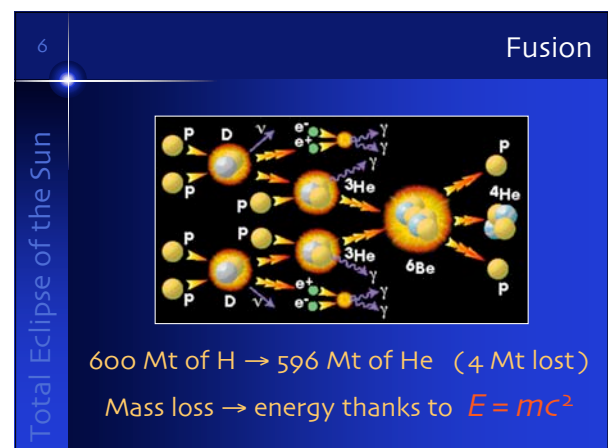
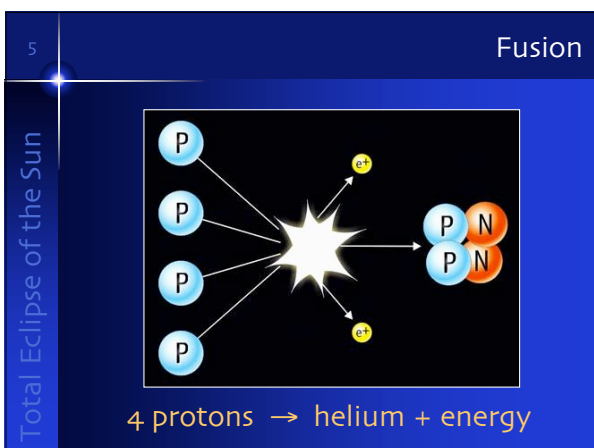
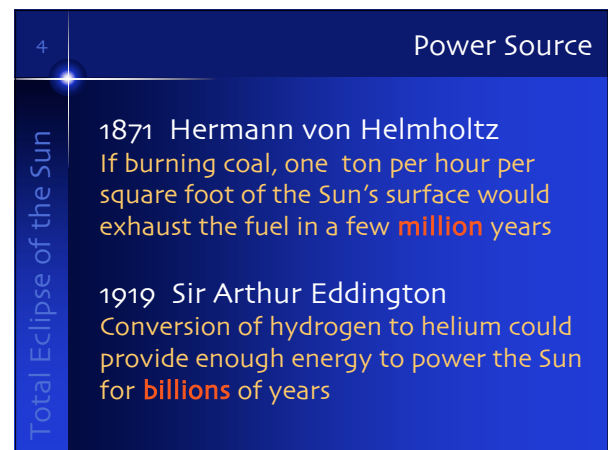
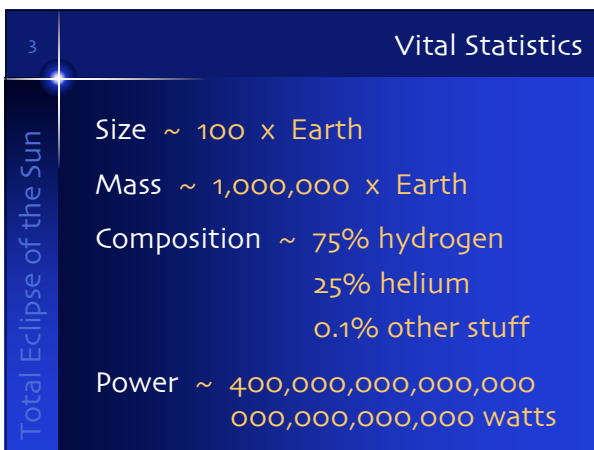
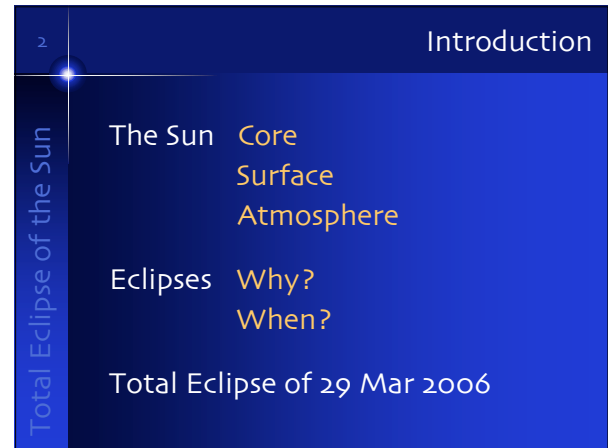
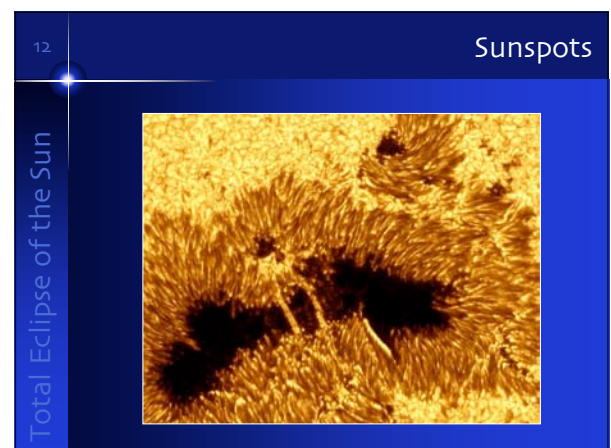
