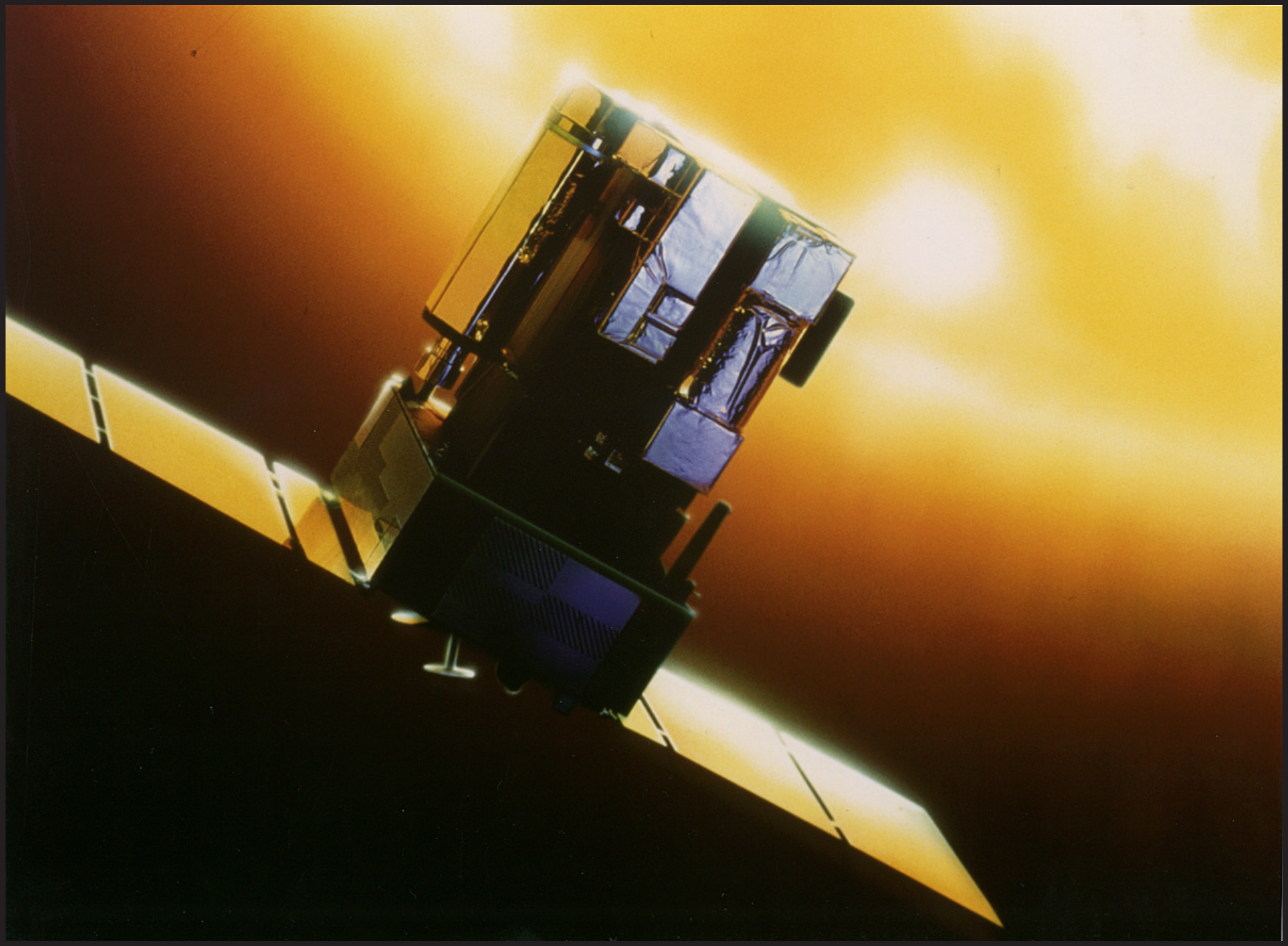
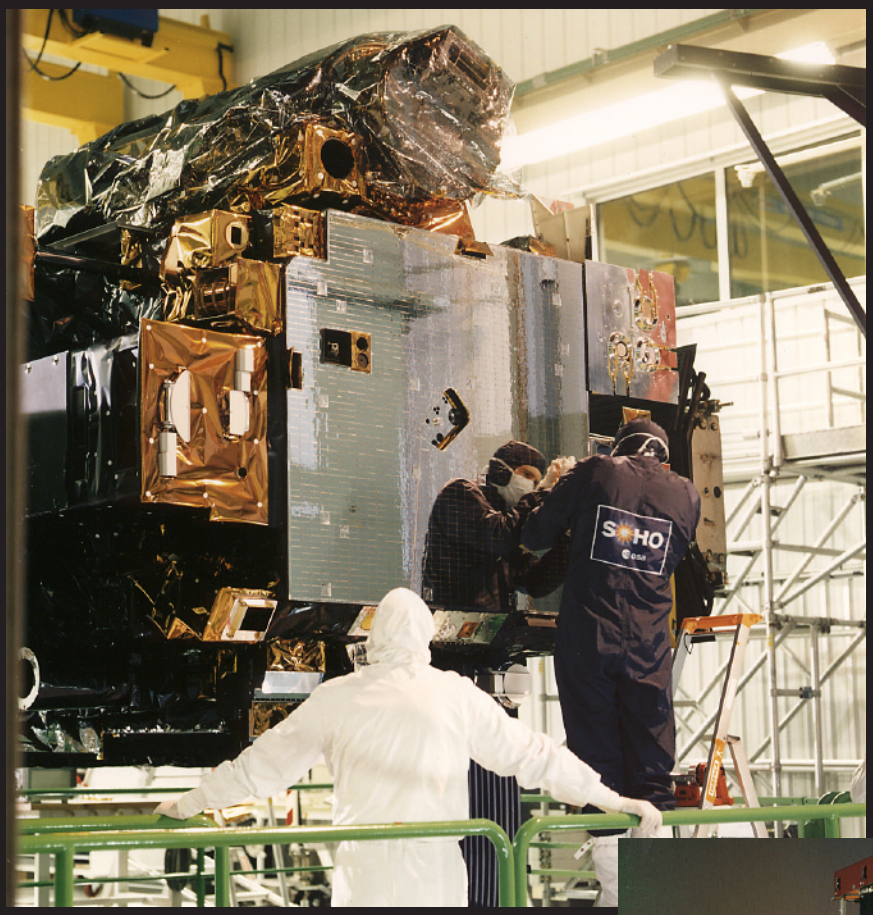
SOHO is a mission of international cooperation between ESA and NASA

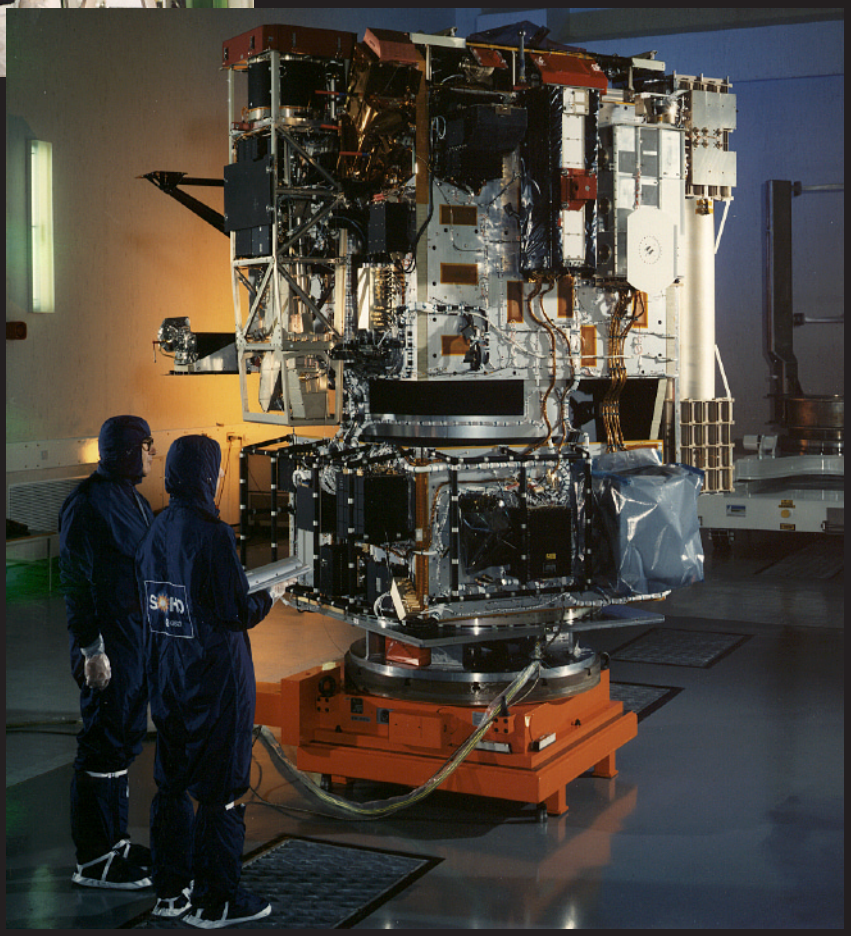
An artist's illustration of the SOHO spacecraft



