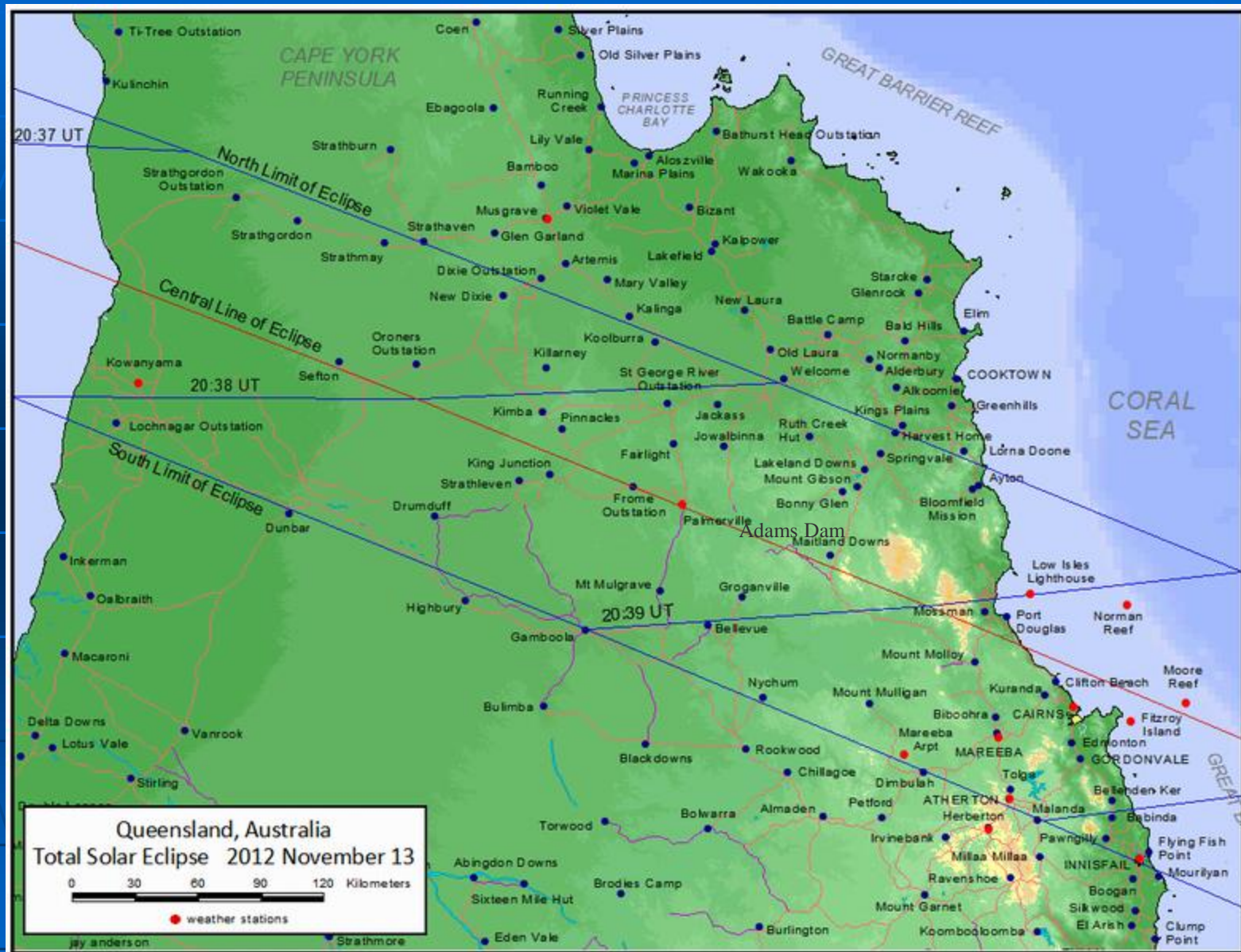
Brown Lun. No. = 1124



F. Espenak, NASA's GSFC - Fri, Jul 2,  
[sunearth.gsfc.nasa.gov/eclipse/eclipse.html](http://sunearth.gsfc.nasa.gov/eclipse/eclipse.html)



# TSE 2012





## TSE 2012 Australia

- Main destination – The photography to Solar Corona at tothality in different exposure time (1/2000s-2s) from paralactical mount (Jan Zahajsky) for later processing.
- 2 lences, 500/8, 1000/10
- Calibration, Dark frames, Flat fields etc.