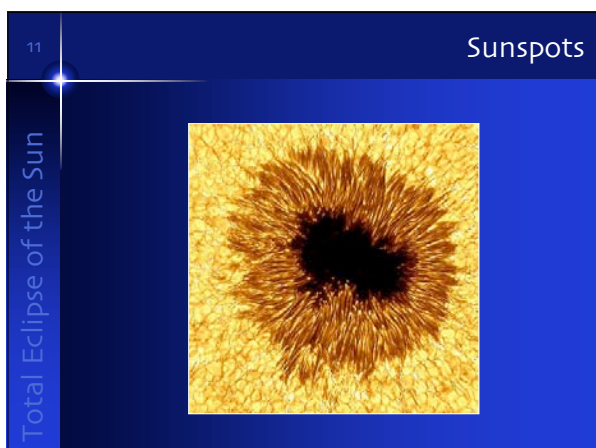
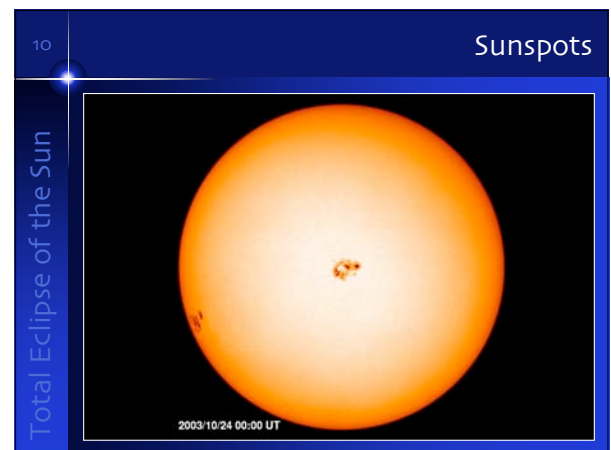
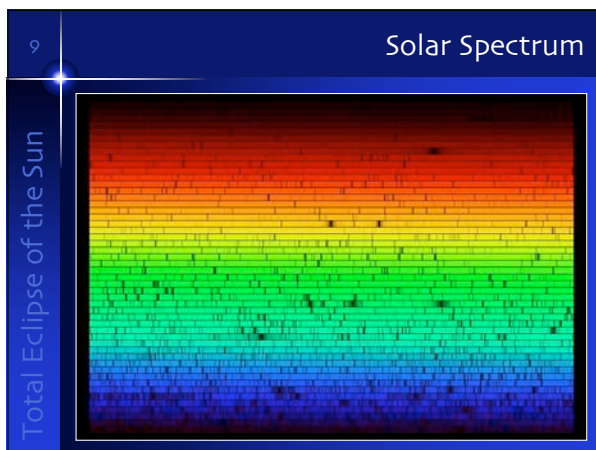
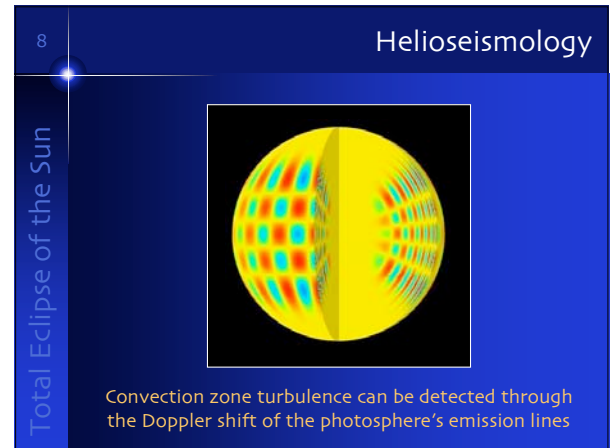
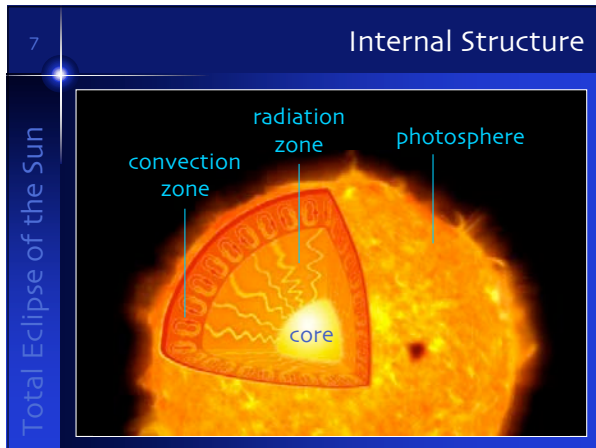


