Discovery Space
Newsletter
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INDEX

1. The Sun
2. Motion of the Moon and Earth
3. The what, why, how and when of Solar Eclipses
   3.1 Why the phenomenon has the term 'Solar Eclipse'
   3.2 What are the types of Solar Eclipses
   3.3 When do we have a total eclipse and when an annular one
   3.4 What is the duration of a total solar eclipse?
   3.5 What is the frequency of Solar Eclipses
4. Did you know that:
   4.1 There are two parts of the Moons' Shadows?
   4.2 One may predict other eclipses?
5. Past, Present and Future of Solar Eclipse
   5.1 Historical Solar Eclipses
   5.2 Present of Solar Eclipse: The Solar Eclipse of 29th of March 2006
   5.3 Future Solar Eclipses
6. Solar Eclipses and Eyes' protection
   6.1 Observing a Solar Eclipse
   6.2 Totality during total eclipses
7. News
   7.1 The SkyWatch 2006 Contest is now open!
   7.2 DSpace Dissemination workshop at Ampelakia, Larissa, 1st April 2006
8. Editorial

Dear DSpacers,

It is a more than a perfect circumstance that the 3rd DSpace Newsletter comes out following the Total Solar Eclipse of the 29th of March. The DSpace team presents, in the current issue, moments from the on –site observation of the Total Solar Eclipse from Kastelorizo and the broadcasting of the phenomenon via Discovery Space site (www.discoveryspace.net). Be also informed about the what, why, when and how of solar eclipses, and the past and future of solar eclipses as well.
Find out the specifics about the Sky Watch 2006 contest organized by DSpace team .
We hope that you have already enjoyed the Total Solar Eclipse and that we will meet some of you at CERN on June where the award ceremony for the Sky Watch 2006 contest will take place!
In the mean time let's Discover-y Space!

Editor of the DSpace Newsletter
Anna K. Touloumakos

1. The Sun

The Sun is the center and source of life in our solar system. The Sun is about 5 billion years old and is about halfway through its main sequence evolution, during which nuclear fusion reactions in its core fuse hydrogen into helium. About 74% of the Sun's mass is hydrogen, 25% is helium, and the rest is made up of trace quantities of heavier elements (oxygen, carbon, iron, neon, nitrogen, silicon, magnesium, sulfur).
It is comprised by the core, the radiation zone (solar material from .2 to .7 solar radii, dense enough that thermal radiation is sufficient to transfer the intense heat of the core outward), the convection zone (material from .7 to 1.0 solar radii, not dense enough to transfer heat outward), the photosphere (the visible surface of the Sun, the layer below which the Sun becomes opaque to visible light) and the atmosphere (parts of the Sun below photosphere). The latter is comprised by temperature minimum, the chromosphere, the transition region, the corona, and the heliosphere. One of the most famous and spectacular natural phenomena one can witness is Solar Eclipse and revolves Sun and the motion between Moon and Earth.

2. Motion of the Moon and Earth

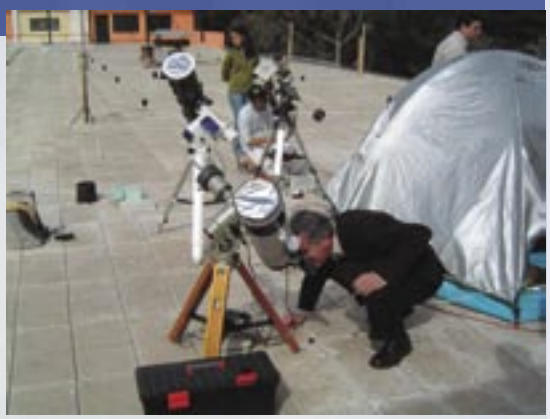
Moon orbits Earth and is inclined at an angle of just over 5 degrees to the plane of the Earth's orbit around the Sun. Due to that fact Moon passes above or below the Sun during only a particular phase (the lunar phases vary cyclically as the Moon orbits the Earth): the New Moon phase. Solar Eclipses accordingly can take place only during the New Moon lunar phase.

With respect to the period it takes Moon to orbit Earth the fact is that it takes approximately 27.3 days (sidereal month). During that period though of 27.3 days Earth has also moved orbiting the Sun and for that reason it takes more than 27.3 days for the Moon to get to the New Moon phase, and that is estimated to be approximately 29.6 days (synodic month, lunar month). Why then don't we have a Solar Eclipse every month? This is not the case as Moon's orbit around Earth is tilted 5 degrees to Earth's orbit around the Sun.