# TSE 2012 Australia, Queensland, near Adams Dam

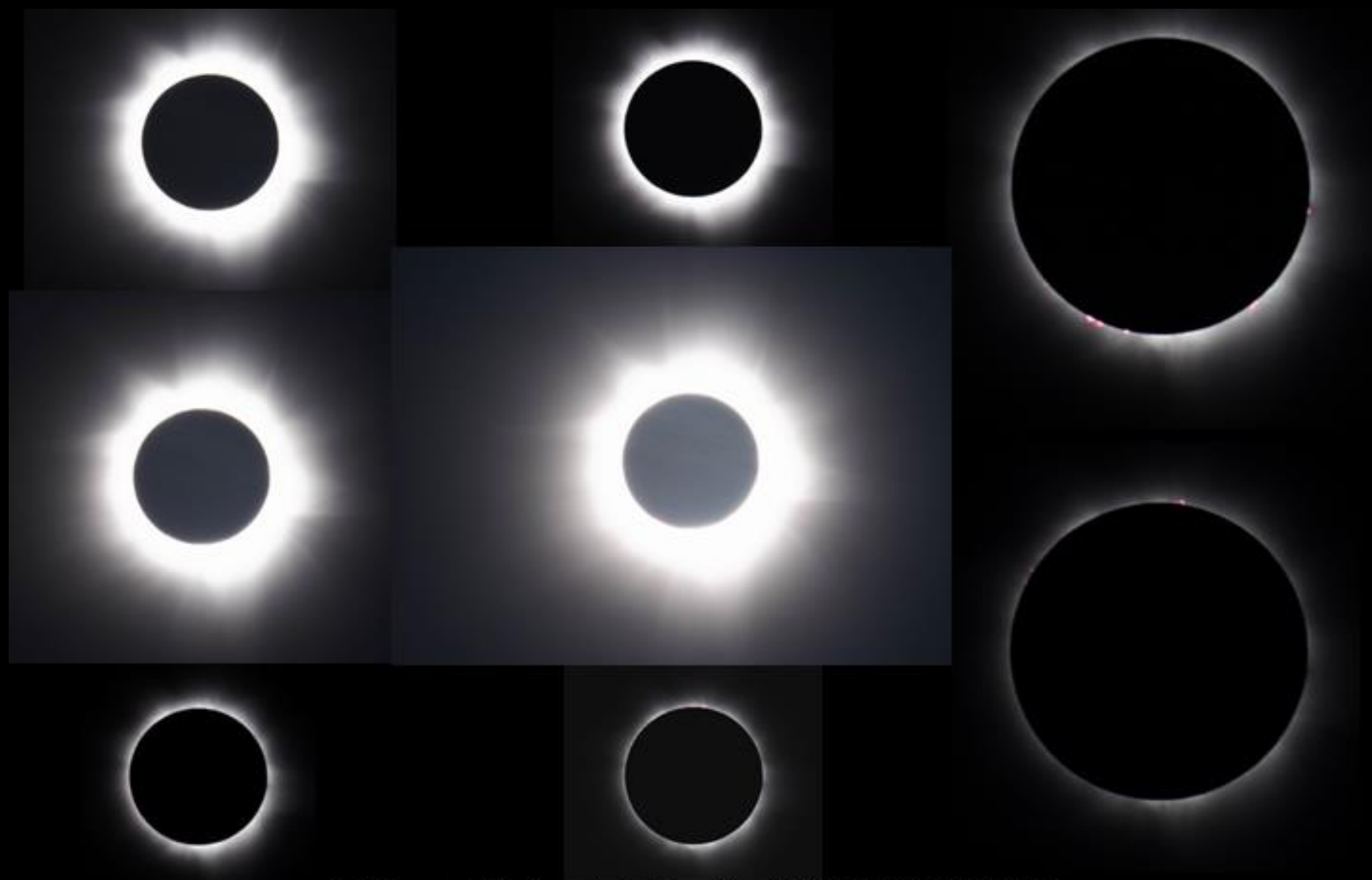




TSE 2012



# TSE 2012



Lokalita: Austrálie, Queensland, Adams Dam 13.11.2012 20:37 - 20:39 UTC

Fotoaparát: Canon EOS 350D