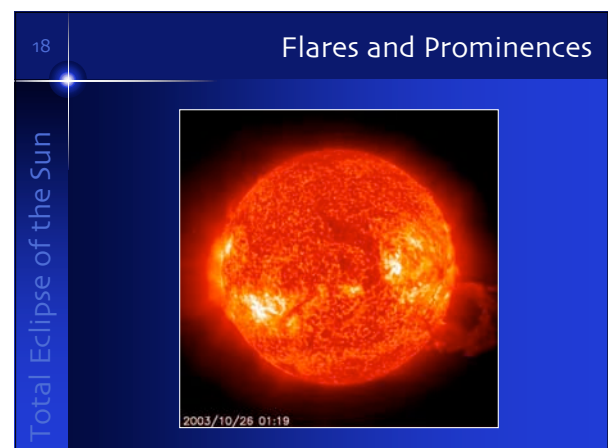
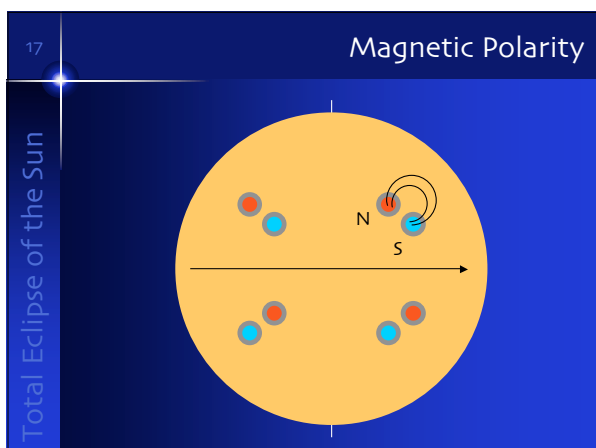
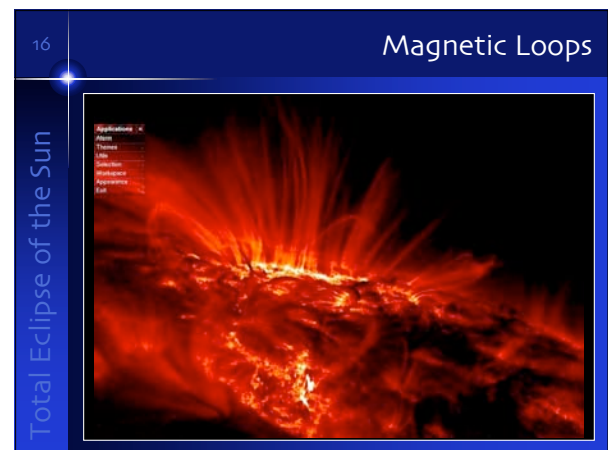
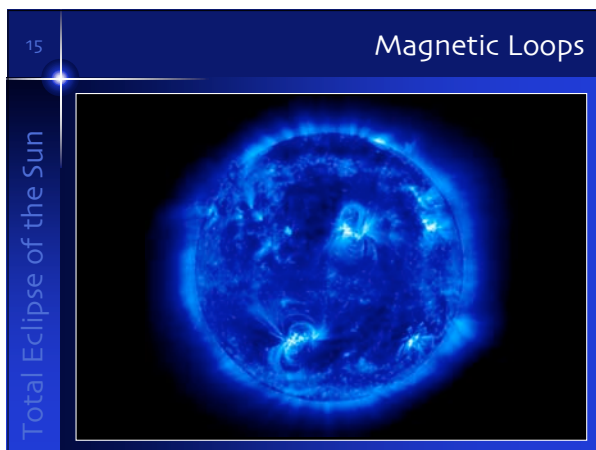
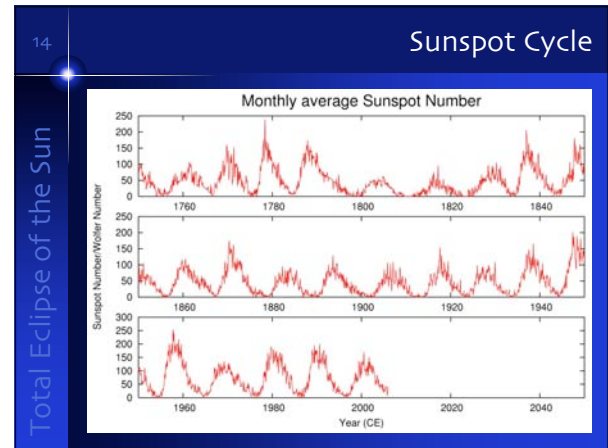
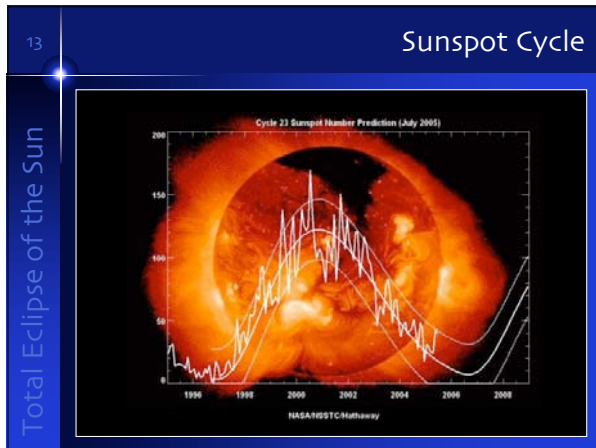
Total Eclipse of the Sun



