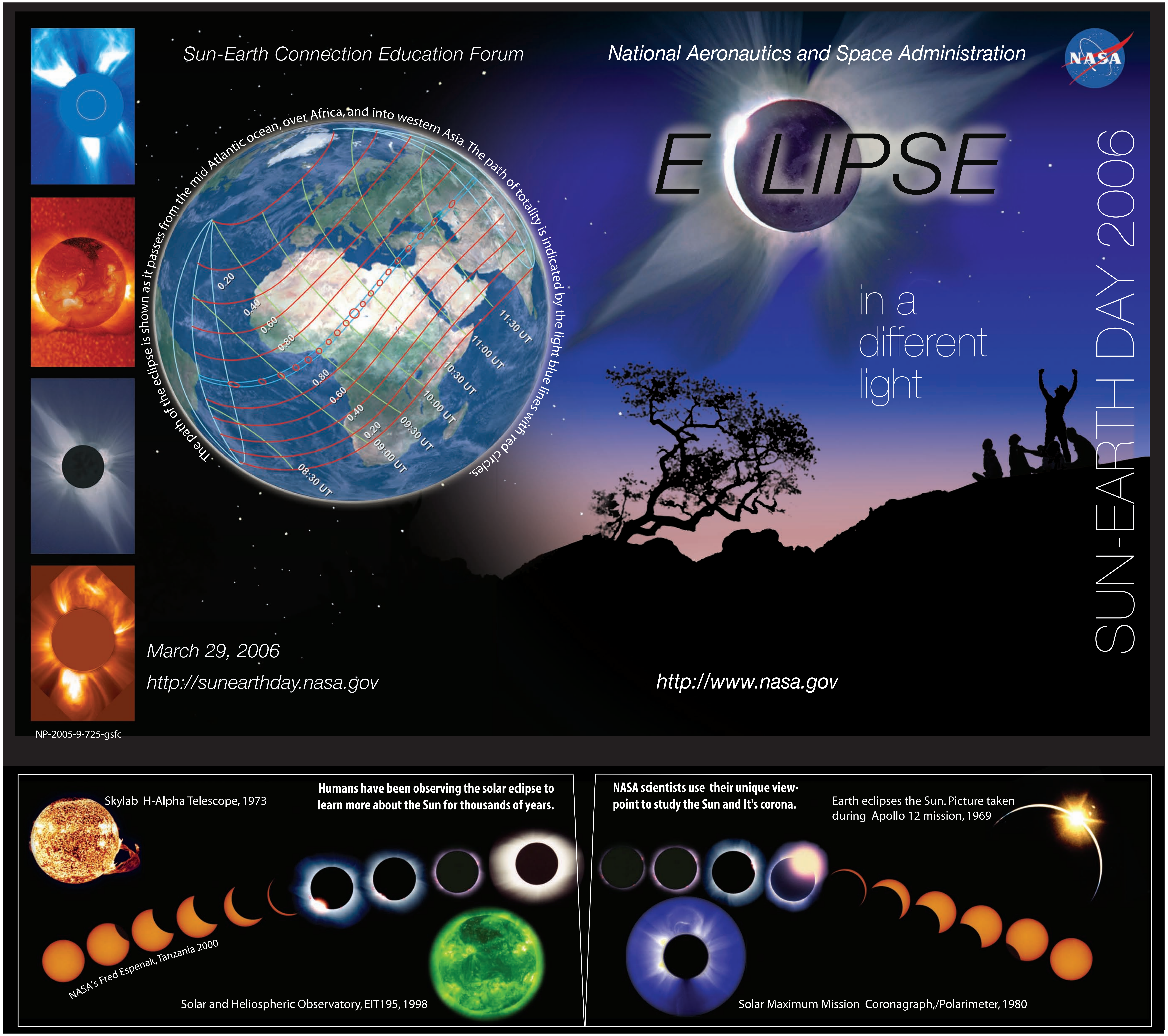
