TOTAL AND PARTIAL SOLAR AND LUNAR ECLIPSES Version 2.1 for iOS, Android and MAC OS By P.Massimino - © 2009-2019

Description

Moon Total Sol	ar Eclipses	Movie
•		
Date	02 Jul 20	019
Initial phase U.T.	18: 3.0	D
Longitude	160.1	
Latitude	-37.66	5
Final phase U.T.	20:44.	3
Longitude	57.44	
Latitude	-35.8	
MAXIMUM PHASE		
Duration	4.53 mi	n.
Width	201 km	1.
U.T.	19:23.9	9
Longitude	108.7	
Latitude	-17.4	
Path of the Umbra	L = (16 1 -	
Longitude	Latitude	
160.150	-37.660	
131.850	-24.110	
116.540	-18.180	Map
108.760	-17.400	
100.960	-17.970	
57.440	-22.000	Almanac
Notice: Negative longitude towards EAST of Greenwich		
	Partia	al eclipses

Total and Total-annular solar eclipses processed by the program are comprised between 1900 and 2100, exactly 287 eclipses from 28th May 1900 to 4th September 2100. Also partial solar eclipses are comprised: from February 5, 2000 up to October 24 2098. For Lunar eclipses read below.

The program gives the times in Universal Time (Greenwich time) of the Total Solar eclipses phases (initial, central

and final) and the geographical coordinates where it is possible to observe those circumstances of the eclipse. It also gives maximum duration and the width of the lunar umbra. The date is that of the initial phase of the eclipse. Below the label *Path of the Umbra* are listed Longitude and Latitude of seven points of the lunar umbra path on the Earth surface.

For the partial solar eclipses the program gives U.T. of the maximum phase, duration, magnitude and coordinates of the geographic point from where it is possible to see maximum phase.

The program offers these functions: *Earth Map*, *Movie* and *Map* (Google Map) visualization. The first allows seeing a few points of the path of the lunar umbra on Earth surface; the second creates an animation: the user will see the eclipse from one hour before up to one hour after its maximum phase with step of 2 minutes; the third function (present only in iOS environment) allows to visualize Google Map of the area around the point where the eclipse reaches the maximum.

Moreover it is possible to change geographical coordinates of the observer (see *Change Coordinates* section). This allows knowing if and how the eclipse will be seen from other points of the Earth surface (e.g. it is possible to know if the eclipse will be partial or it does not occur for those coordinates). The user interface supports both English and Italian language: automatically it will use device configuration.

Use of the program

DATE AND CIRCUMSTANCES OF THE SOLAR ECLIPSES

Horizontal scroll bar (see above figure) allows to change date (Im middle button for fast movement, left or right buttons for single step movement, *movie* button for see animation of selected eclipse,



left bottom icon to change observer geographical coordinates;



right bottom icon to see a digest part of this information.

central bottom icon to see a few points of the path of the lunar umbra on Earth surface. For partial eclipses just the point of the maximum phase.

MOVIE



They are displayed: the Universal Time (U.T. time of Greenwich meridian), the Local Time of the observer, the Right Ascension (R.A.) and Declination of the Sun and of the Moon. In the bottom middle of the blue square we have the Sun azimuth and in the right middle the Sun altitude above the horizon. All these data will change during the eclipse evolution. At the bottom of the screen we have five

buttons that have these functions: play be movie (when the evolution ended, the movie will play in reverse direction), pause the movie, change direction (rewind or forward).

Smaller buttons allow to see single step (of 2 minutes everyone) of the eclipse: \blacksquare for previous step and \blacktriangleright for next step. When the Sun is below the horizon its color will be gray.

Lunar and solar disk diameters are displayed proportionally. This means that it is possible to notice the difference between total and annular solar eclipses: when lunar disk is smaller than sun disk the eclipse will be annular.