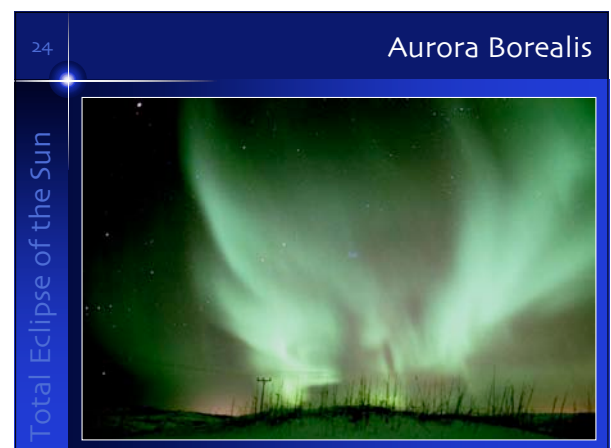
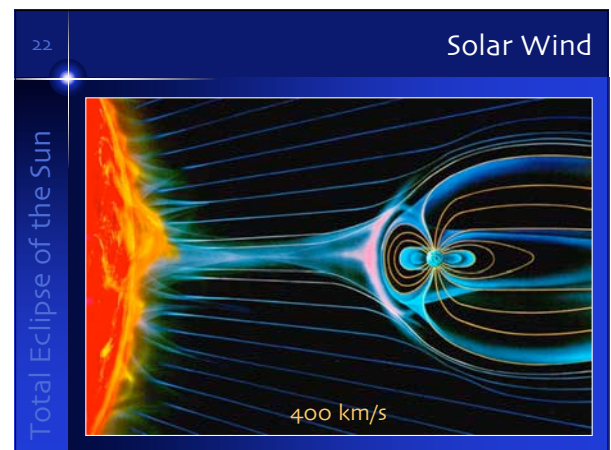
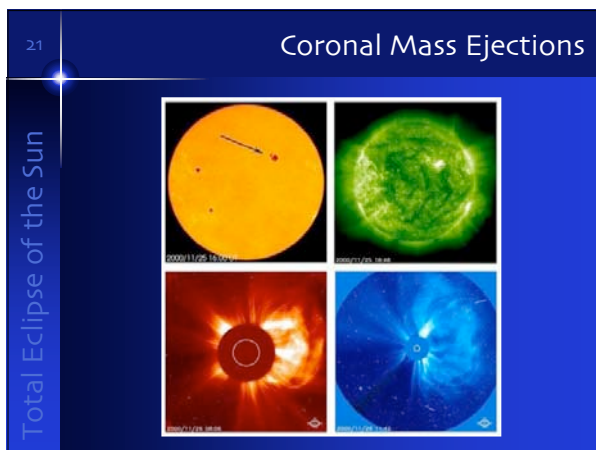
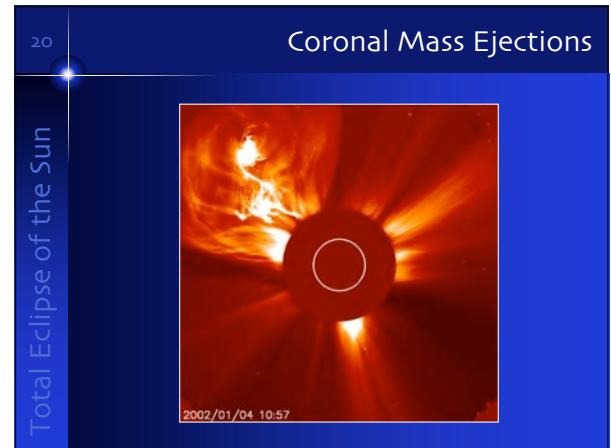
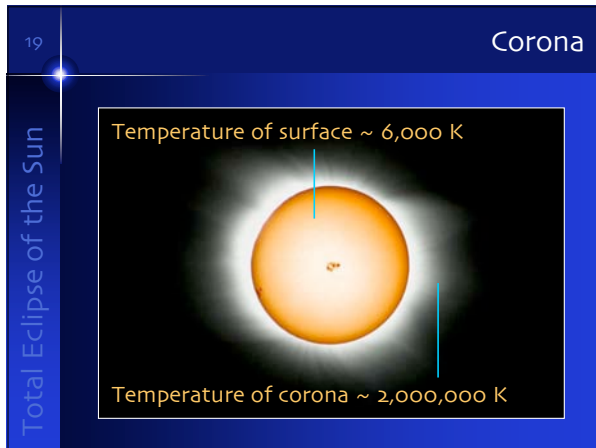
Total Eclipse of the Sun