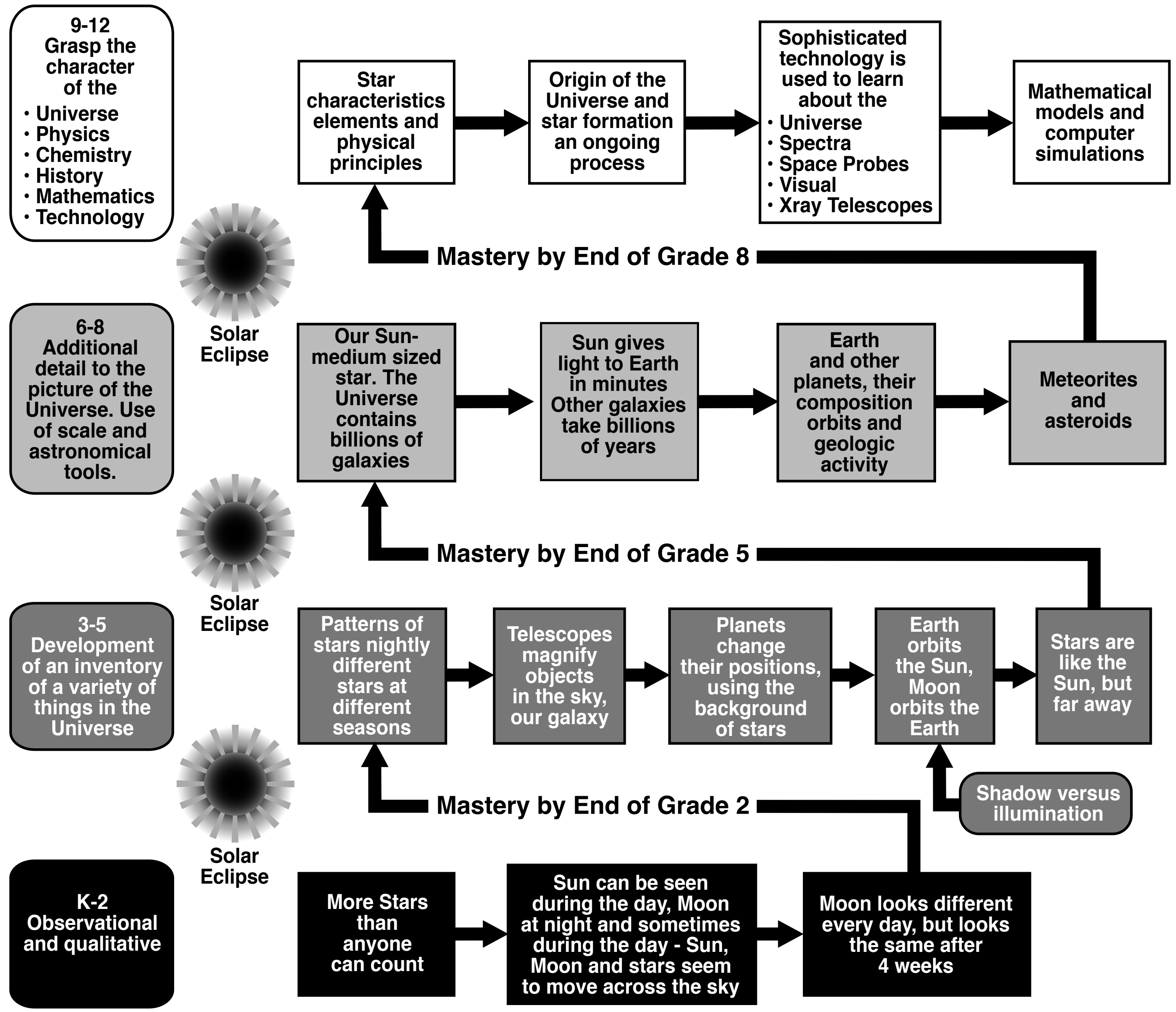