Tap on one of the Longitude or Latitude coordinate components (degrees, arc minutes or arc seconds): the selected one will show its background in white color. Use buttons I to change its value (middle button for fast movements). East Longitude and South Latitude are towards the right of the screen.

Store coord button allows using the selected coordinates. These will be the new position of the observer. The program will store these values and they will be used when the user will observe other eclipses. Long Max Phase button will cancel this setting and will reset observer coordinates to the point, on Earth surface, from where it is possible to see maximum phase of the eclipse.

Back button will return to previous screen.

GPS button allows using internal smartphone GPS, or those offered from MAC OS, that will give local geographic coordinates.

Sometime, when the Moon and the Sun are enough near, you can observe celestial configuration also if the eclipse does not occur. In this case you will see to transit the Moon inside the blue square but it does not cross the solar disk. If from those coordinates the eclipse does not occur and the two disks are not near, the program will show a message.





It is displayed Earth surface and on it the path of the lunar umbra by small red circles (yellow circle represents the geographical site where the eclipse will reach the maximum); their coordinates are the same displayed in Date window, below Path of the Umbra. Right bottom icon
to back in the previous phase of the program. For partial solar eclipses a small red circle is displayed on the point from where it is possible

to see maximum phase.

Left bottom icon allows seeing a more detailed map of the event (see figure in the next page).

In this map we see the complete path of the lunar umbra on Earth surface and the areas from where it is possible to observe the eclipse as partial.



The icons at the bottom allow returning to the previous phases of the program.

Button that displays a range of years (e.g. 2008-2030) will allow obtaining a large image that is possible to scroll in any direction by using the finger. It will show all paths of the eclipses that it will possible to observe in that range of data.





Tapping on the white left areas of the image the program will return to previous page. Tapping on the white right areas of the image will change the map image: northern hemisphere image or southern hemisphere image.



Astronomical almanac

Back As	stroAlmanac 1998 - 2059
Year 2006	>
Year 2007	
Year 2008	*
Year 2009	
Year 2010	
Year 2011	
Year 2012	
Year 2013	
Year 2014	*

The program allows knowing the dates of main celestial events from 1998 up to 2059.

The button *Back* allows to return back to previous screen when the list shows the year 1998...

The list contains following events:

- Solar and lunar eclipses
- Elongation of Mercury and Venus
- Phases of the Moon
- Equinoxes and solstices
- Conjunction and opposition of the planets
- Transits of Mercury and Venus Mercury: 15/11/1999, 7/5/2003, 8/11/2006, 9/5/2016, 11/11/2019, 13/11/2032, 7/11/2039, 7/5/2049, 9/11/2052 Venus: 8/6/2004, 6/6/2012
- Date of the Easter

Lunar Eclipses



The program takes in account the lunar eclipses included between 1999 and 2030. For each eclipse we can see the main data of the event: initial, final and maximum phases, Moon position respect on both the ecliptic and the Earth surface, magnitude of the eclipse.

At the right bottom is displayed the Earth hemisphere from where

is possible to observe the eclipse.

To observe better the graphic representation of the lunar eclipse it is possible to tap on the *Tap here for* graphics button or *Click here for graphics* if you use the mouse.

In this way we will be able to see the areas both of the umbra (magenta circle) and of the penumbra (gray circle) that our planet projects on the sky. Remember: lunar eclipse occurs when the Earth is between the Sun and the Moon, on the same line.

The types of the lunar eclipse are: Total umbra, Total penumbral, Partial penumbral.

When the type of the eclipse is Total umbra or Total penumbral, the graphic will show three small Moons: on the right we have the first contact of the Moon with the umbra (*Moon enters umbra*), on the center we have maximum phase of the eclipse, on the left the last contact of the Moon with the umbra (*Moon leaves umbra*). In the other cases it will be only displayed a small Moon, at the moment of the maximum phase of the eclipse.

Program developed by P.Massimino (C) 2009-2019 by using CoronaLabs

e-mail: pmaxim@gmail.com