Total Eclipse of the Sun



Total Eclipse of the Sun



Total Eclipse of the Sun

25 Eclipses

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

26 Eclipses

Sun

Moon

Umbra

Penumbra

Earth

Total Eclipse (long)

Total Eclipse (short)

Annular Eclipse

Total Eclipse of the Sun

27 Transit of Venus 2004

Total Eclipse of the Sun

28 Eclipse Geometry

Solar Eclipse Geometry

Sun

Moon

Earth

An eclipse cannot occur at every New Moon because the Moon's orbit is **tilted** by $\sim 5^\circ$.

Total Eclipse of the Sun

29 Eclipse Geometry

Ecliptic

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

Total Eclipse of the Sun

30 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

Total Eclipse of the Sun

Total Eclipse of the Sun

31 The Saros Cycle

Total Eclipse of the Sun

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.

32 Saros 139

Total Eclipse of the Sun

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

33 Eclipses Coming Soon

Total Eclipse of the Sun

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

34 Eclipses

Total Eclipse of the Sun

Map showing Total and Annular Solar Eclipse Paths: 2001–2020. The map displays the paths of various solar eclipses across the globe, with total eclipses in blue and annular eclipses in red. The paths are concentrated in the tropics and subtropics.

35 Eclipses

Total Eclipse of the Sun

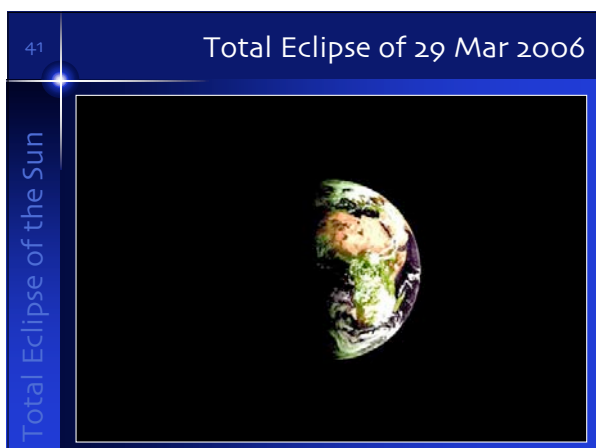
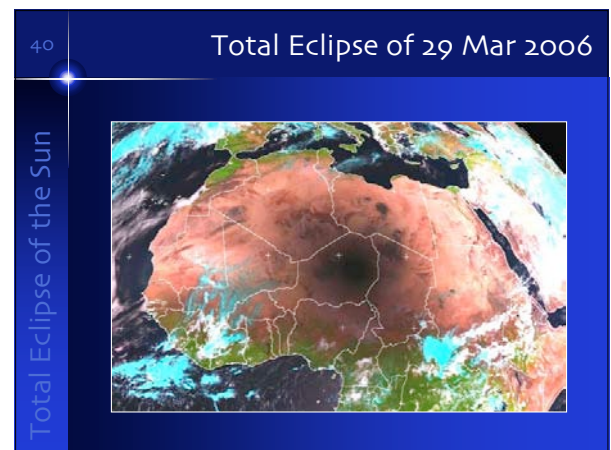
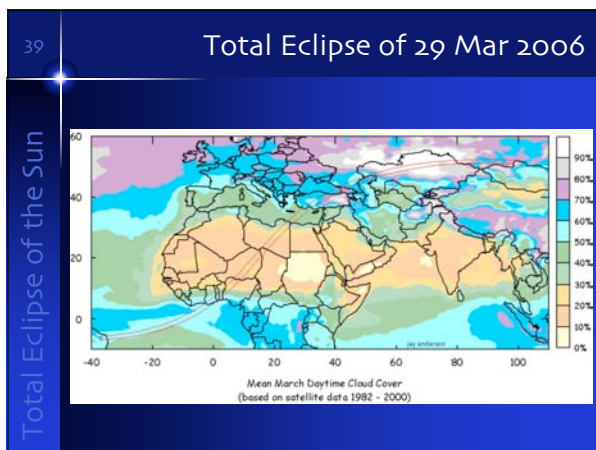
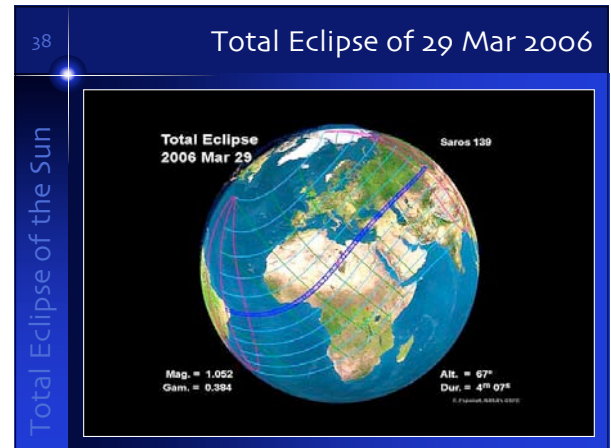
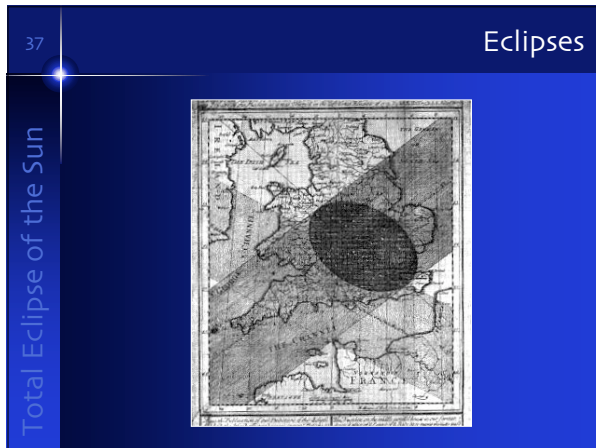
Map showing Total Solar Eclipse Paths: 2001–2025. The map displays the paths of various solar eclipses across the globe, with total eclipses in blue and annular eclipses in red. The paths are concentrated in the tropics and subtropics.