3. The what, why, how and when of Solar Eclipses

3.1 Why the phenomenon has the term 'Solar Eclipse'

Eclipse is actually a Greek word from the verb 'ekleipo' (spelled in Latin characters) that means 'to vanish'. In astronomy is used to describe what is actually an occultation. Occultation refers to one celestial object standing between the observer and another celestial object and it assumes that the first object is larger and therefore hides the second. When one of those three objects is the Sun, we witness an eclipse as well, because as the Moon occults the Sun, it casts a small shadow on the surface of the Earth, and therefore the Moon's shadow is partially eclipsing Earth. Therefore a so-called "solar eclipse" actually consists of (i) an occultation of the Sun by the Moon, as seen from Earth, and (ii) a partial eclipse of Earth by the Moon's shadow (http://en.wikipedia.org/wiki/Occultation)



3.2 What are the types of Solar Eclipses

The phenomenon has a lot of alterations depending on a number of criteria and therefore there are 4 distinct types of solar eclipses:

1. Total Eclipse: we witness it when the Sun is completely hidden by the Moon. Instead of the disk of the Sun we see the dark outline of the Moon whereas the only visible part of the intensely bright Sun is the much fainter corona.

2. Annular Eclipse: we witness it when the Sun and Moon are exactly in line, however due the apparent size of the Moon being smaller than that of the Sun the latter appears as a very bright ring surrounding the outline of the Moon.

3. Hybrid Eclipse: we witness it when an intermediate between a total and annular eclipse phenomenon takes place. The eclipse starts as an annular one, then turns into a total and by the end it returns to the annular phase.

4. Partial Eclipse: we witness it when the Moon only partially obscures the Sun as Moon and Sun are not perfectly in line.

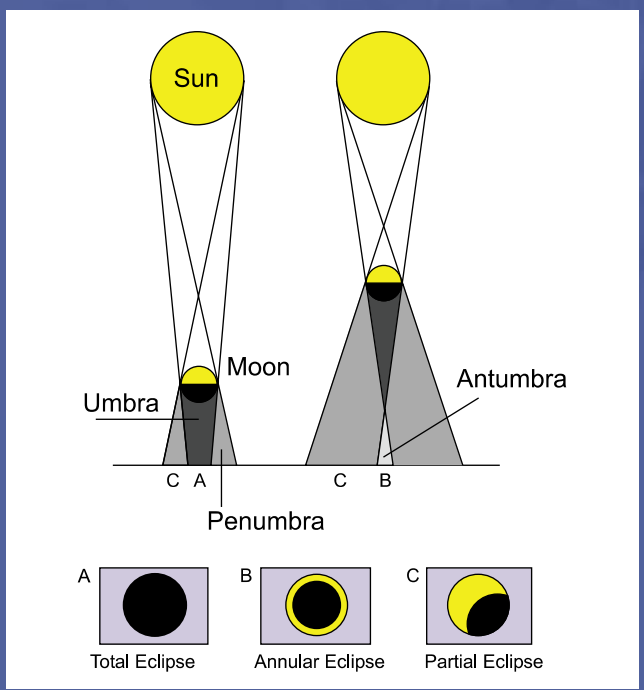
3.3 When do we have a total eclipse and when an annular one

The reason for having total eclipses as opposed to annular eclipses (and the other way around) has to do with the elliptical nature of the Moon's orbit around Earth. Note that the Sun lies about 400 times as far from Earth as does the Moon, and that the Sun is also about 400 times the diameter of the Moon. However, when seen from Earth, the Sun and the Moon appear to be of about the same size. Due to the elliptic more than cyclic orbit of the Moon around Earth, it is further away or closer to Earth than average.

When the Moon is at its closest position in relation to Earth, it appears large enough to cover the intensively bright Solar disk completely and therefore the observer witnesses a total eclipse.

When on the other hand Moon is at its farthest position in relation to Earth, it respectively appears smaller and doesn't seem to cover completely the Solar disk. The ring that remains even at the time of the greatest eclipse of that type is called an annulus of extremely brigth Sun and therefore we say that this is an annular eclipse.

The annular eclipses are little less rare than total as the Moon seems to be at its farthest position from the Earth more often.



3.4 What is the duration of a total solar eclipse?

The duration of the total solar eclipse is brief; It can last several minutes than in some cases can exceed an hour.

3.5 What is the frequency of Solar Eclipses

The Moon's orbit intersects with the ecliptic at the two nodes that are 180 degrees apart. Therefore, the New Moon occurs close to the nodes at two periods of the year approximately six months apart, and there will always be at least one solar eclipse during these periods. Sometimes the New Moon occurs close enough to a node during two consecutive months. This means that in any given year, there will always be at least two solar eclipses, and there can be as many as five. However, some are visible only as partial eclipses, because the umbra passes either above or below the earth, and others are central only

in remote regions of the arctic or antarctic.

