

Total Eclipse of the Sun



3 Introduction

Total Eclipse of the Sun

The Sun Core
Surface
Atmosphere

Eclipses Why?
When?

Total Eclipse of 29 Mar 2006

4 Solar Vital Statistics

Total Eclipse of the Sun

Size ~ 100 x Earth ~ 400 x Moon
Distance ~ 370-410 x Moon
Mass ~ 1,000,000 x Earth
Composition ~ 75% hydrogen
25% helium
0.1% other stuff
Power ~ 400,000,000,000,000
000,000,000,000 watts

5 Power Source

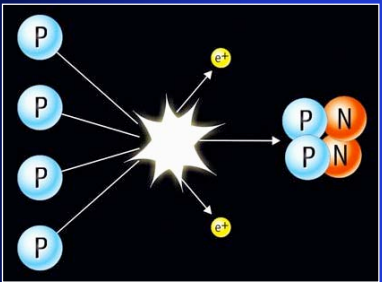
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1871 Hermann von Helmholtz
Burning coal, one ton per hour per square foot of the Sun's surface, would exhaust the fuel in a few million years

1919 Sir Arthur Eddington
Conversion of hydrogen to helium could provide enough energy to power the Sun for billions of years

6 Fusion

Total Eclipse of the Sun

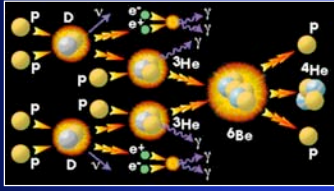


hydrogen → helium + energy

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7 Fusion

Total Eclipse of the Sun



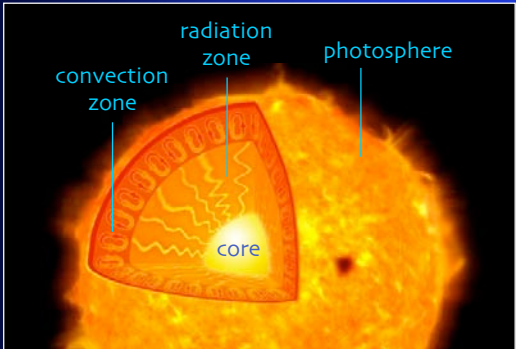
600 Mt of H → 596 Mt of He

Sun loses 4 million tons every second

Mass loss → energy thanks to $E = mc^2$

8 Internal Structure

Total Eclipse of the Sun



convection zone

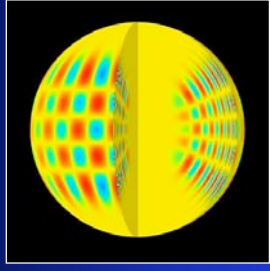
radiation zone

photosphere

core

9 Helioseismology (or "Star Quakes")

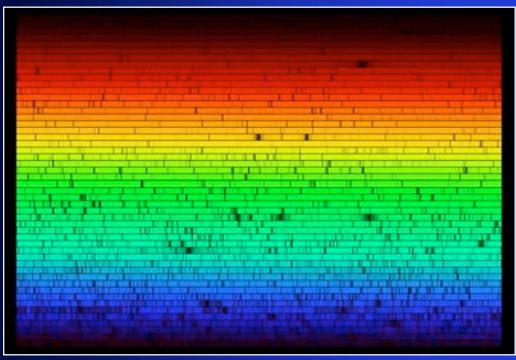
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Convection zone turbulence can be detected through the Doppler shift of the photosphere's emission lines