Sun-Earth Connection Education Forum
National Aeronautics and Space Administration
NASA
The path of the eclipse is shown as it passes from the mid Atlantic ocean, over Africa, and into western Asia. The path of totality is indicated by the light blue lines with red circles.
0.20
0.40
0.60
0.80
0.80
0.60
0.40
0.20
08:30 UT
09:00 UT
09:30 UT
10:00 UT
10:30 UT
11:00 UT
11:30 UT
ECLIPSE
in a
different
light
SUN-EARTH DAY 2006
March 29, 2006
http://sunearthday.nasa.gov
http://www.nasa.gov
NP-2005-9-725-gsfc
Skylab H-Alpha Telescope, 1973
Humans have been observing the solar eclipse to learn more about the Sun for thousands of years.
NASA's Fred Espenak, Tanzania 2000
Solar and Heliospheric Observatory, EIT195, 1998
NASA scientists use their unique view-point to study the Sun and It's corona.
Earth eclipses the Sun. Picture taken during Apollo 12 mission, 1969
Solar Maximum Mission Coronagraph,/Polarimeter, 1980

Finding Our Place in the Cosmic Scheme of Things

People of the past used their extensive knowledge of the stars to plan when to plant crops and how to navigate the oceans. Today, this wisdom is mostly a lost art. People only glance at the stars occasionally, largely because so fewer stars are seen due to light pollution from cities. But science and technology have led to new understandings about the stars and the Universe, including our Sun. The national Benchmarks for Science Literacy (AAAS, 1993) recommend that three aspects of the current scientific view be investigated as part of students' required learning: (1) the composition of the cosmos and its scale of space and time; (2) the principles on which the universe seems to operate; and (3) how the modern view of the universe emerged. These bring us to a perfect launching place to begin exploring the wonders of a total solar eclipse, and learn anew about the stars.



Total solar eclipses have fascinated us since the dawn of recorded history. It is impossible to say exactly how long humans have been aware of this awesome celestial event. There was no “first discoverer” of eclipses just as there was no discoverer of the Moon, or the stars in the sky. Only eclipse anecdotes survive, such as the story about the two Chinese astrologers in 2134 BC who were beheaded for not forecasting an eclipse accurately. Babylonian astronomers mentioned an eclipse in 1375 BC, and Greek astronomers reported eclipses in 762, 647 and 584 BC. Only a scattering of descriptions even hinted at the spectacular shape of the most dramatic, visual, feature of these events: the solar corona. Solar eclipses were first mentioned by Chinese astronomers in 1307 BC, and later by Plutarch in 71 AD. No one who has seen a solar eclipse can soon forget the spectacle of the faint, luminous halo surrounding the blackened disk of the Sun during totality.

The corona has been the Holy Grail of modern eclipse watchers, who have traveled to the four corners of the Earth to set up telescopes to capture its ephemeral hues and shapes. The first photograph, taken in 1851, captured its visible appearance. Since then, photographs have revealed dazzling details, plumes, streamers and fountains of gas hovering above the darkened lunar limb. Since the 1800s, astronomers studied the corona, searching for clues to its origins, structure and basic physical properties. The corona was found to be the outer atmosphere of the sun (not the moon as some thought!), heated to millions of degrees, flowing out into the solar system in a dilute, interplanetary wind.

The advent of satellite technology, such as NASA's Orbiting Solar Observatories (OSO), Skylab, and collaborations with European (SOHO) and Japanese (Yohkoh) space agencies, led to magnificent views of the turbulent and violent corona. At higher resolution, NASA satellites such as TRACE and RHESSI explore the details of how solar flares occur, and the manner in which they release their titanic energies. Infused with new data, scientists discovered the corona's changes during the sunspot cycle, and that the Sun's corona was laced with “holes” where particles could freely escape into space. The many plumes and streamers that eclipse observers had admired in centuries past were the hosts of spectacular explosions of magnetized plasma clouds into space - Coronal Mass Ejections. Even the million-degree temperature of the coronal gases now had the beginnings of an explanation, with clues found on the solar surface in an ever-changing magnetic carpet of microflares and other activity.

As older questions have found their answers in modern data, a new generation of questions spawned by newer forms of data now present themselves. How do solar magnetic fields break apart, reform, and release energy? Why do solar flares happen, and can they be predicted? How is the Sun's magnetic field created below its surface?

Figure 1: Ultraviolet coronagraph image of the solar corona seen by the SOHO, LASCO instrument showing a coronal mass ejection in progress. The satellite instrument creates an artificial, total solar eclipse to record the faint light from the corona. (Courtesy SOHO) C-3 Blue.

Figures 2 : X-ray image of the solar corona showing dark 'coronal holes' and the bright plumes of trapped particles heated to over 100,000 C. (Courtesy Yohkoh)

Figures 3: Optical composite photograph of solar corona, showing details. (Courtesy Steve Albers)

Figure 4: Ultraviolet coronagraph image of the solar corona seen by the SOHO, LASCO instrument showing a coronal mass ejection in progress. The satellite instrument creates an artificial, total solar eclipse to record the faint light from the corona. (Courtesy SOHO) C-2 Orange