

Recurring Space-Weather Events 2006/2007

Many space-weather events are recurrent and periodic in nature. *Sunspot* regions and *coronal holes* on the surface of the sun if long lived can lead to recurrent space weather effects on the earth. The sun's rotation, taking approximately 27 days, brings such regions into an earthward facing or "geo-effective" position over a 27 day period. This type of "recurrence" is used by space weather forecasters to predict the occurrence and severity of disturbances to the ionosphere many days or weeks in advance.

Over larger timescales, space weather phenomena associated with the orbits of planets and other galactic bodies are inherently recurrent due to the periodic nature of their orbits about the sun. Below is a list of predicted space-weather phenomena for 2006/2007 associated with the planets, meteorites and comets which are of particular interest.

Planetary Transits

A transit of Mercury occurred on **November 9 2006** and was observed in Australia by the IPS Culgoora Solar Observatory. Images of the Mercury transit are available on the IPS website at <http://www.ips.gov.au/Educational>

The next Planetary Transit is a transit of Venus occurring **June 6 2012**.

Lunar Eclipses

Two spectacular lunar eclipses will occur during 2007, both visible in Australian regions:

Date	Type	Places where Eclipse is visible
03 Mar 2007	Total	Americas, Africa, Asia, Australia and Europe.
28 Aug 2007	Total	Americas, Western Asia and Australia.

3 March 2007

The first of two total lunar eclipses is partially visible from all continents of the world. Parts of the eclipse will be visible from all bar the east coast of Australia. Observers in western parts of Australia will see the initial partial stages of the eclipse before the moon sets.

Penumbral Eclipse Begins: 20:18:11 UT
Partial Eclipse Begins: 21:30:22 UT
Total Eclipse Begins: 22:44:13 UT
Greatest Eclipse: 23:20:56 UT
Total Eclipse Ends: 23:57:37 UT
Partial Eclipse Ends: 01:11:28 UT
Penumbral Eclipse Ends: 02:23:44 UT

28 August 2007

The second total lunar eclipse of the year will be particularly spectacular in Australia. All phases of the eclipse are visible in south-eastern Australia.

Penumbral Eclipse Begins: 07:53:39 UT
Partial Eclipse Begins: 08:51:16 UT
Total Eclipse Begins: 09:52:22 UT
Greatest Eclipse: 10:37:22 UT
Total Eclipse Ends: 11:22:24 UT
Partial Eclipse Ends: 12:23:30 UT
Penumbral Eclipse Ends: 13:21:01 UT

Lunar eclipse times and maps indicating world-wide visibility (see below) are taken from the NASA Eclipse home page; <http://sunearth.gsfc.nasa.gov/eclipse/eclipse.html>.

Total Lunar Eclipse of 2007 Mar 03

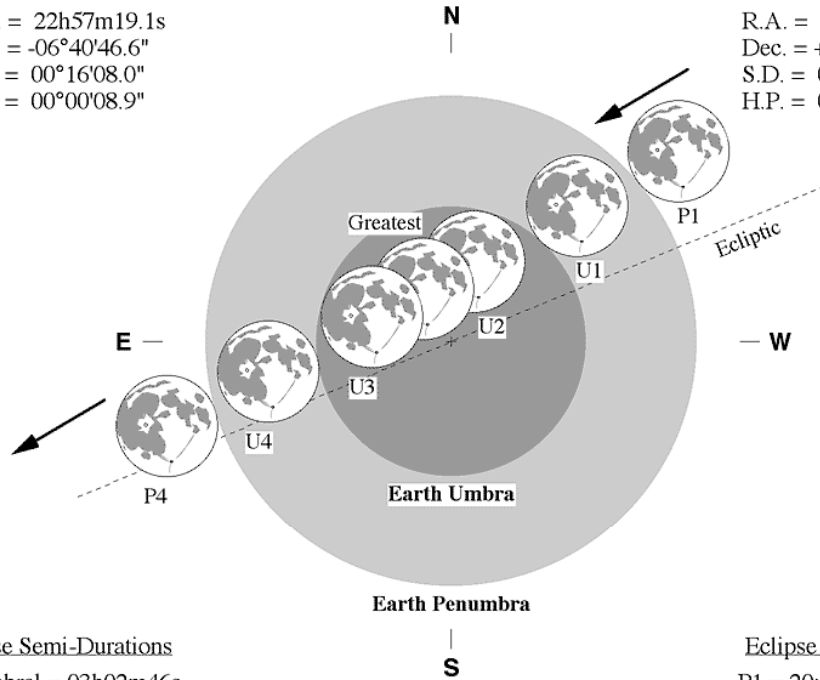
Geocentric Conjunction = 23:00:47.6 UT J.D. = 2454163.45888
 Greatest Eclipse = 23:20:55.8 UT J.D. = 2454163.47287
 Penumbral Magnitude = 2.3192 P. Radius = 1.1891° Gamma = 0.3174
 Umbral Magnitude = 1.2331 U. Radius = 0.6514° Axis = 0.2883°
 Saros Series = 123 Member = 52 of 73