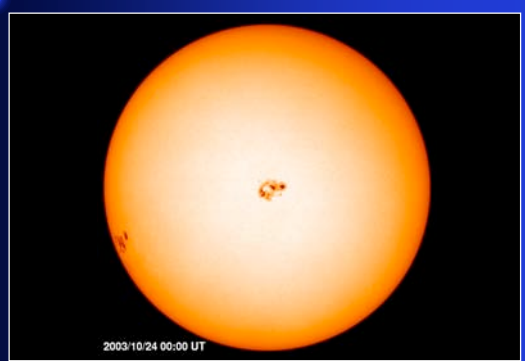
10 Solar Spectrum

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11 Sunspots

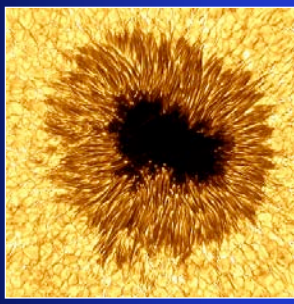
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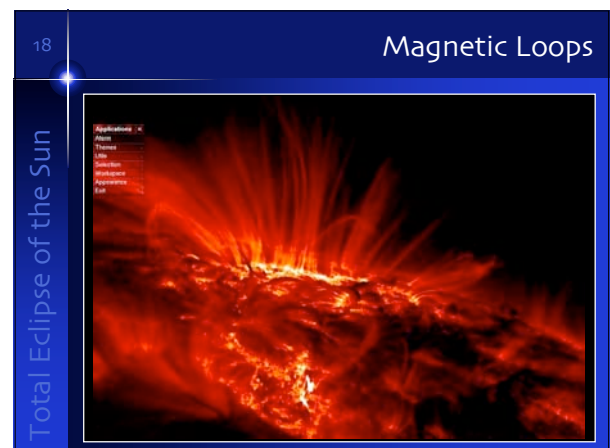
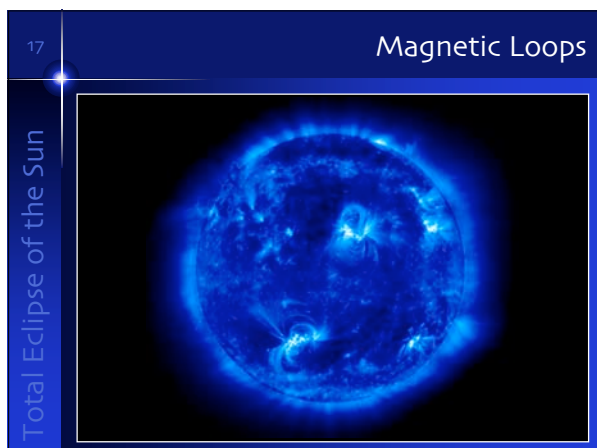
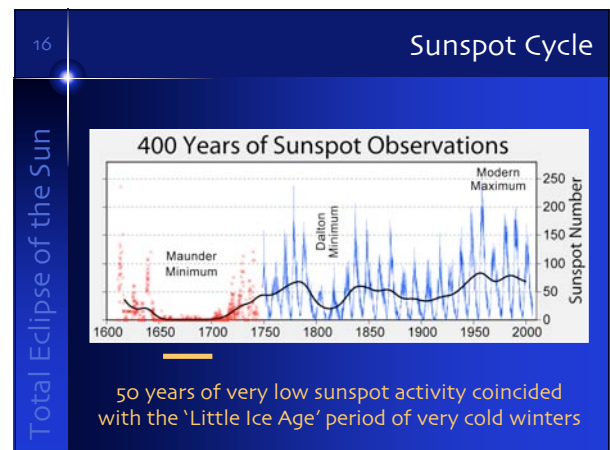
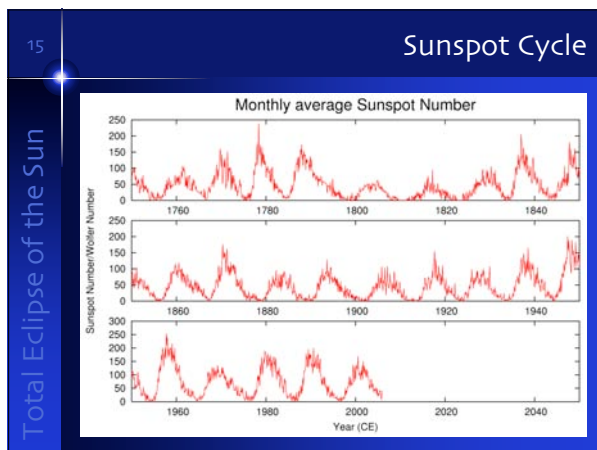
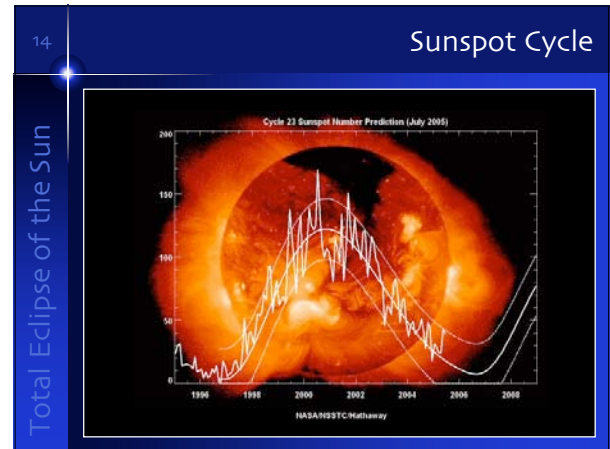
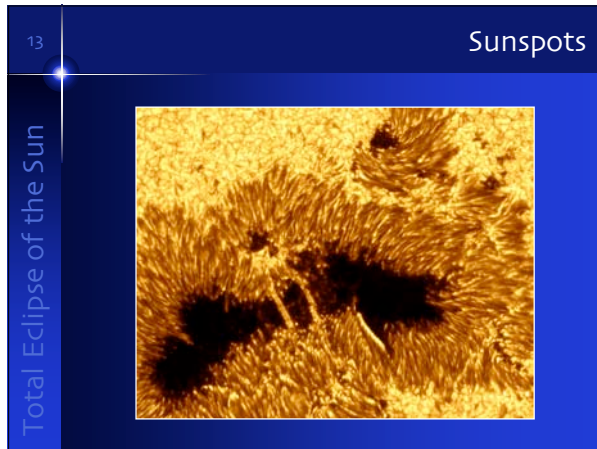
2003/10/24 00:00 UT