Objektiv: 3M-5A 500mm/ƒ8

Paralaktická montáž: Vixen Photo Guider GP2 - zapůjčil Jan Zahajský

© 2012 Jan Sládeček



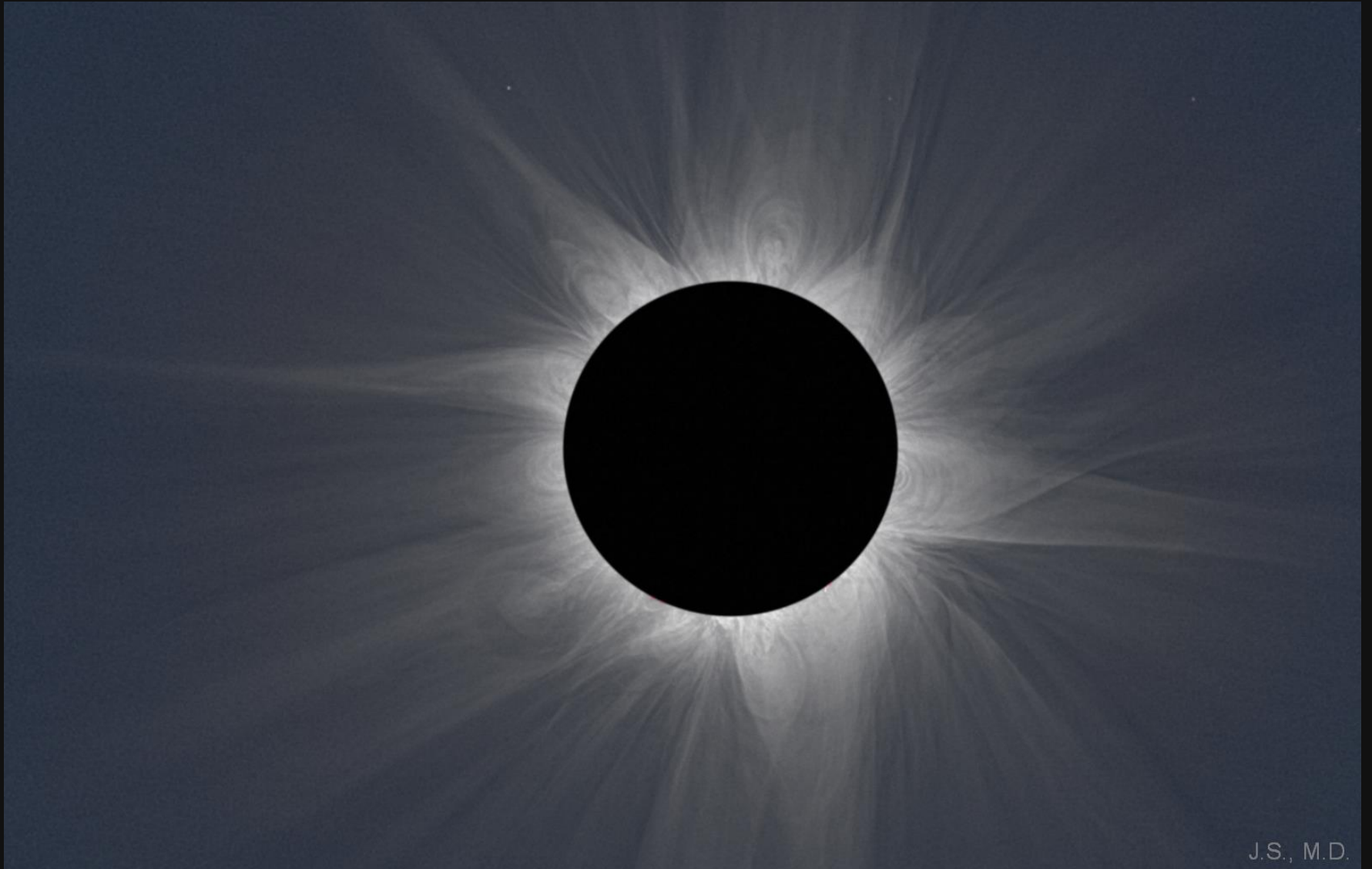
TSE 2012



TSE 2012



# TSE 2012



J.S., M.D.