Sun at Greatest Eclipse (Geocentric Coordinates)

R.A. = 22h57m19.1s
 Dec. = -06°40'46.6"
 S.D. = 00°16'08.0"
 H.P. = 00°00'08.9"

Moon at Greatest Eclipse (Geocentric Coordinates)

R.A. = 10h57m52.2s
 Dec. = +06°56'00.6"
 S.D. = 00°14'51.3"
 H.P. = 00°54'31.1"

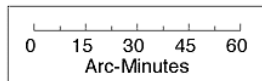


Eclipse Semi-Durations

Penumbral = 03h02m46s
 Umbral = 01h50m33s
 Total = 00h36m42s

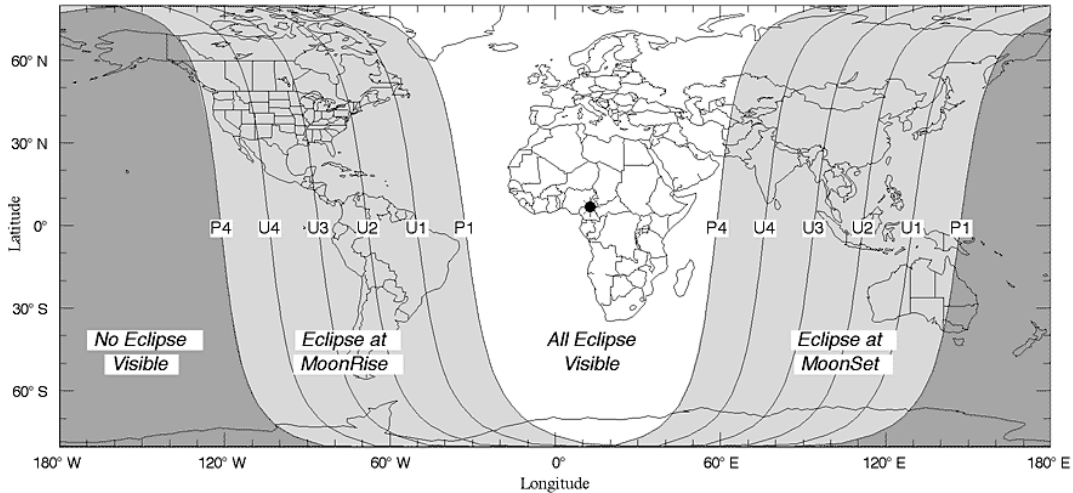
Eclipse Contacts

P1 = 20:18:11 UT
 U1 = 21:30:22 UT
 U2 = 22:44:13 UT
 U3 = 23:57:37 UT
 U4 = 01:11:28 UT
 P4 = 02:23:44 UT



Eph. = Newcomb/ILE
 Rule = CdT (Danjon)
 $\Delta T = 65.0$ s

F. Espenak, NASA's GSFC - 2006 Apr 20
<http://sunearth.gsfc.nasa.gov/eclipse/eclipse.html>



Total Lunar Eclipse of 2007 Aug 28

Geocentric Conjunction = 10:25:41.6 UT J.D. = 2454340.93451
 Greatest Eclipse = 10:37:22.3 UT J.D. = 2454340.94262

Penumbral Magnitude = 2.4528 P. Radius = 1.2677° Gamma = -0.2145
 Umbral Magnitude = 1.4760 U. Radius = 0.7400° Axis = 0.2126°