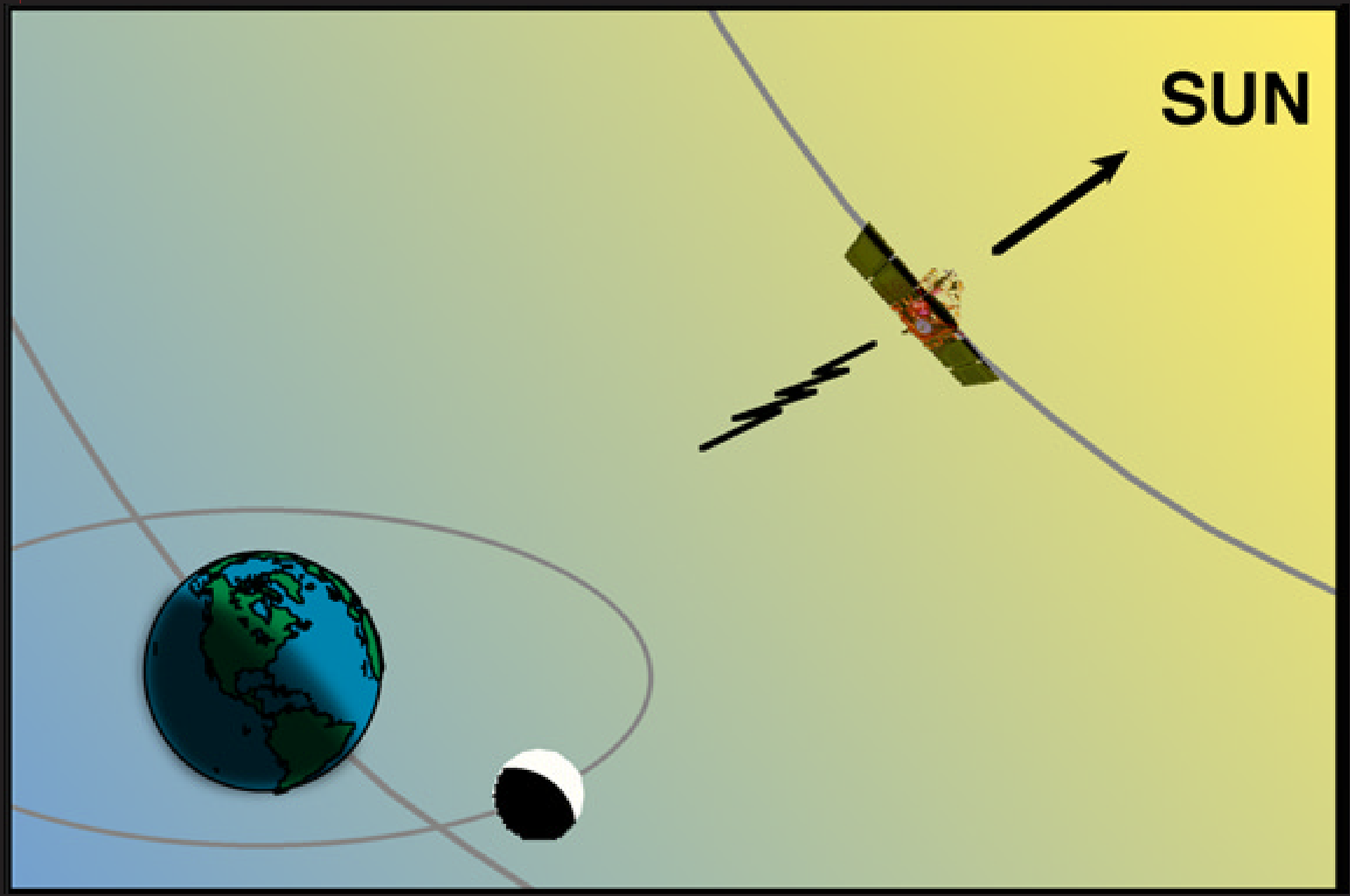
The SOHO spacecraft under construction and prepared for testing



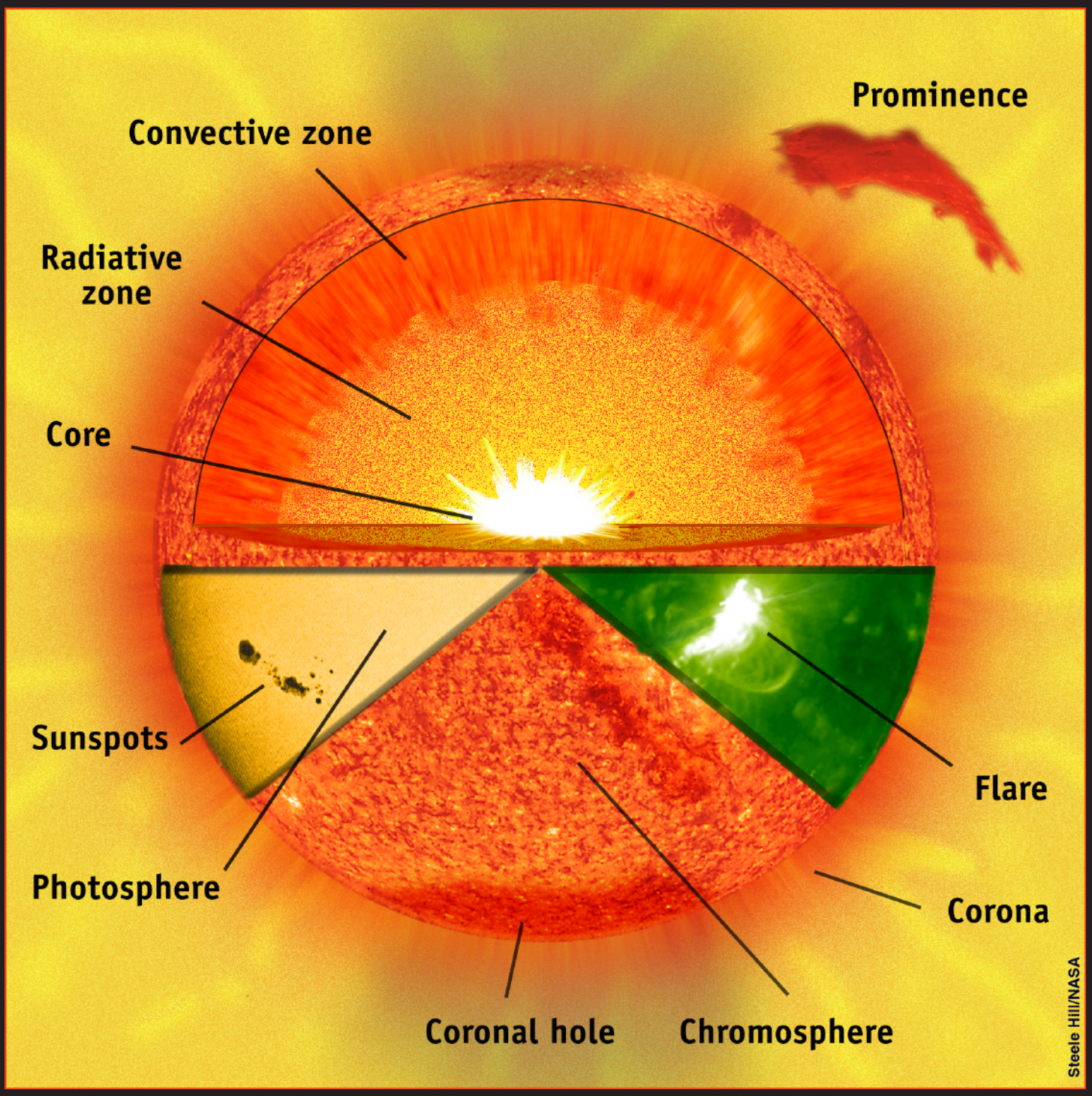
- taller than a school bus
- weighs over 2 tons
- stretches 9 meters with solar panels extended
- launched in late1995