4. Did you know that:

4.1 There are three parts of the Moons' Shadows?

There are three parts of the Moon's shadows: a) Penumbra b) Umbra and c) Antumbra. That is the case for every celestial object.
Penumbra is the 'faint outer' shadow, Umbra is the 'dark inner' shadow of the Moon and Antumbra may be referred as a "negative shodow". When Penumbra strikes Earth there is a partial eclipse. When Umbra sweeps Earth's surface there is respectively a Total Eclipse like the upcoming one on the 29th of March and when Antumbra strikes Earth there is an annular eclipse. The track of the Moon's shadow across Earth's surface is called the Path of Totality.

4.2 One may predict other eclipses?

One is in a position to predict other eclipses if the date and time of a solar eclipse is known. That can be done employing the eclipse cycles. Two such cycles are the Saros and the Inex. The Saros cycle is probably the most well known, and one of the best, eclipse cycles. After this interval, the Moon's eclipses recur with respect to the lunar calendar. 223 synodic months equals 242 draconitic months to within 51minutes. The Inex cycle is itself a poor cycle, but it is very convenient in the classification of eclipse cycles. After a Saros cycle finishes, a new Saros cycle begins 1 Inex later (hence its name:in-ex). It is the interval after which the Moon's eclipses recur at the same longitudes as the previous cycle but at the opposite latitudes.

5. Past, Present and Future of Solar Eclipse

5.1 Historical Solar Eclipses

The first solar eclipse that can be exactly dated is the one of the 15 June 763 BC (this is mentioned in an Assyrian text). Even though there are claims for some eclipses earlier (China and Babylon) to the aforementioned not much of evidence exist around those rumors.

In Greek History Thales of Miletos seemed to have predicted an eclipse during the war between Medians and Lydians that led soldiers put down their weapons.
An annular eclipse is noted at Sardis on February 17, 478 BC, and another solar eclipse at Sparta, on August 1, 477 BC are also recorded and reported in his books by Herodotus.

5.2 Present of Solar Eclipse: The Solar Eclipse of 29th of March 2006

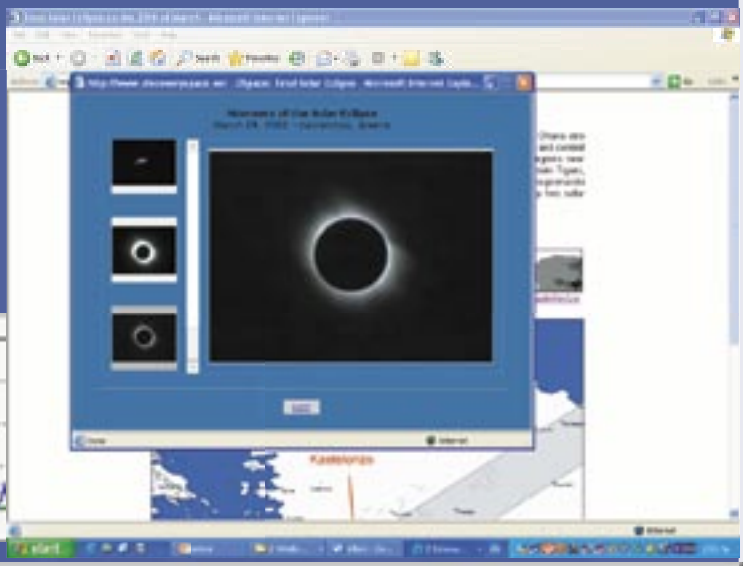
The 29th of March 2006 Total Solar Eclipse, centered on 10:12 UT, was visible across Africa (from the coast of Ghana into Togo, Benin, Nigeria, Niger, Libya, and the Libya/Egypt border), the Mediterranean, Turkey, and central Asia. Greatest eclipse, with 4 minutes 7 seconds of totality, occured in southern Libya. Regions near the path of totality will see a partial solar eclipse. The DSpace team (Vagelis Tsamis, Kyriaki Tigani, Stefanos Sofologis - Greek Astronomical Society - Sofoklis Sotiriou, Stavros Savas - Ellinogermaniki Agogi - and Costas Tsolakidis - University of Aegean) traveled to Kasteloriso and set up two solar telescopes with CCD cameras to observe the phenomenon.

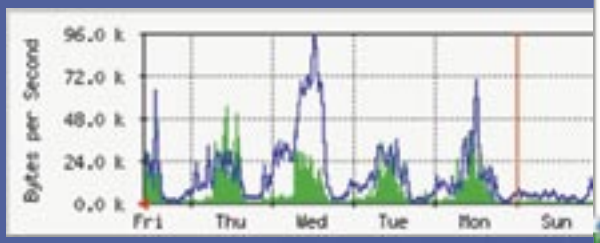
The emission was realized from the school of Kasteloriso. More than 3.500 people visited the island of Kasteloriso for the Solar Eclipse of 29th of March 2006, one of the most spectacular natural phenomena. People who gathered in Kasteloriso came from lots of places mostly around Europe. Note that was the Solar Eclipse could be seen as a Partial one from any other part of Greece.