12 Sunspots

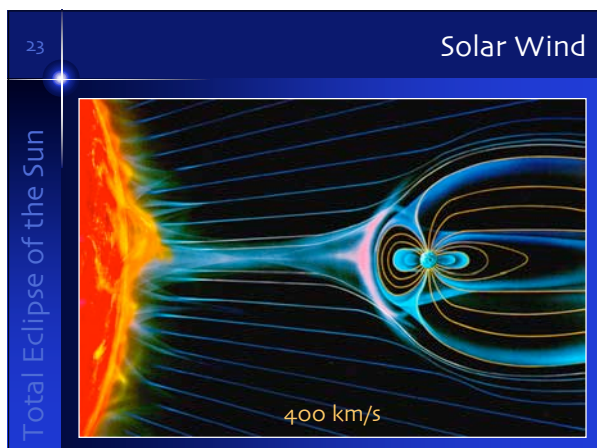
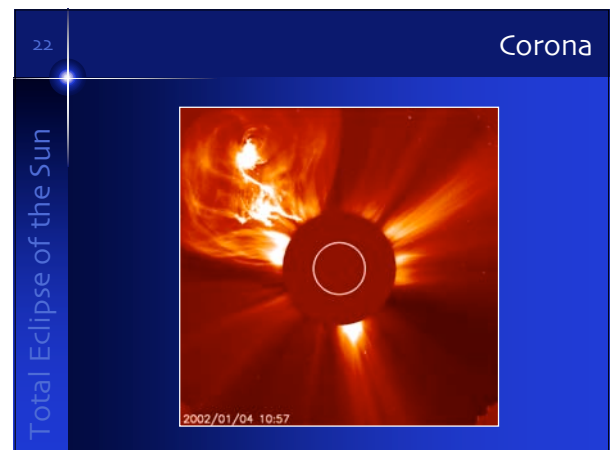
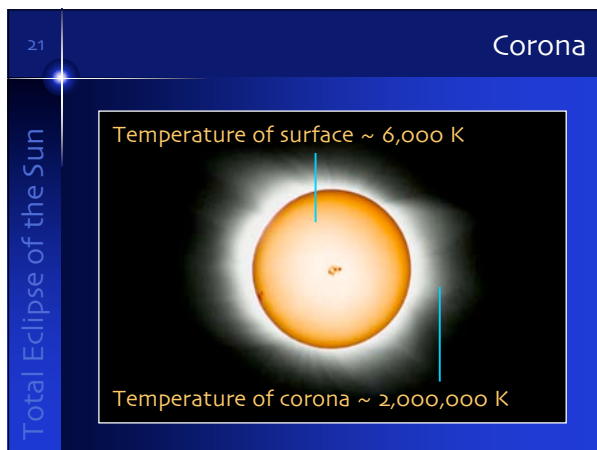
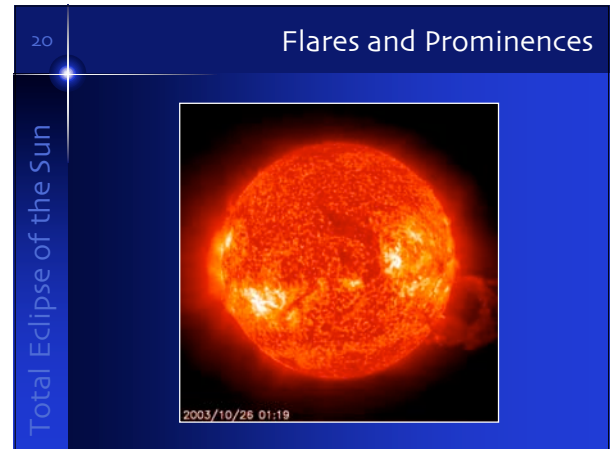
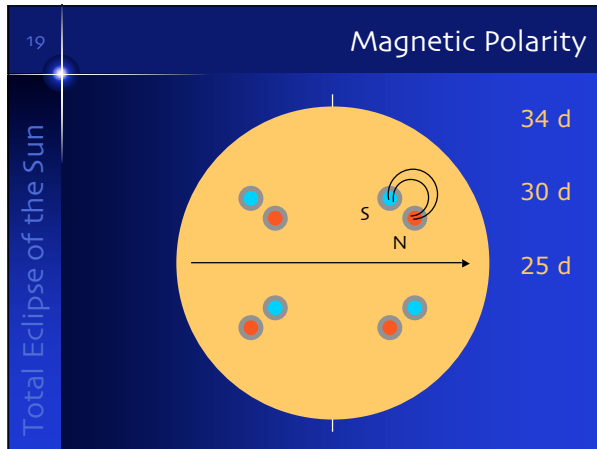