36 Eclipses

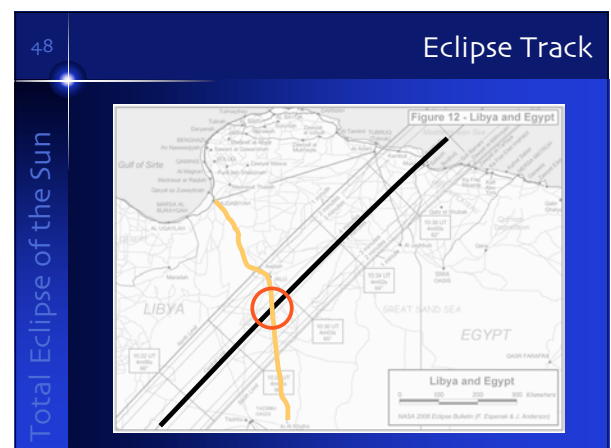
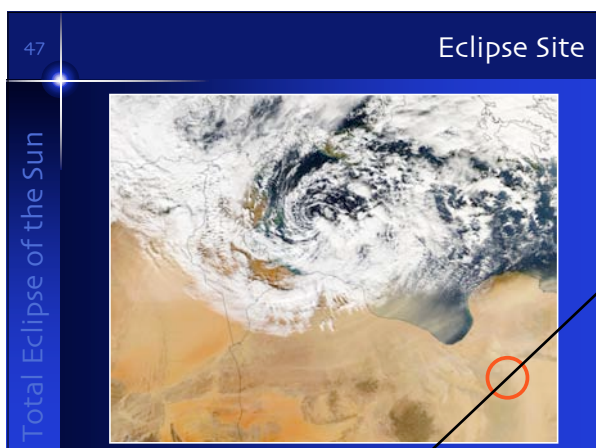
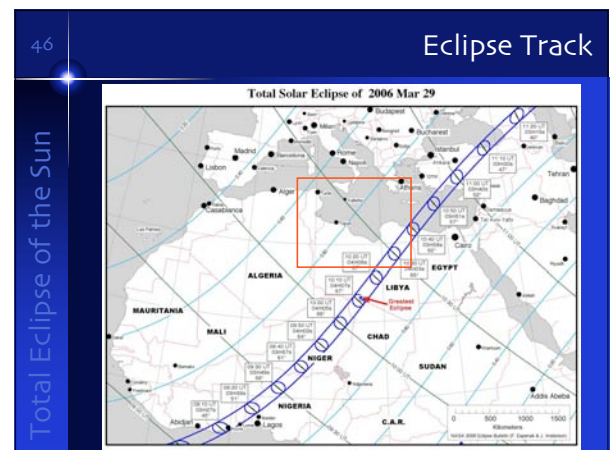
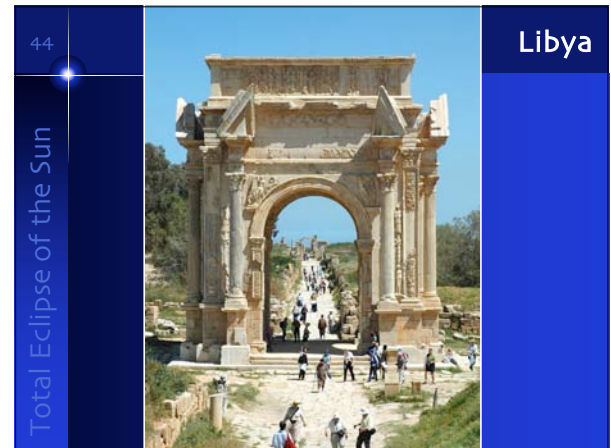
Total Eclipse of the Sun