The DSpace team set up the two solar telescopes and performed trials beginning the previous day of the Total Solar Eclipse.

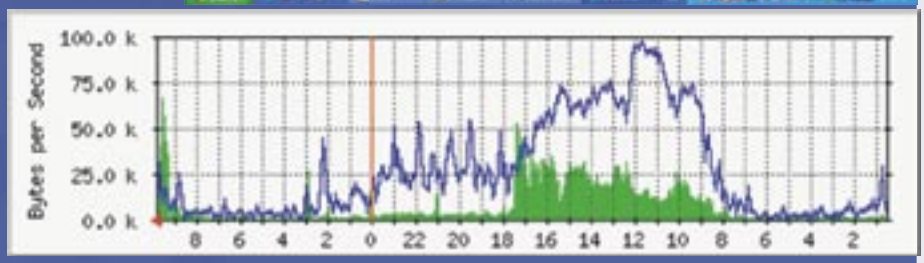
During the day of the Eclipse people gathered to the yard of the school and were prepared for the minutes of the Eclipse to come. The Moon started covering the Sun at 12:34:45 and it arrived at its totality at 15:10:46 (local time GMT+3).
The DSpace team has captured spectacular pictures of the phenomenon some of which you can see below:

The event was bradcasted to the web and the video was available to the public through the DSpace website. More than 7500 visitors have seen the emission over the DSpace server. The interest was very high also





the time before and after the eclipse. We have to say that this event has made the DSpace site a very popular resource as after the 29th of March about 5000 people have re-visited the site and got information about different events or performed observations.



5.3 Future Solar Eclipses

The table below presents the future Solar Eclipses to 2008. The source of the present table is NASA Eclipse Home Page (http://sunearth.gsfc.nasa.gov/eclipse/eclipse.html)

Solar Eclipses: 2006 - 2008

Date	Eclipse Type	Eclipse Magnitude	Central Duration	Geographic Region of Eclipse Visibility
2006 Sep 22	Annular	0.935	07m09s	S. America, w Africa, Antarctica [Annular: Guyana, Suriname, F. Guiana, s Atlantic]
2007 Mar 19	Partial	0.874	-	Asia, Alaska
2007 Sep 11	Partial	0.749	-	S. America, Antarctica
2008 Feb 07	Annular	0.965	02m12s	Antarctica, e Australia, N. Zealand [Annular: Antarctica]
2008 Aug 01	Total	1.039	02m27s	ne N. America, Europe, Asia [Total: n Canada, Greenland, Siberia, Mongolia, China]

6. Solar Eclipses and Eyes' protection

6.1 Observing a Solar Eclipse

Solar Eclipse observation can be an amazing spectacle given that we make sure that we protect our eyes. What can be very damaging and leading even to permenant impairement of vision, including blindness is looking directly at the Sun. When we are refering to the Sun we are actually referring to the photosphere of the Sun that due to its intense visible and invisible ratiation. The damage on the retina of the eye can be very severe, without a warning that injury is occuring during the time that this happens.

Under normal conditions, the Sun is so bright that it's difficult to stare at it directly, so there is no tendency to look at it in a way that might damage the eye. However, during an eclipse, with so much of the Sun covered, it is easier and more tempting to stare at it. Unfortunately, looking at the Sun during an eclipse is just as dangerous as looking at it outside an eclipse, except during the brief period of totality.

6.2 Totality during total eclipses

That is the only phase that is safe to observe directly with the unaided eye, binoculars or a telescope, towards Sun as the Sun's photosphere is completely covered by the Moon. The Sun's faint corona will be visible, and even the chromosphere, solar prominences, and possibly even a solar flare may be seen. However, it is important to stop directly viewing the Sun promptly at the end of totality.

7. News

7.1 The SkyWatch 2006 Contest is now open!

The SkyWatch 2006 contest addresses educators and teachers, mainly in the fields of Astronomy, Physics or Mathematics, who will be requested to propose interesting ideas and consequently implement them as scenarios for utilizing a network of robotic telescopes in the classroom for educational purposes.
From the pool of applicants in the first phase the best 30 proposals will be admitted to the second phase, where the best 10 educational scenarios will be awarded in at CERN in June 2006. Find out more at: http://www.discoveryspace.net/skywatch2006/contest.htm

Moments of the SkyWatch 2005 Contest Awards Ceremony

7.2 DSpace Dissemination workshop at Ampelakia, Larissa, 1st April 2006

EA and QPLAN in collaboration with the Greek Astronomical Society organized a dissemination workshop on the 1st of April 2006 within the context of the 11th National Conference of the Greek Physical Society that will take place in the area Ampelakia of Larissa. A brief description of the presentations conducted is available through the DSpace website: http://www.discoveryspace.net/news/Syn_Ampelakia.htm

8. Editorial

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