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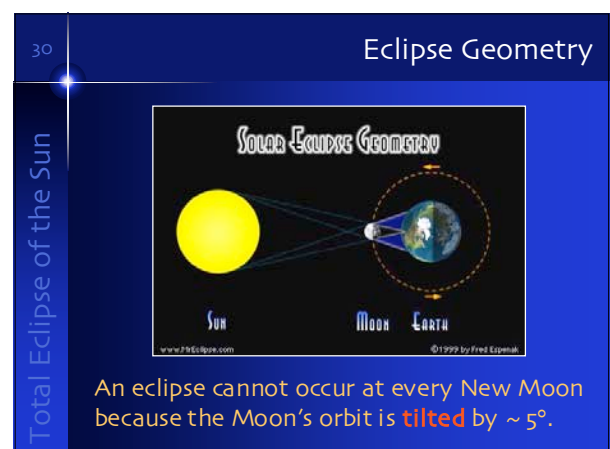
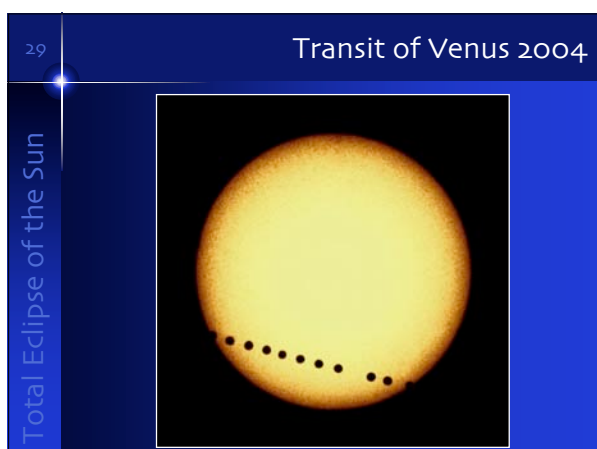
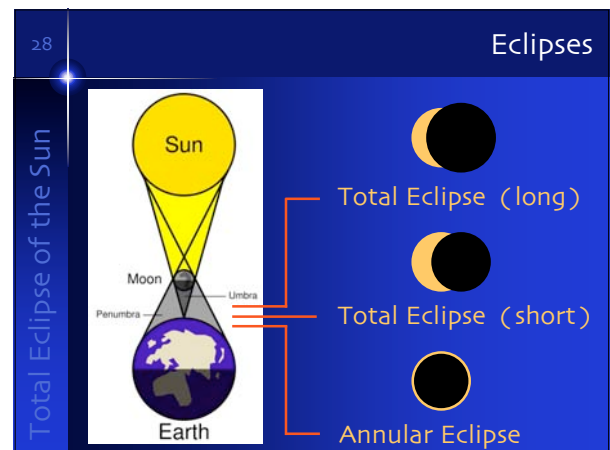