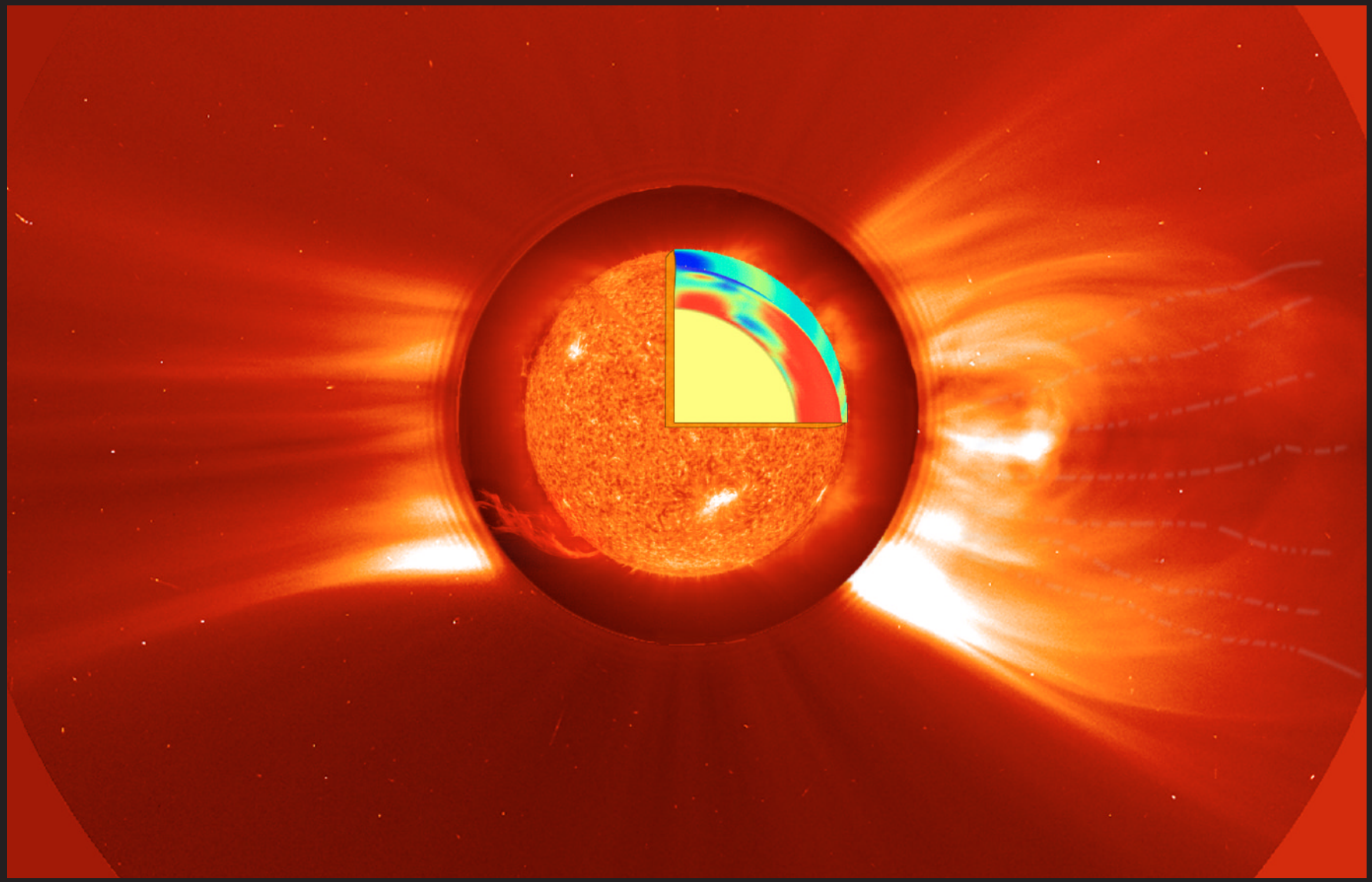
SOHO maintains an orbit around the Sun, 1.5 million km (a million miles) from Earth at the Lagrangian point (L1)



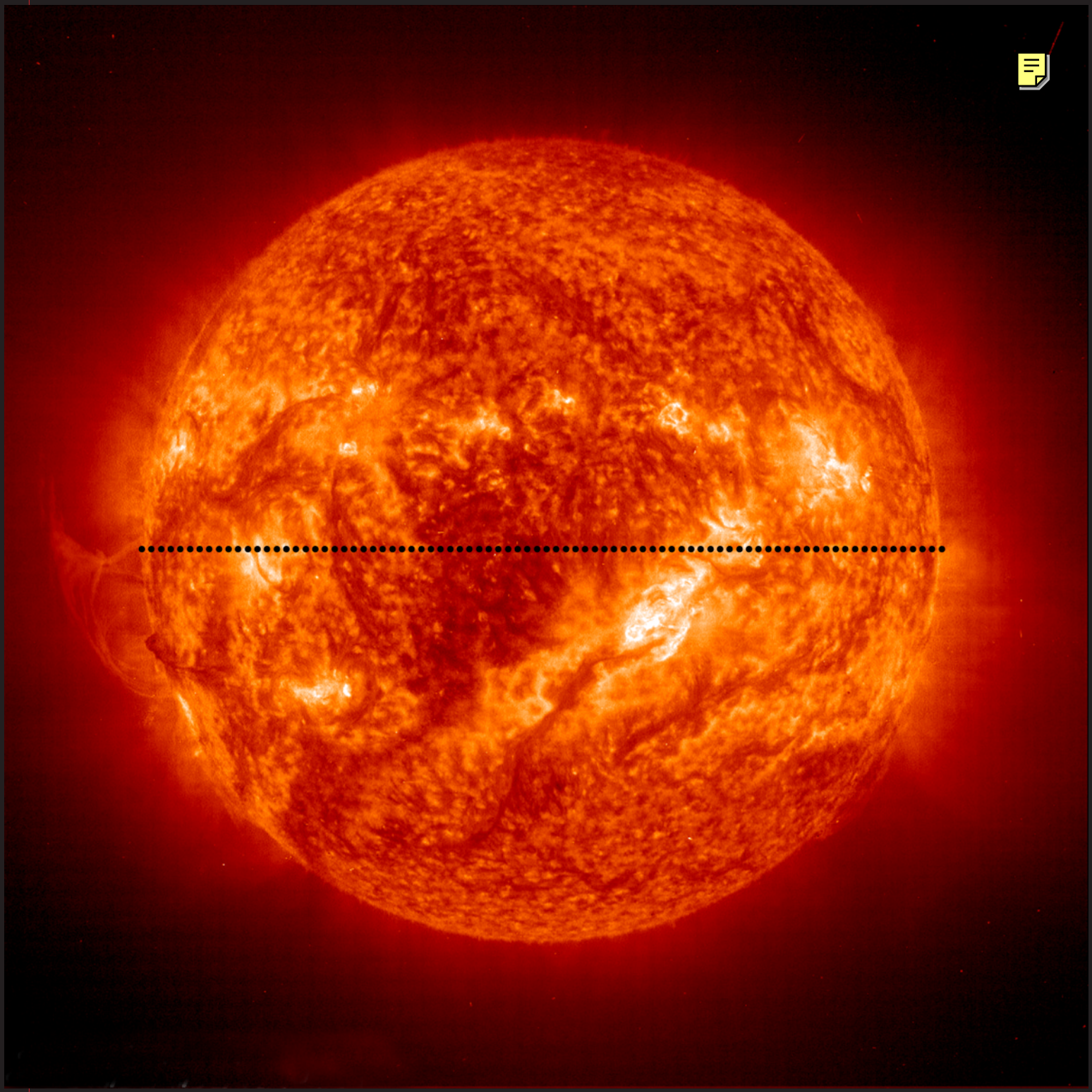
The parts of the Sun



The three major areas of SOHO's scientific investigations are the solar interior, the corona, and the solar wind