# TSE 2012

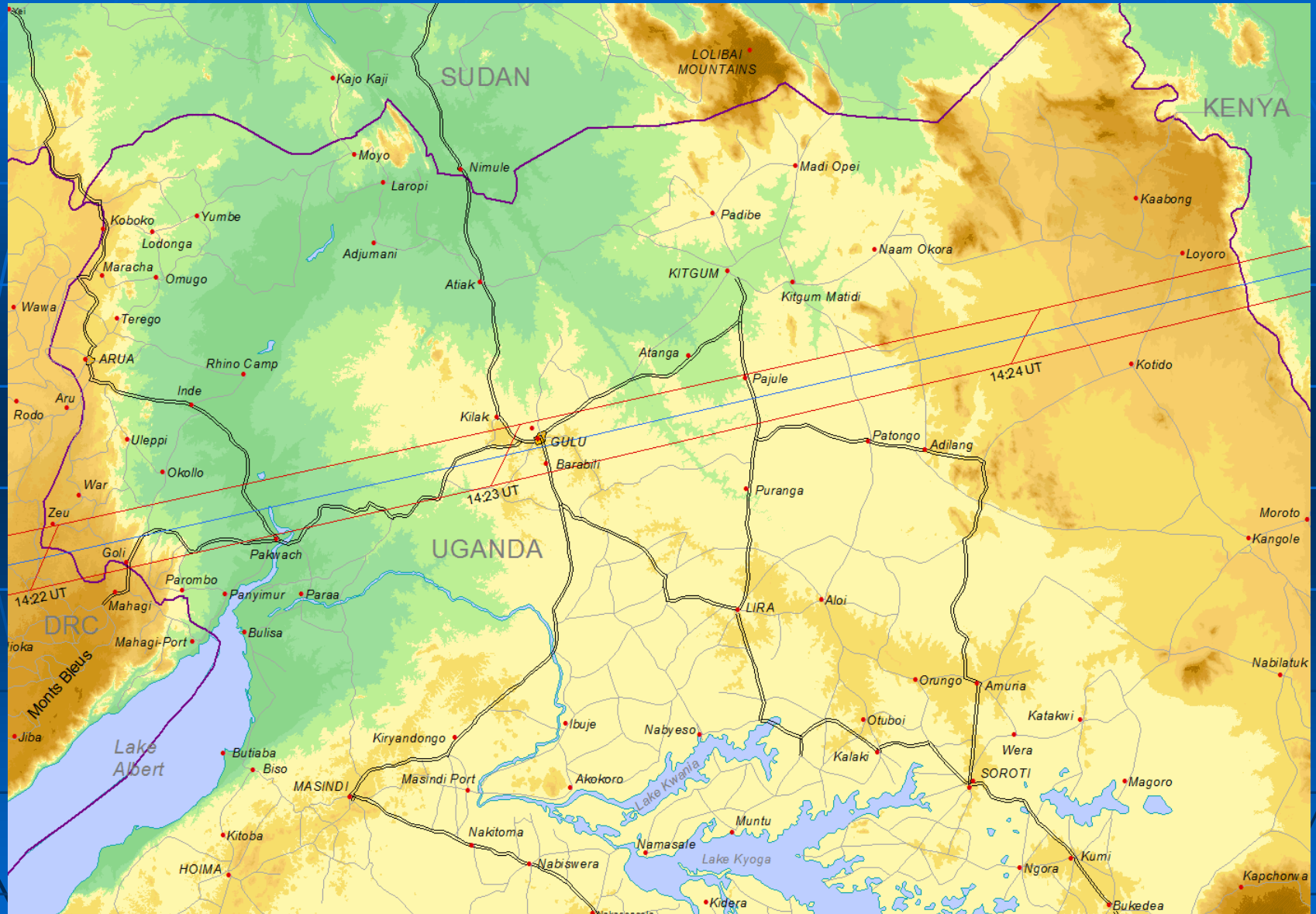


Total Solar Eclipse 2012

© 2012 Jan Sládeček © 2013 Miloslav Druckmüller

<http://www.zam.fme.vutbr.cz/~druck/Eclipse/Ecl2012a/0-info.htm>

# Totality of HSE 2014



# HSE 