26 Eclipses

Total Eclipse of the Sun

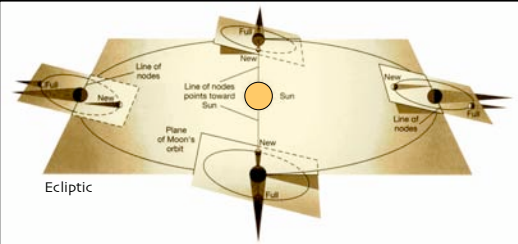
Eclipse
The passage of one object into the shadow cast by another.
Thus an *Eclipse of the Sun* should be called an *Eclipse of the Earth*.

Occultation
The passage of one object in front of another, hiding the latter from view.



Total Eclipse of the Sun

31 Eclipse Geometry



The Moon crosses the plane of the Earth's orbit (the Ecliptic) at a **node**.

32 Eclipse Timing

Synodic Month
New Moon to New Moon 29.53 days

Draconic Month
Node to Node 27.21 days

Anomalistic Month
Perigee to Perigee 27.55 days

33 The Saros Cycle

223 Synodic months = 6585.32 days

242 Draconic months = 6585.36 days

239 Anomalistic months = 6585.54 days

Over this time, the **saros** cycle, the Moon's orbital periods are back in 'synch'.

Two eclipses separated by one saros cycle have similar geometries.