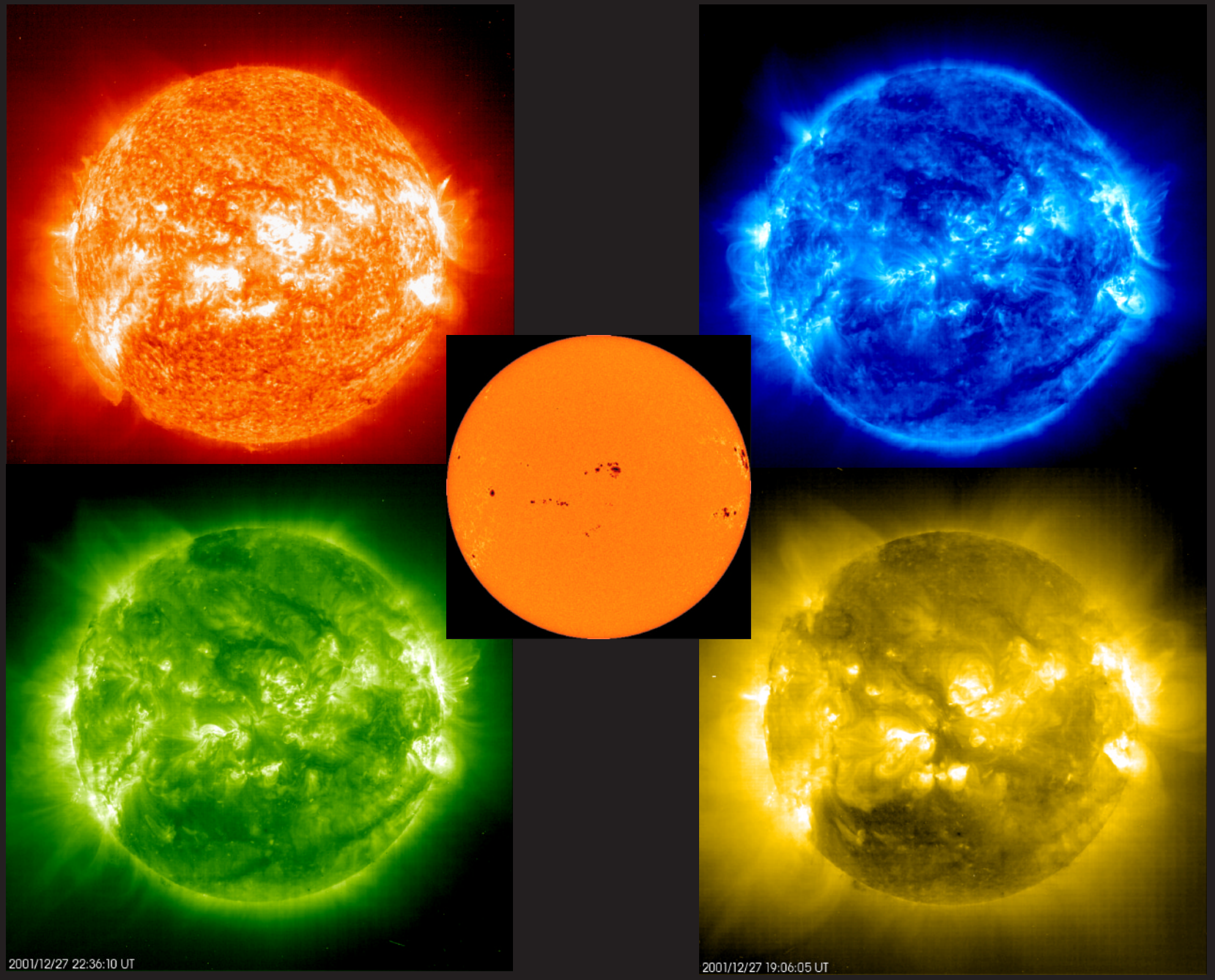


How big is the Sun? You could fit 108 Earths across the diameter of the Sun. It accounts for 99% of the mass in our solar system.

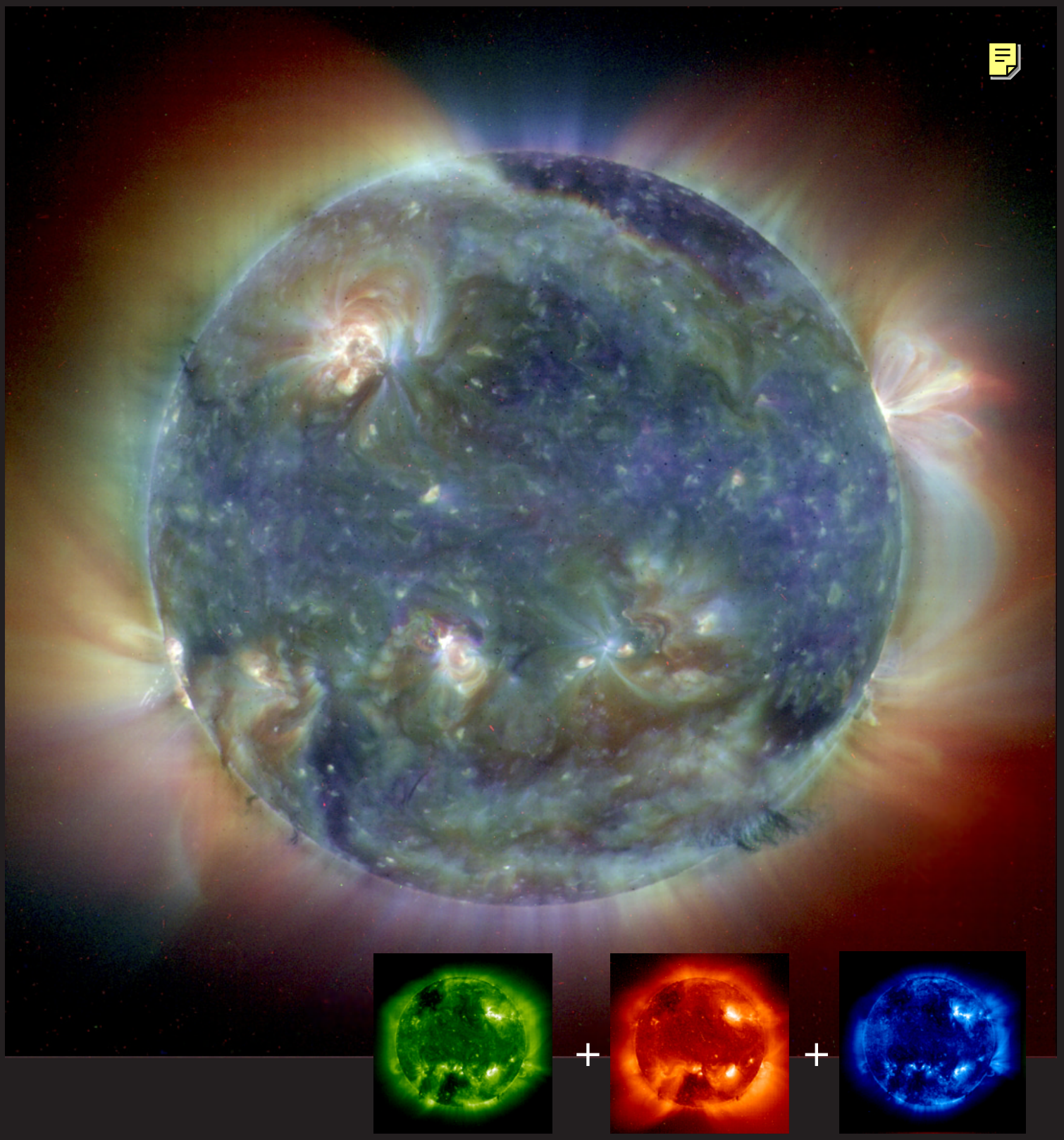


The Sun has a diameter of about 1.3 million kilometers (860,000 miles)

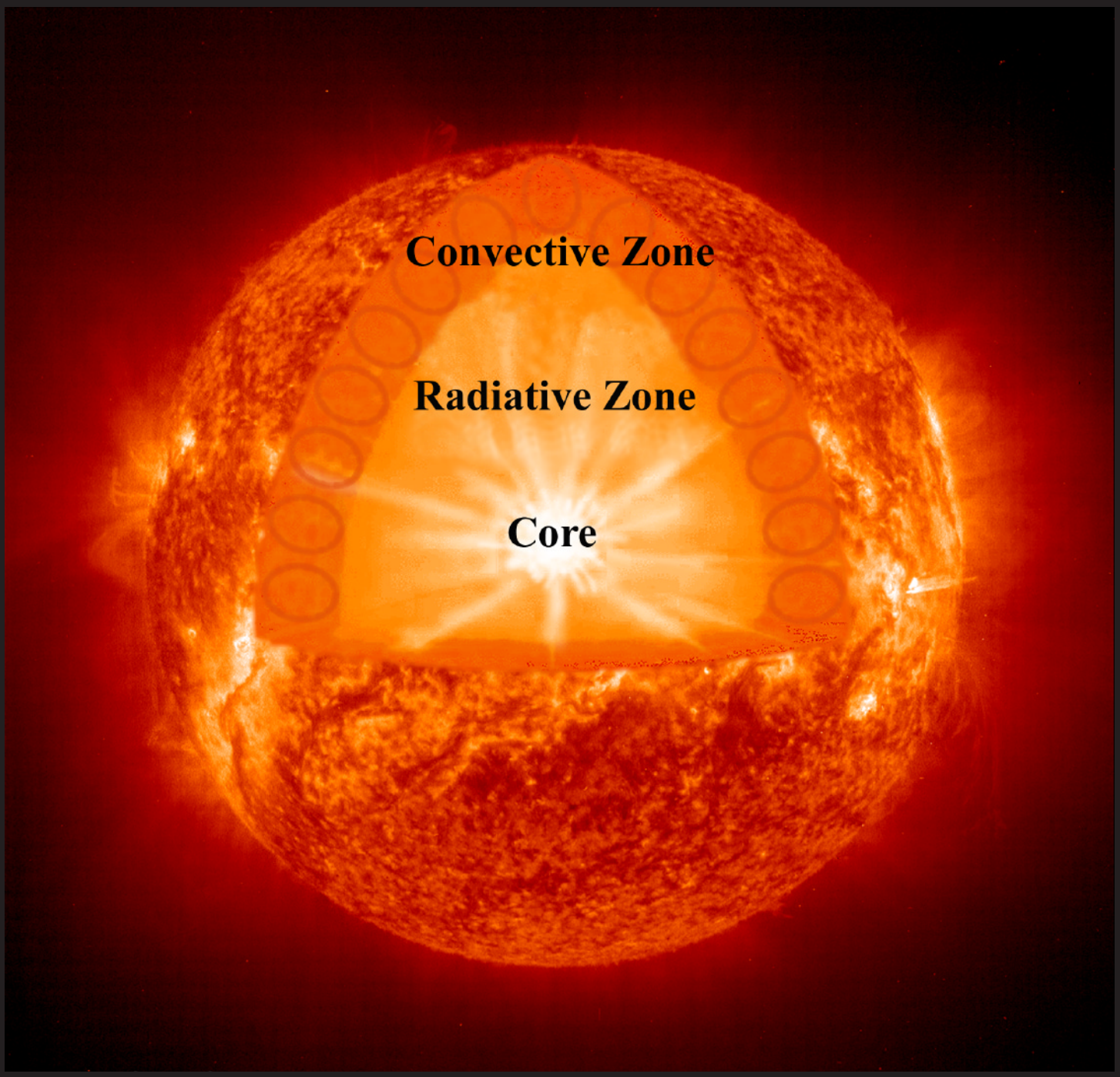
SOHO observes the Sun in four extreme ultraviolet wavelengths as well as in visible light (center)