2013, Uganda, Pockwero





# HSE 2013, Uganda, Pockwero





# HSE 2013, Uganda, Pockwero



HSE 2013, Uganda, Pockwero





# Total phase of HSE 2013 Uganda



# Total phase of HSE 2013 Uganda



# Total phase of HSE 2013 Uganda





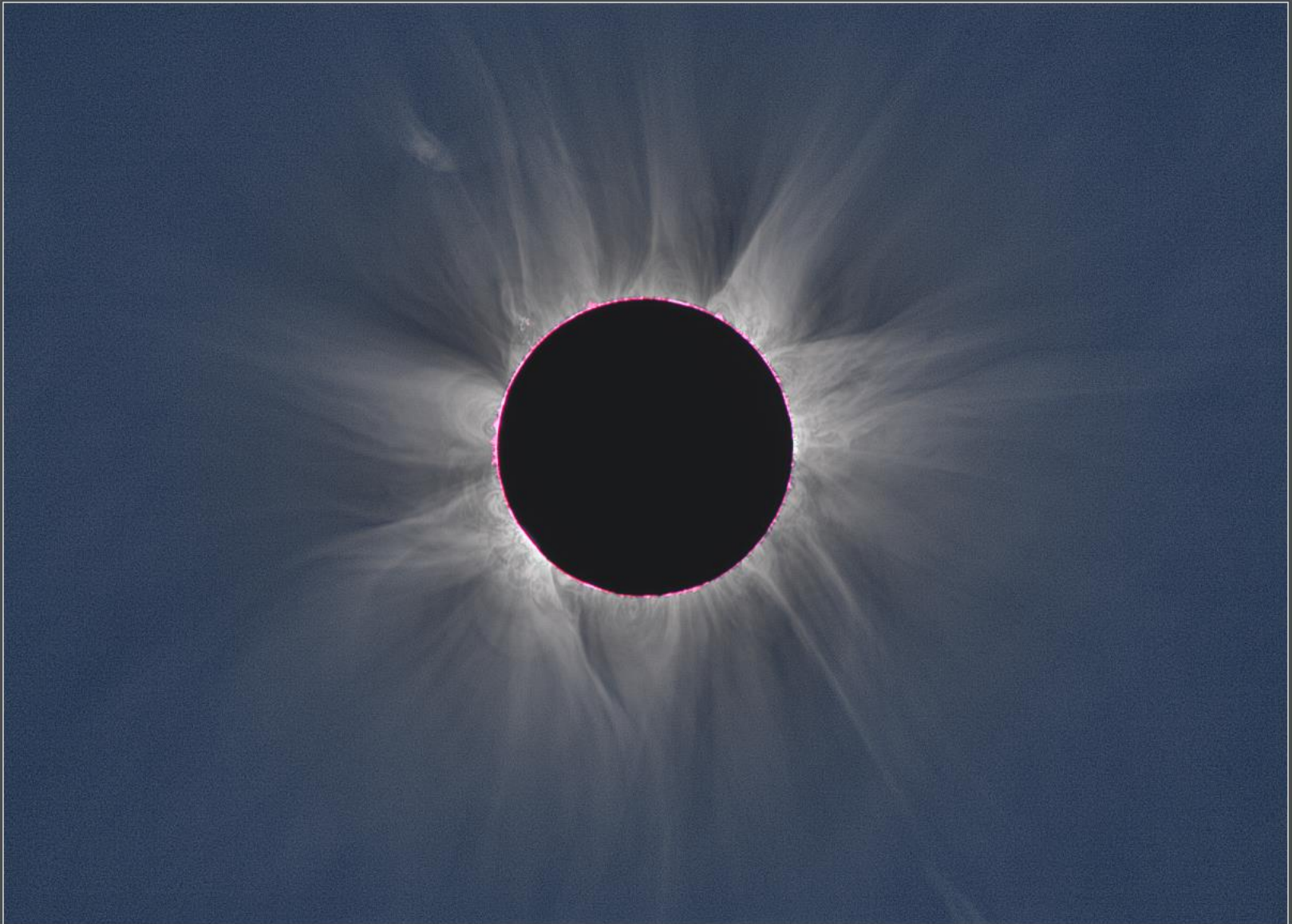
# Total phase of HSE 2013 Uganda



Petr Horalek

<http://www.astronom.cz/horalek/?cat=4>

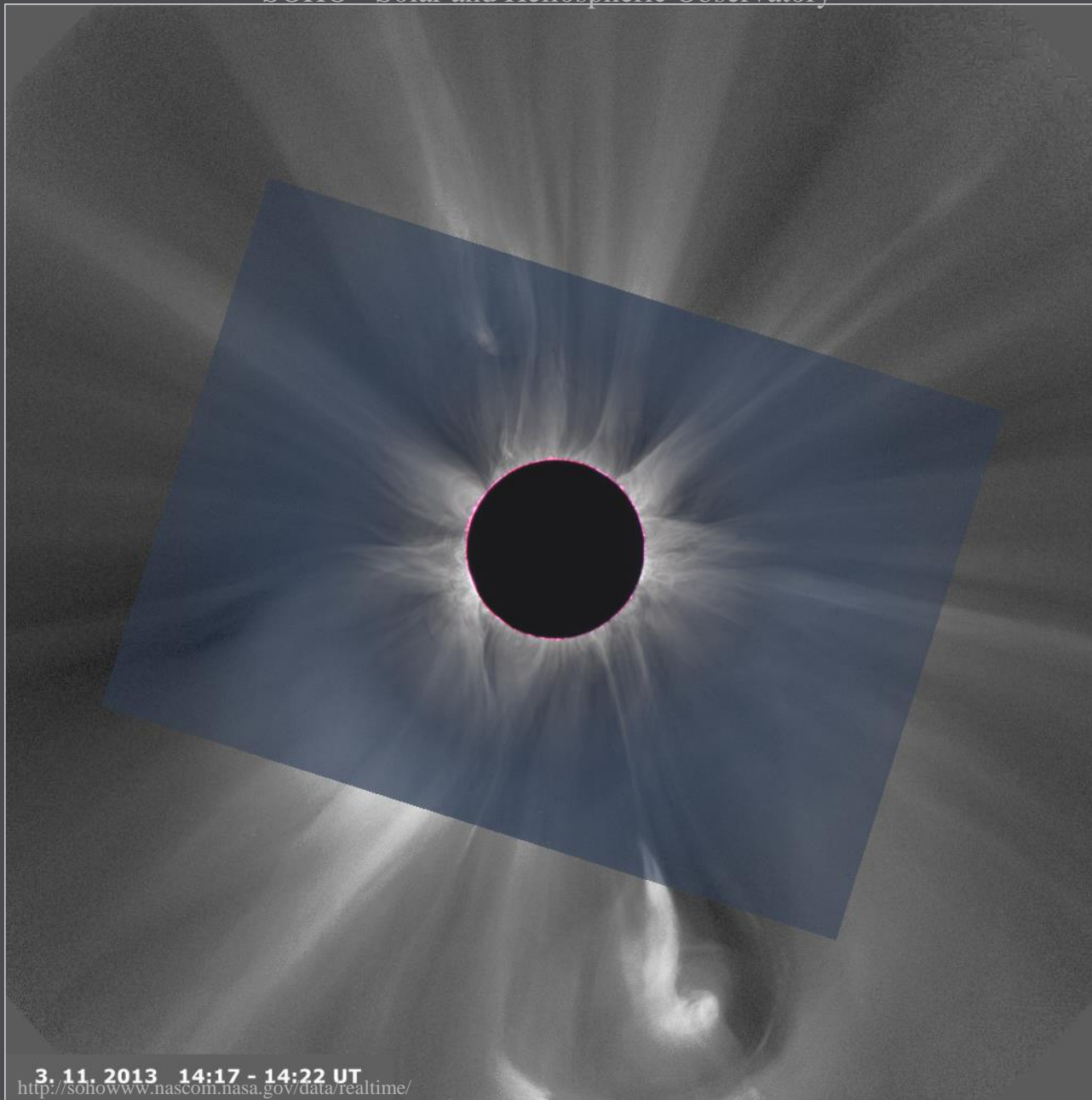
# Picture after procession, total phase of HSE 2013 Uganda