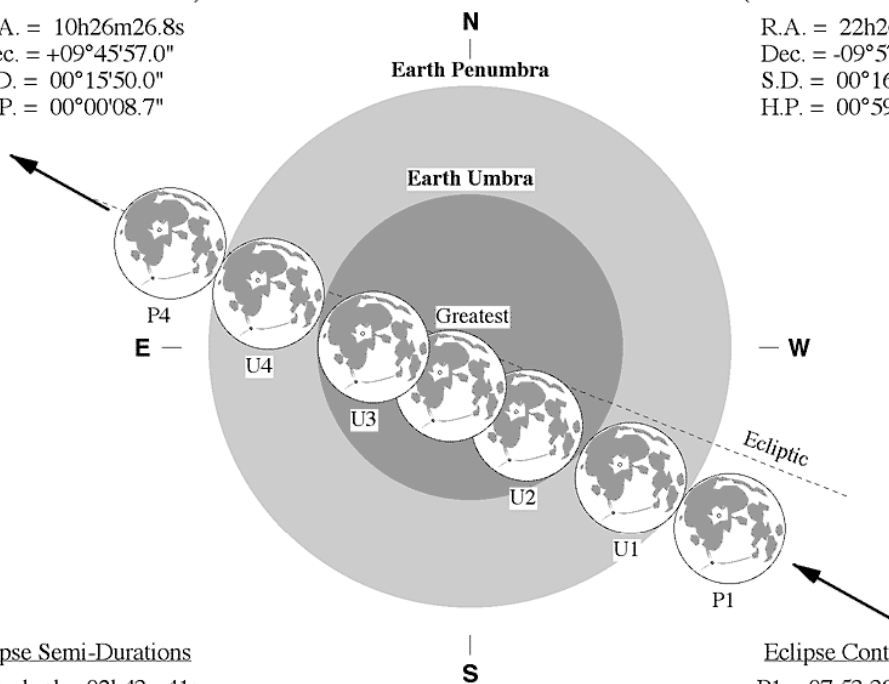
Saros Series = 128 Member = 40 of 71

Sun at Greatest Eclipse (Geocentric Coordinates)

R.A. = 10h26m26.8s
 Dec. = +09°45'57.0"
 S.D. = 00°15'50.0"
 H.P. = 00°00'08.7"

Moon at Greatest Eclipse (Geocentric Coordinates)

R.A. = 22h26m50.4s
 Dec. = -09°57'18.5"
 S.D. = 00°16'12.5"
 H.P. = 00°59'29.2"

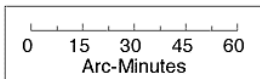


Eclipse Semi-Durations

Penumbral = 02h43m41s
 Umbral = 01h46m07s
 Total = 00h45m01s

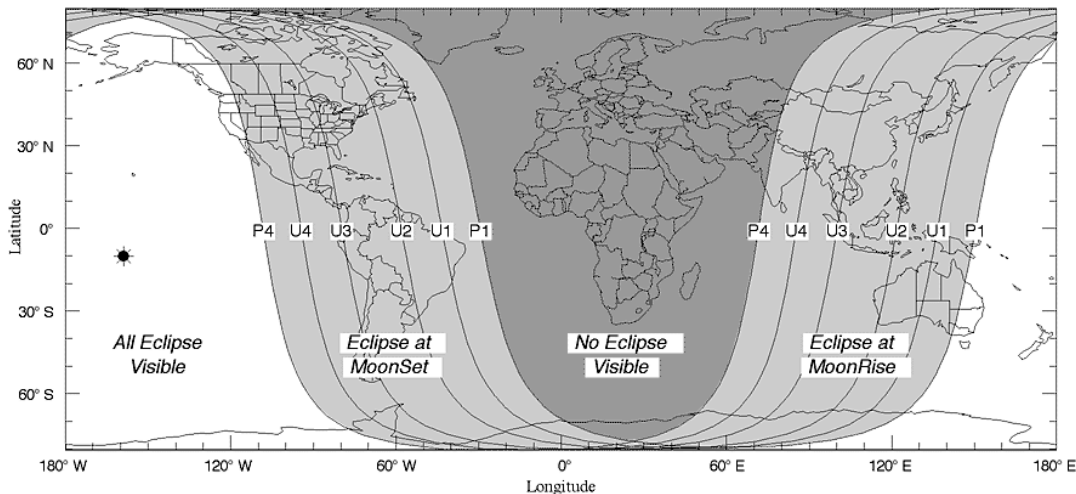
Eclipse Contacts

P1 = 07:53:39 UT
 U1 = 08:51:16 UT
 U2 = 09:52:22 UT
 U3 = 11:22:24 UT
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Meteor Showers

A meteor shower may occur when the Earth passes near the orbital path of a comet or an asteroid cluster. When the Earth intercepts a particle debris stream, the individual particles travel through the earth's atmosphere. Large frictional forces heat the particles and the surrounding atmosphere and a visible meteor is seen. The meteor typically is formed around 100 km altitude with few particles or meteoroids surviving below 80 km.