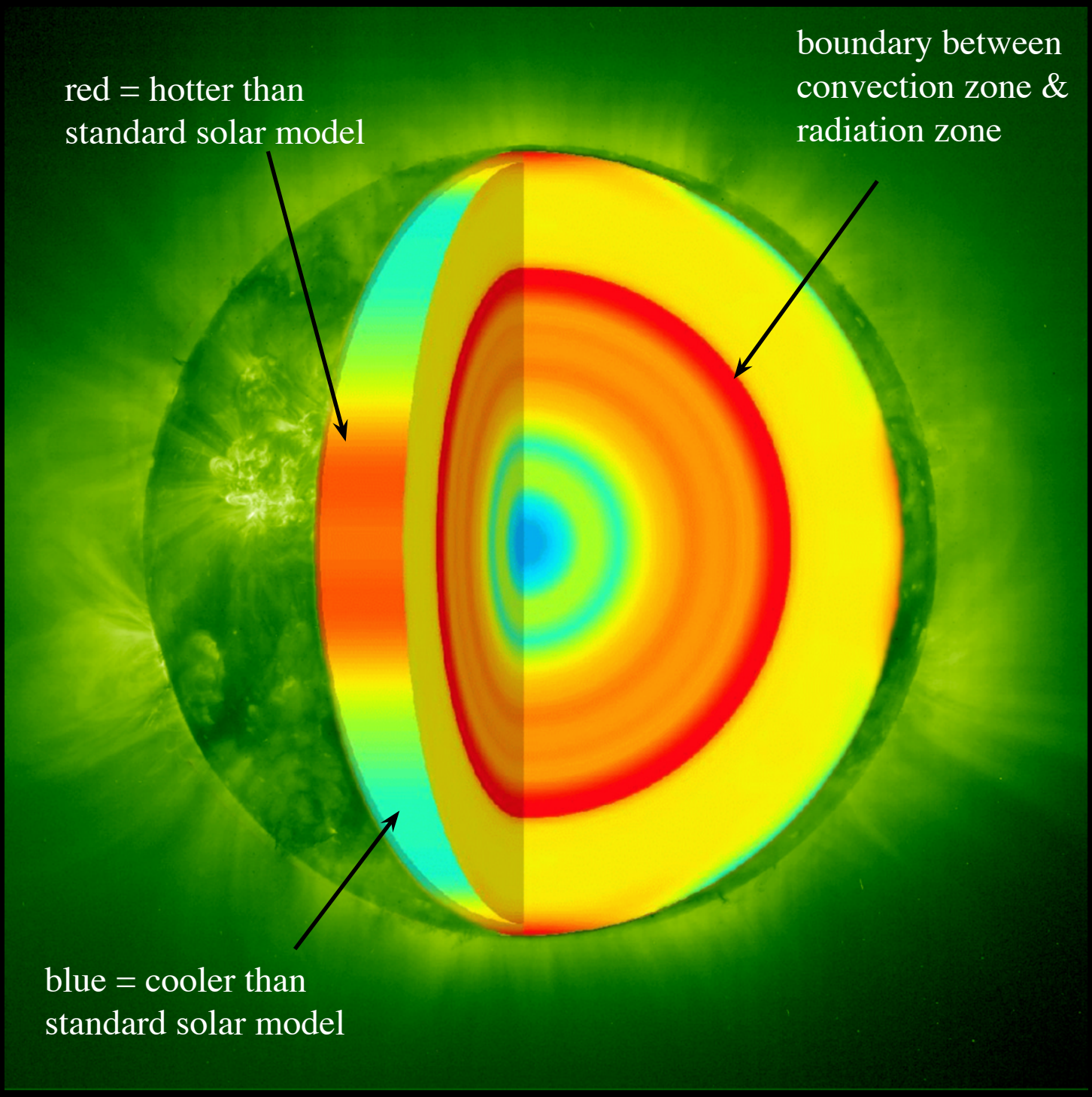
A composite image of the Sun, combining three different ultraviolet wavelengths, reveals solar features unqiue to each



The three major layers of the Sun's internal structure



Using helioseismology, SOHO can see inside the Sun to reveal its structure and interior processes



A magnetic observation of the Sun where the black and white areas represent north and south polarities -- magnetic fields are the forces driving most solar activity