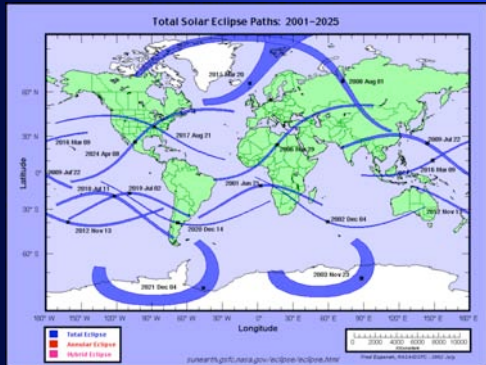
34 Saros 139

Date	ØM/ØS	Length	Seen from
1988 Mar 18	1.046	3 ^m 46 ^s	Asia
2006 Mar 29	1.052	4 ^m 07 ^s	Africa
2024 Apr 08	1.057	4 ^m 28 ^s	Americas
2042 Apr 20	1.061	4 ^m 51 ^s	Asia
2060 Apr 30	1.066	5 ^m 15 ^s	Africa
2078 May 11	1.070	5 ^m 40 ^s	Americas
2096 May 22	1.074	6 ^m 06 ^s	Asia

35 Eclipses Coming Soon

Date	Saros	Length	Seen from
2006 Mar 29	139	4 ^m 07 ^s	Africa, Turkey
2008 Aug 01	126	2 ^m 27 ^s	Greenland, Siberia
2009 Jul 22	136	6 ^m 39 ^s	India, China
2010 Jul 11	146	5 ^m 20 ^s	S Pacific, S America
2012 Nov 13	133	4 ^m 02 ^s	Australia, S Pacific
2013 Nov 03	143	1 ^m 40 ^s	Africa

36 Eclipses

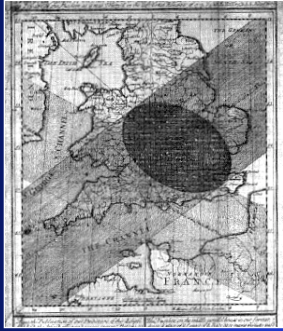


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37

Eclipses

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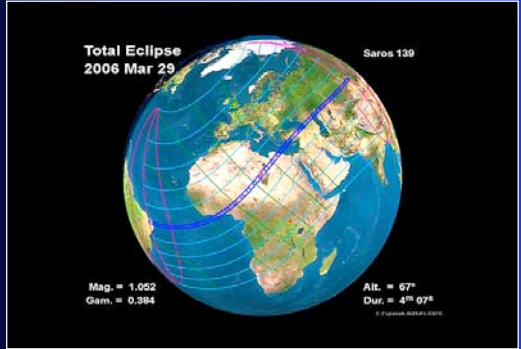
1715

1724

38

Total Eclipse of 29 Mar 2006

Total Eclipse of the Sun



Total Eclipse
2006 Mar 29

Saros 129

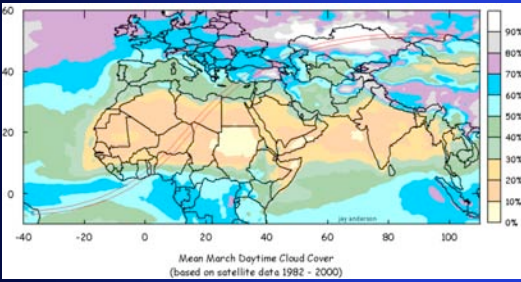
Mag. = 1.052
Gam. = 0.384

Alt. = 67°
Dur. = 4^m 07^s

39

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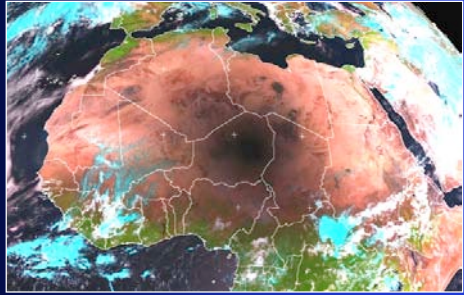


Mean March Daytime Cloud Cover
(based on satellite data 1982 - 2000)