Below is a table showing key upcoming meteor shower events.

Month	Radiant	Duration	Maximum
Nov 2006	Leonids	13 – 20 Nov	17 Nov at 19:11 UT
Dec 2006	Geminids	07 – 17 Dec	14 Dec at 10:45 UT (\pm 2.3 hrs)
Apr 2007	Lyrids	16 – 25 Apr	22 April at 22:30 UT
May 2007	η - Aquarids	21 Apr – 12 May	6 May at ~ 12 UT
Oct 2007	Orionids	2 Oct – 7 Nov	21 Oct
Nov 2007	Leonids	10 – 23 Nov	18 Nov at 02:50 UT
Dec 2007	Geminids	7 Dec – 17 Dec	14 Dec at 16:45 UT (\pm 2.3 hrs)

Viewing Meteor Showers

Visibility of an active Meteor Shower in Australia depends on three things:

- 1) is it night in Australia at or close to the meteor shower “maximum”?
- 2) is the “radiant”, the region of the night sky where the meteor shower will occur, visible during night time hours?
- 3) is the moon visible, which would create a lot of light and poor viewing conditions?

The events listed in the table above all have the possibility of being viewed in Australian skies with **Orionids** 2007 and **Geminids** 2006 and 2007 offering the best prospects for spectacular viewing of a meteor shower.

Comments:

Geminids – Dec 2006

Maximum is expected somewhere between 8pm and midnight on 14 December. The radiant for this event rises around 10pm in the southern hemisphere. A waning crescent moon rises just before midnight in the west and just after midnight in the east. Around midnight in eastern regions offers the best viewing prospects for this event. Make yourself comfortable, point your feet towards the north-east and look low in the northern sky, about 45 degrees above the horizon.

Lyrids – Apr 2007

The Lyrids radiant, close to the Lyra constellation, rises just after midnight in the southern hemisphere and moves across the northern sky. The Lyrids meteor shower is best viewed after midnight on 22 April or well before sunrise on 23 April. Point your feet towards the northern sky and look about 45 degrees above the horizon. The moon sets shortly before Lyra rises, offering dark skies and great viewing prospects.

η - Aquarids – May 2007

Unfortunately, night skies will be badly moonlit during the maximum at around midnight, 5/6 May. Still worth a look.

Orionids – Oct 2007

Although the traditional Orionids maximum occurs on 21 October, an earlier sub-maximum is possible around 17-18 October, when observing conditions are particularly favourable. The radiant rises around midnight in Australia in the north-eastern sky between 17 and 21 October. On the 17th this is just as the moon is setting while on the 21st the moon sets a little later, after 2am. Well worth staying up late on 17, 18 and 21 October, preferably until after moonset. Best to lie with feet to the north and look well above the horizon.

Leonids – Nov 2007

In Australia the radiant rises soon after midnight in the north-eastern night sky. Although the maximum occurs during local daytime hours try early morning before sunrise on 18 November. Dark skies will be available at this time with the moon setting around midnight in all Australian regions.

Geminids – Dec 2007

The radiant appears around local midnight in the southern-hemisphere with a waxing crescent moon setting just before midnight in the east and well before midnight in the west. The best time for viewing in Australia is from around 1am, 14/15 December. Lie with your feet to the north-east and centre your gaze between 45 degrees above the horizon and straight up.

Sources: International Meteor Organisation, NASA, Geoscience Australia

IPS Link to information on recent Leonids meteor shower -

<http://www.ips.gov.au/Educational/4/1/5>

Other links for Meteor Showers -

<http://liftoff.msfc.nasa.gov/Academy/SPACE/SolarSystem/Meteors/Showers.html>

[NASA – Space Exploration, Educational]

<http://www.imo.net/> <http://www.imo.net/calendar/2007>

[International Meteor Organisation]

<http://www.ga.gov.au/geodesy/astro/moonrise.jsp>

<http://www.ga.gov.au/geodesy/astro/moonphases/moonphases.jsp>

[Geoscience Australia – moonrise/moonset times and moon phases]