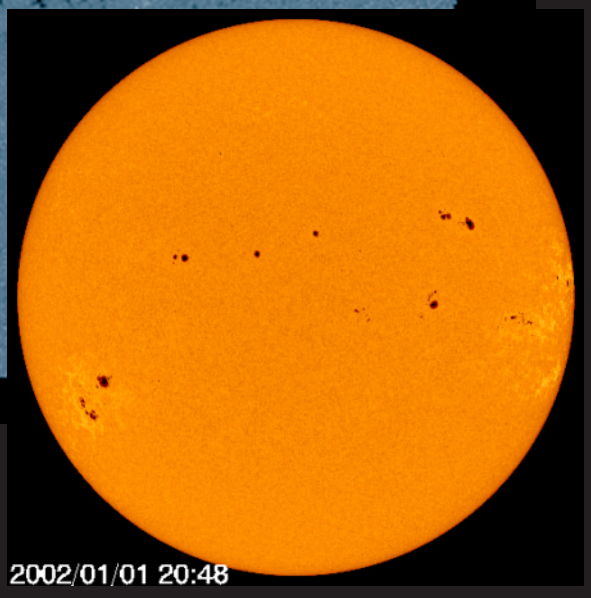
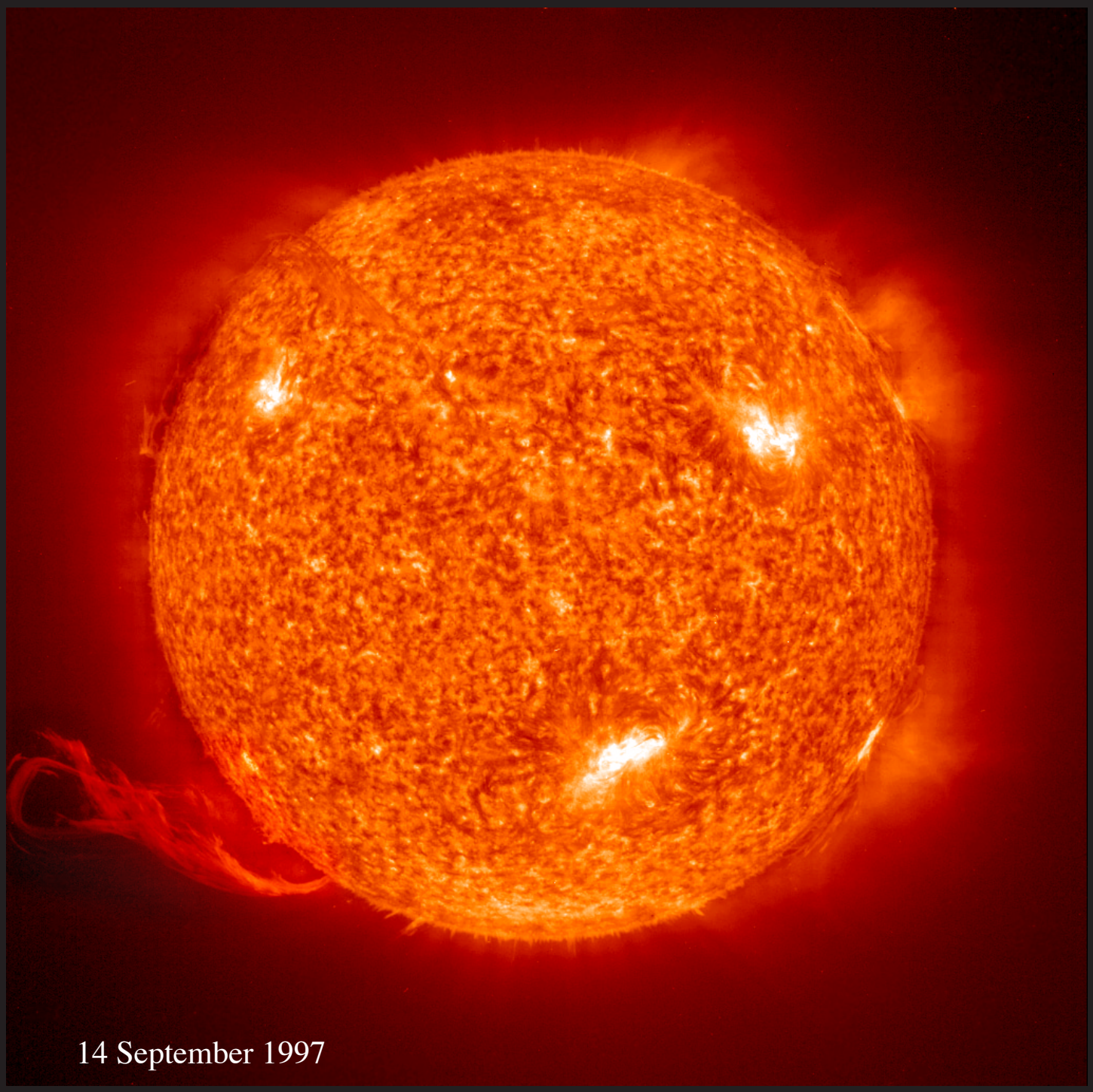
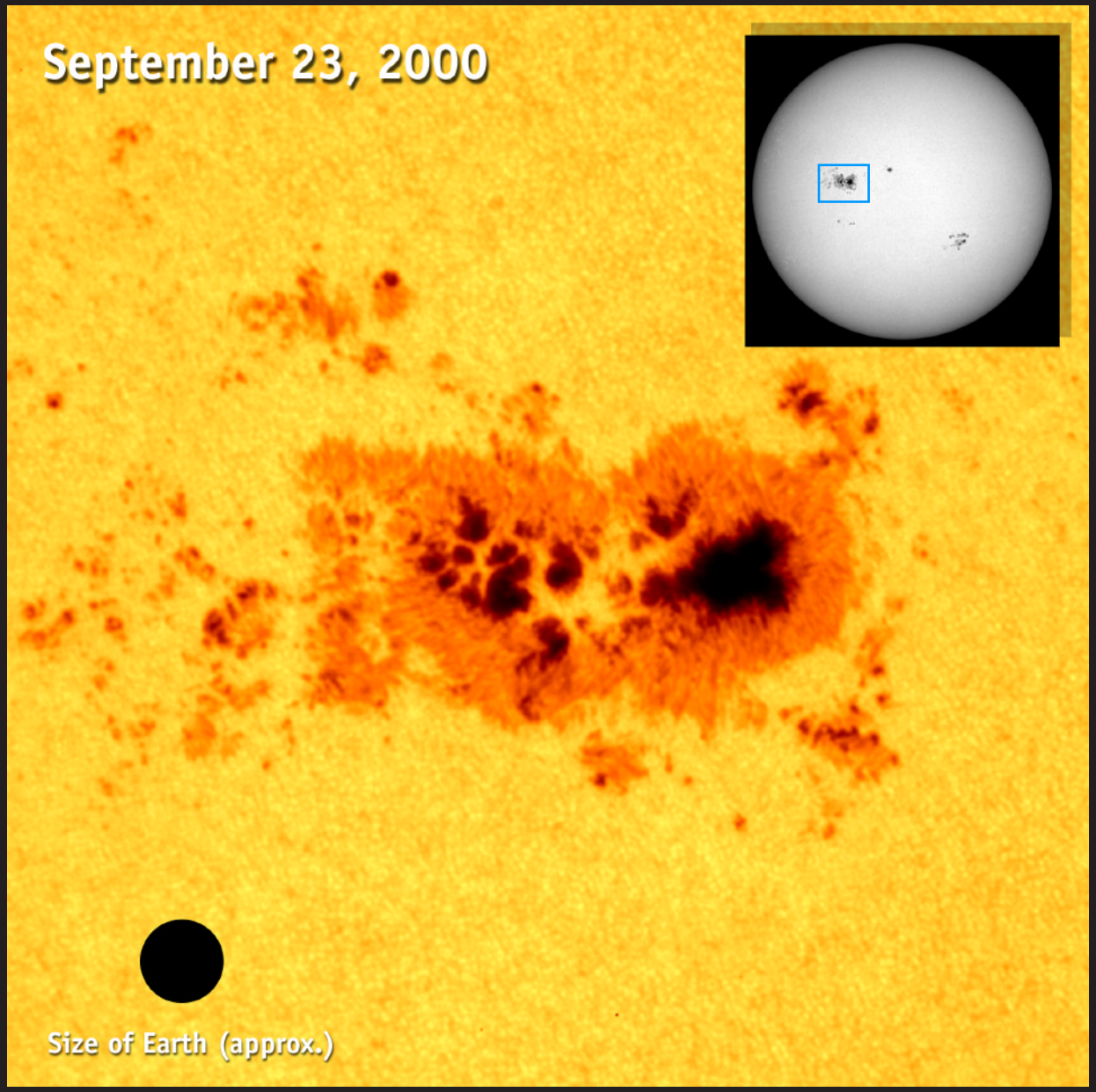


Image in visible light from the same day

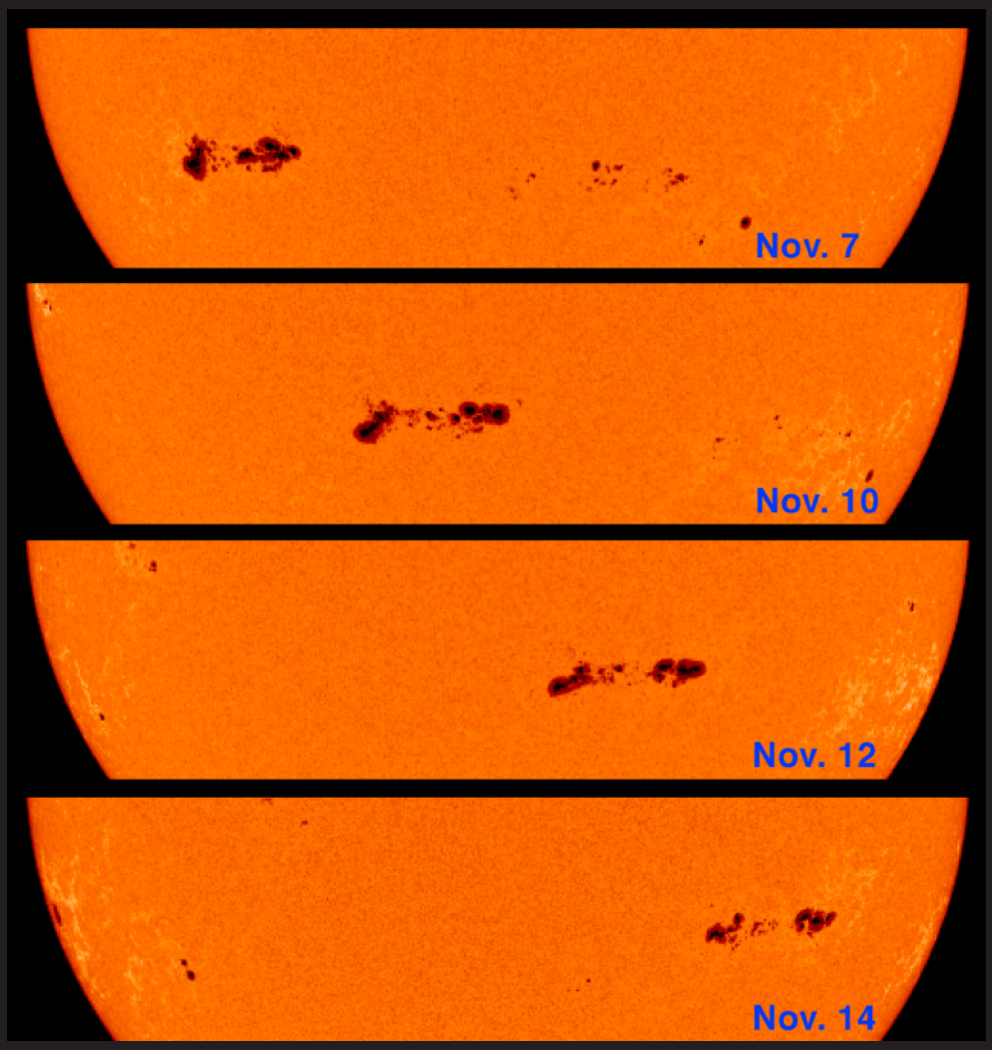
An eruptive prominence extends from the Sun