40

Total Eclipse of 29 Mar 2006


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41

Total Eclipse of 29 Mar 2006

Total Eclipse of the Sun



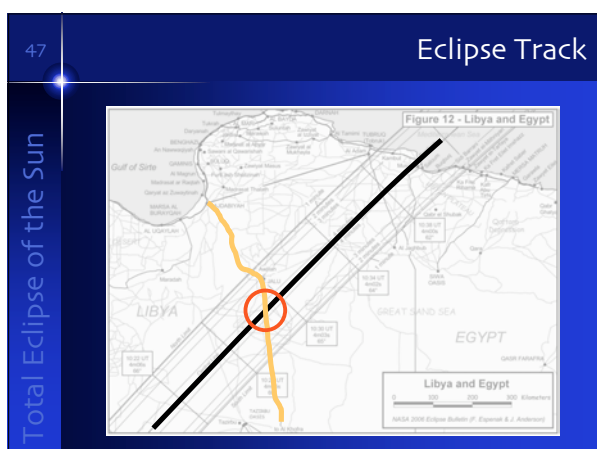
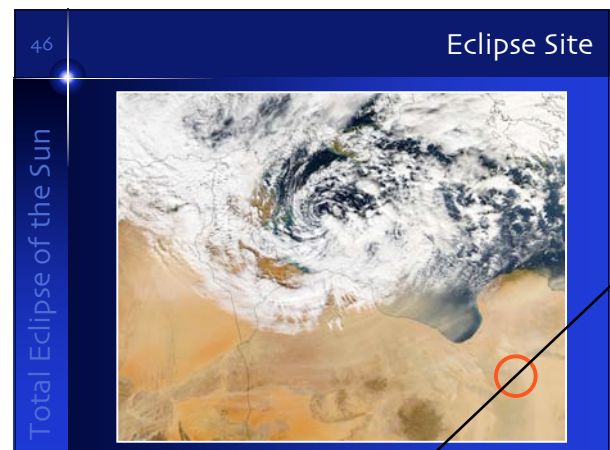
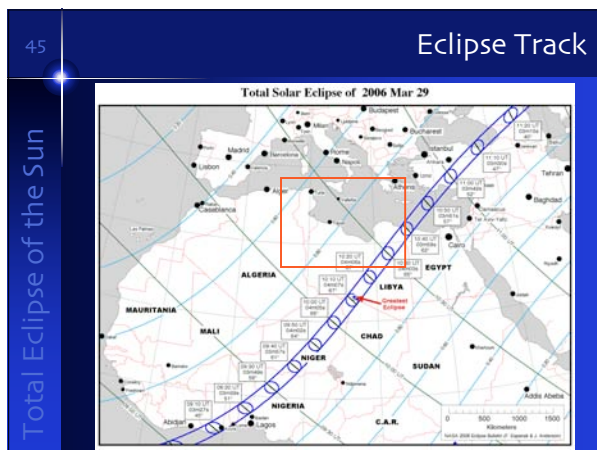
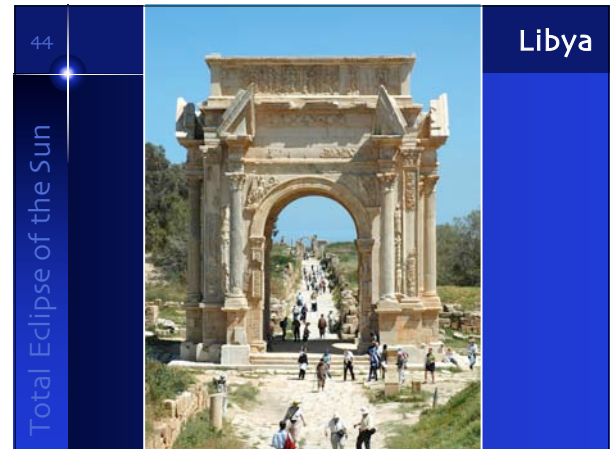
42