Total Solar Eclipse 2013

© 2013 *Úpice observatory, Petr Horálek, Jan Sládeček, Miloslav Druckmüller*

<http://www.zam.fme.vutbr.cz/~druck/Eclipse/Ecl2013u/0-info.htm>



**3. 11. 2013 14:17 - 14:22 UT**  
<http://sohowww.nascom.nasa.gov/data/realtime/>



# Total phase of HSE 2013 Uganda

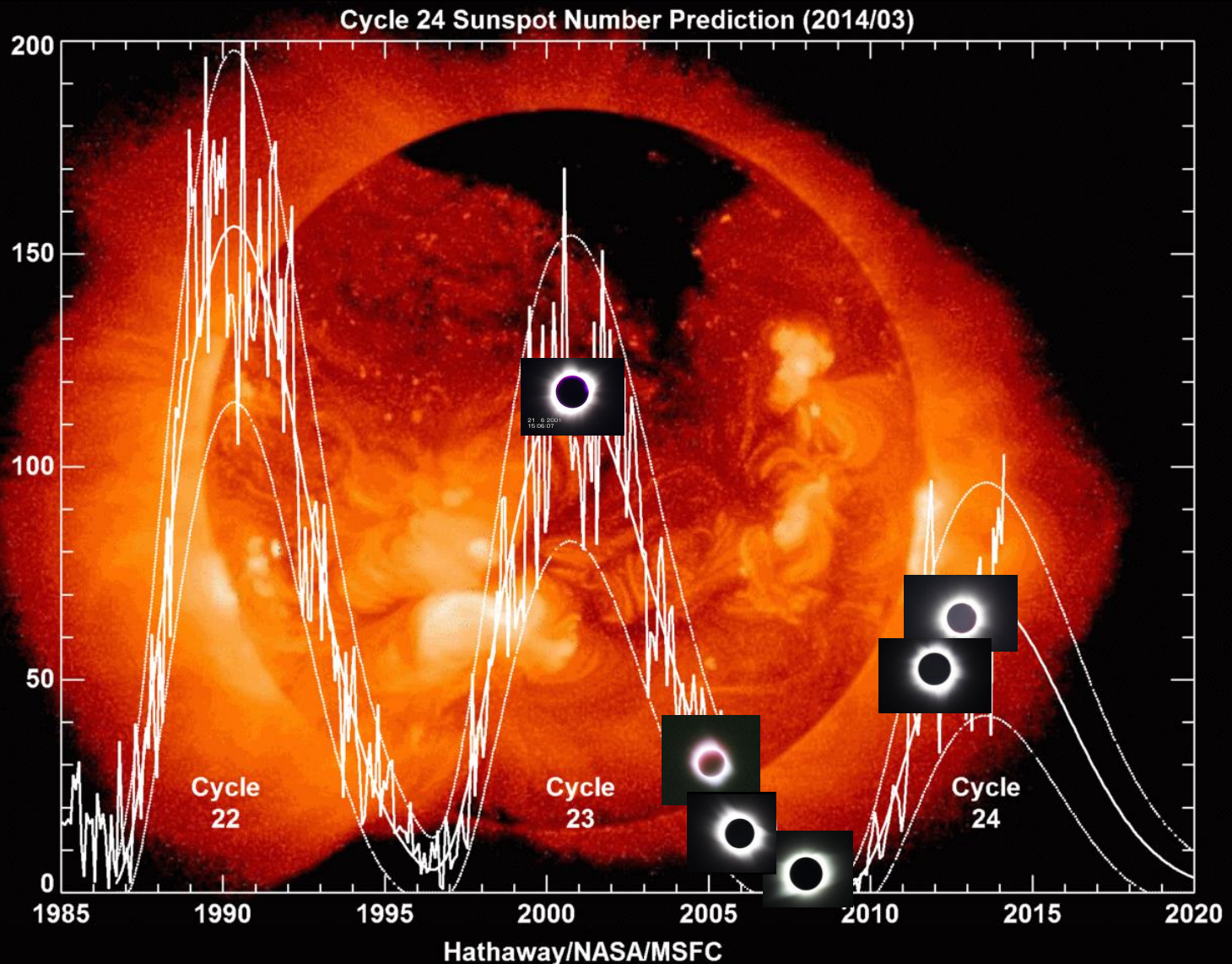


Petr Horalek

<http://www.astronom.cz/horalek/?cat=4>

## The solar cycle (solar magnetic activity Schwabe/Wolf cycle)

The periodic change in the Sun's activity and appearance (visible in changes in the number of sunspots, flares, and other visible manifestations). Solar cycles have an average duration of about 11 years.



Thank you for attention  
JS