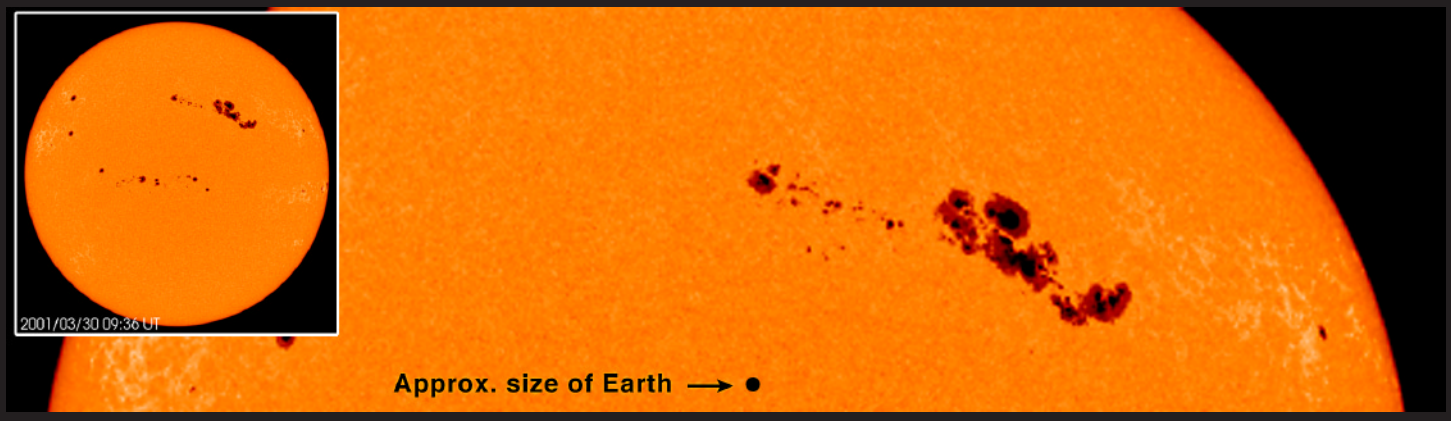
A very large sunspot group, about 13 times the size of Earth



Sunspots changing over a week

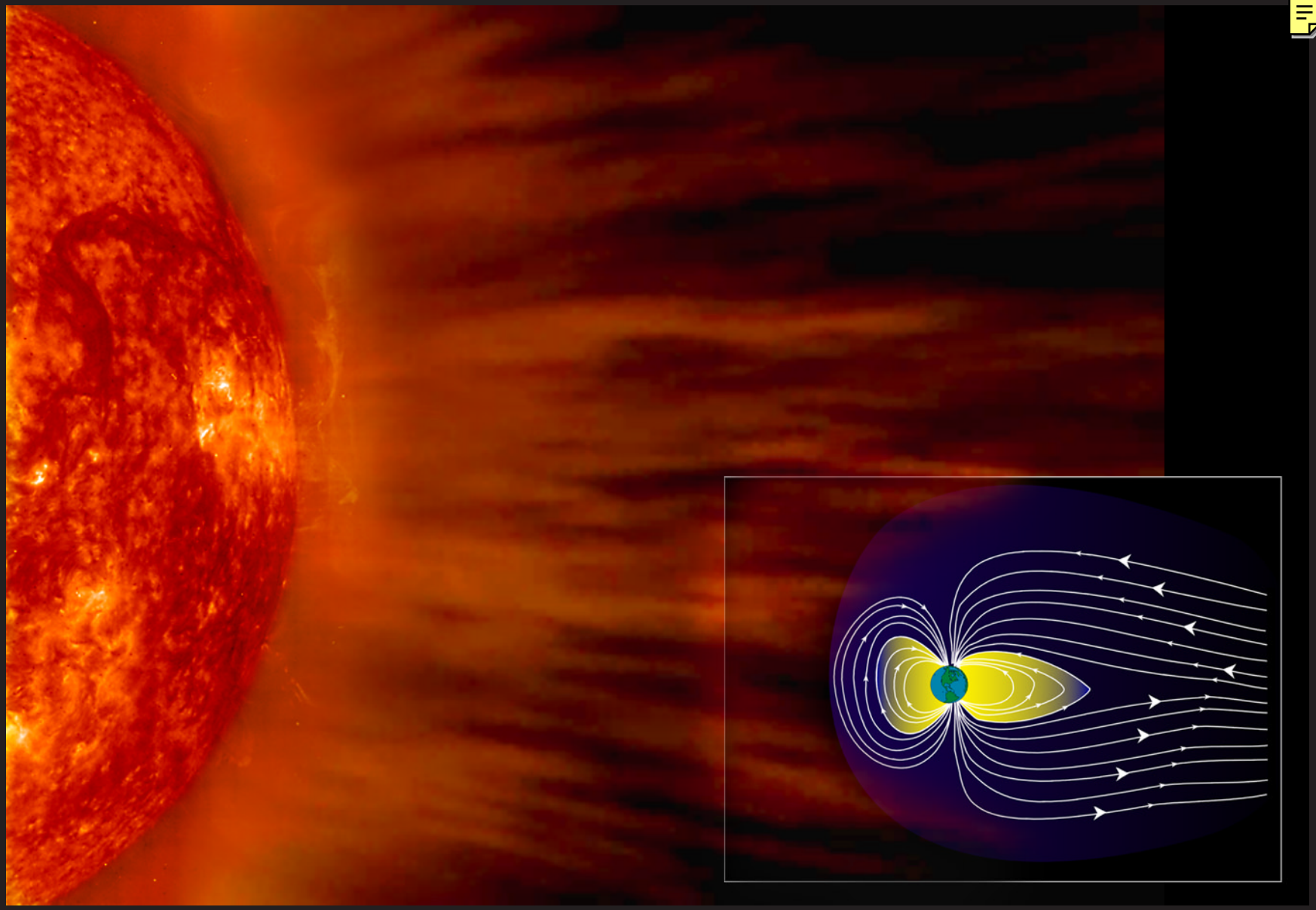


Sunspots rotate with the Sun (every 27 days) and can appear, grow, get smaller or disappear over time. They can last from hours to months.