Eclipse Cruise

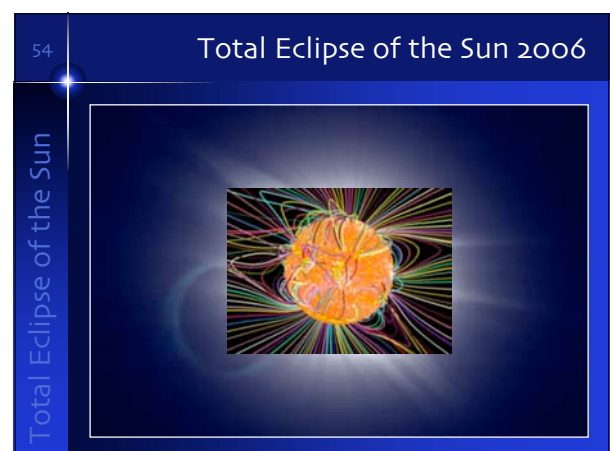
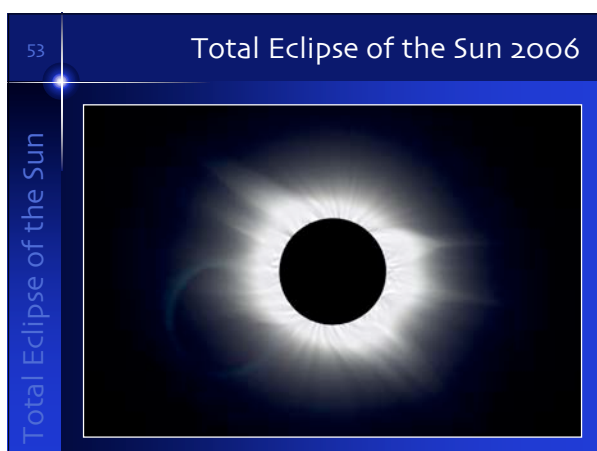
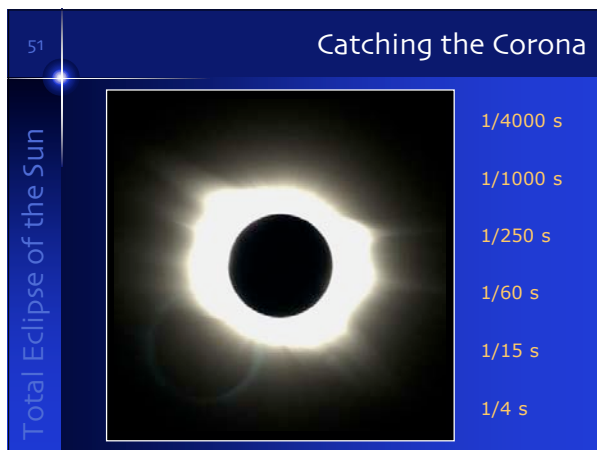
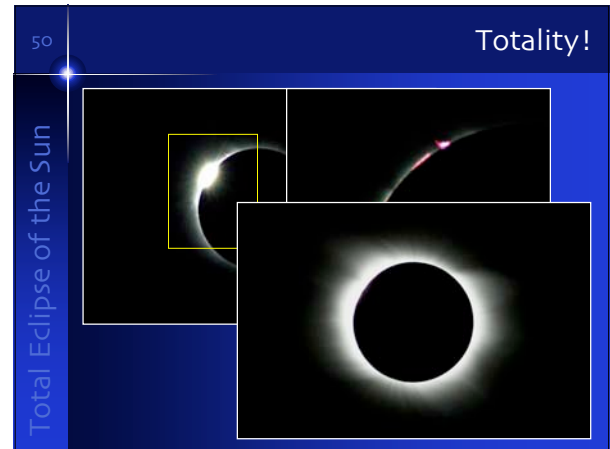
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Total Eclipse of the Sun



Total Eclipse of the Sun



Total Eclipse of the Sun