Map showing Total Solar Eclipse Paths: 1001–2000. The map displays the paths of various solar eclipses across the globe, with total eclipses in blue and annular eclipses in red. The paths are concentrated in the tropics and subtropics.

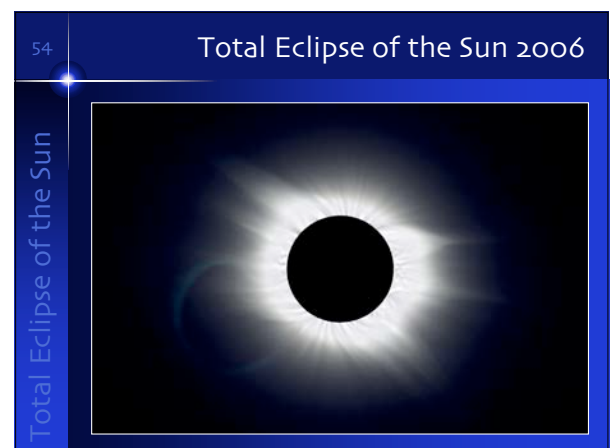
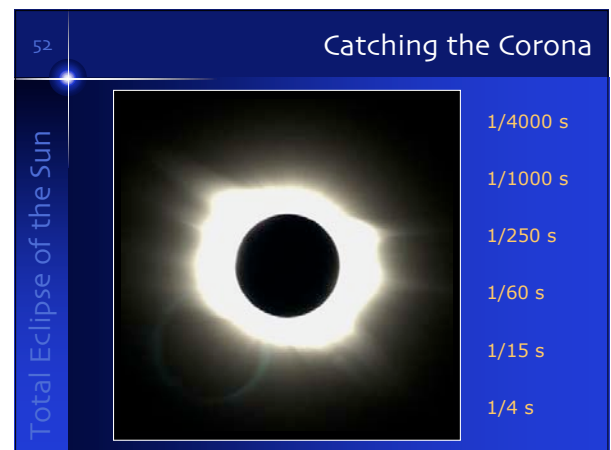
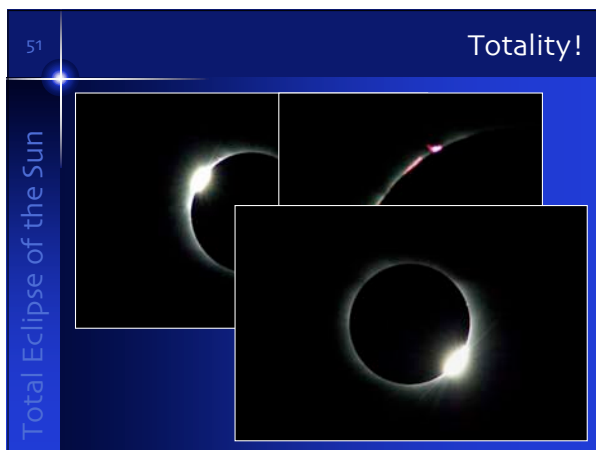
Total Eclipse of the Sun



Total Eclipse of the Sun



Total Eclipse of the Sun



Total Eclipse of the Sun