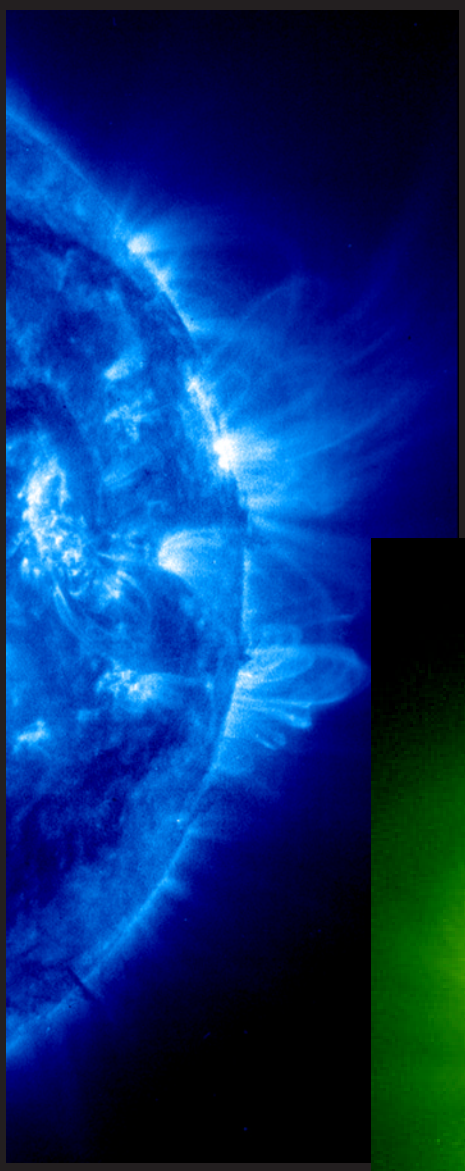


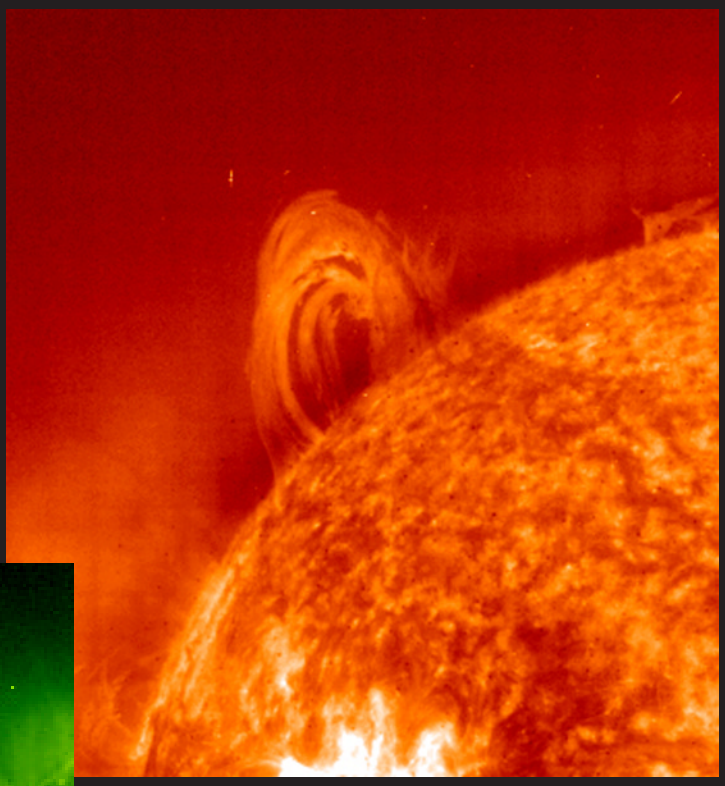
The largest sunspot observed by SOHO was over 13 times the size of Earth

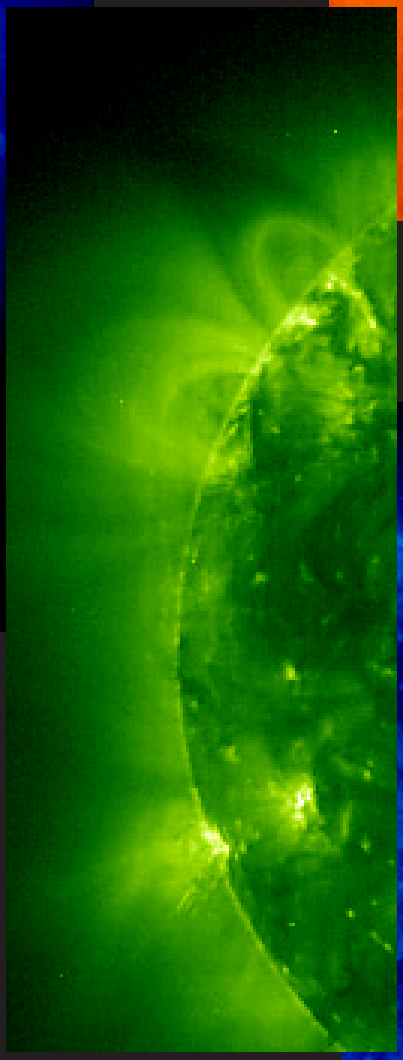
The solar wind constantly streams particles from the Sun into space, which pushes and shapes Earth's magnetosphere -- the Earth bathes in the Sun's atmosphere

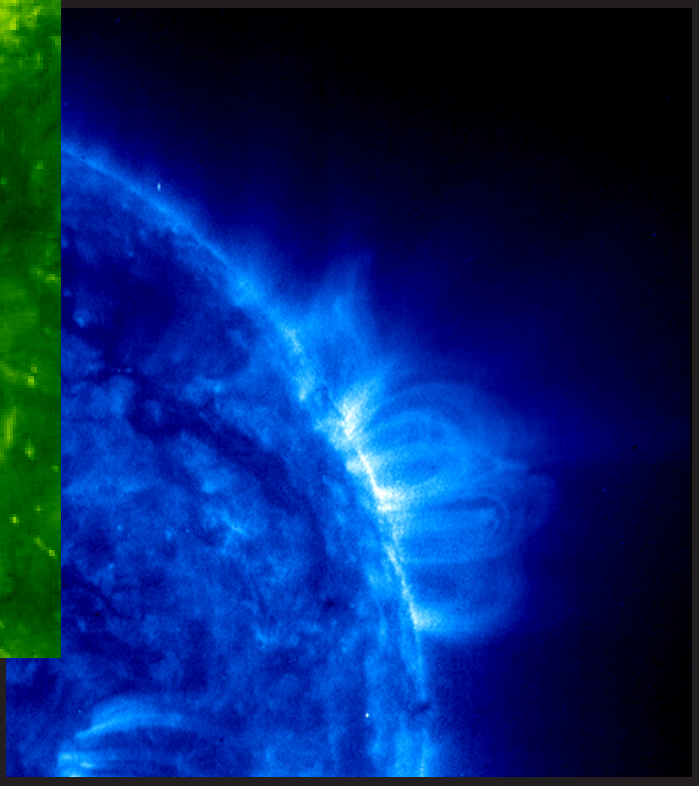


Magnetic loops are made visible by plasma that follows invisible field lines extending above the surface

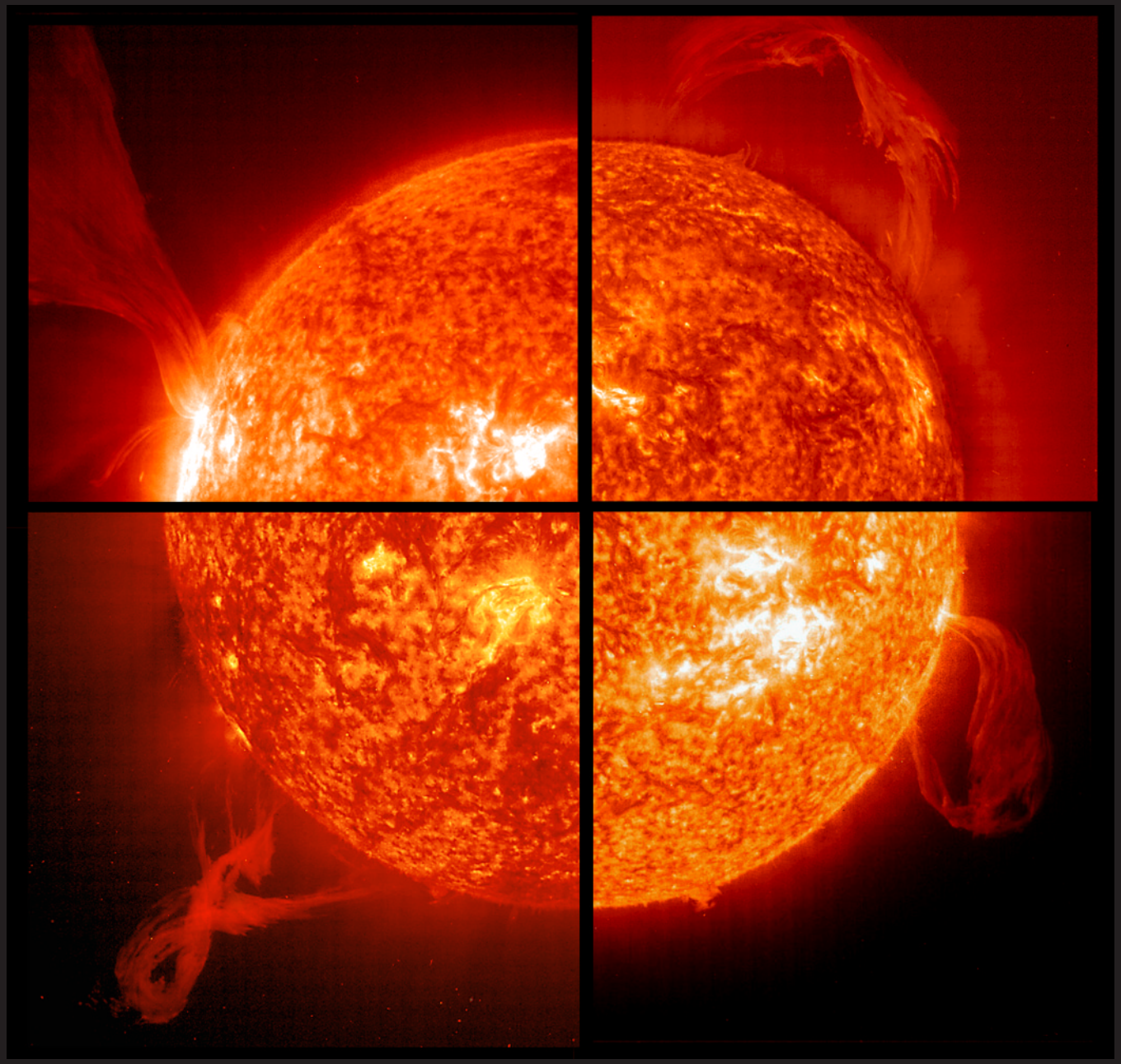




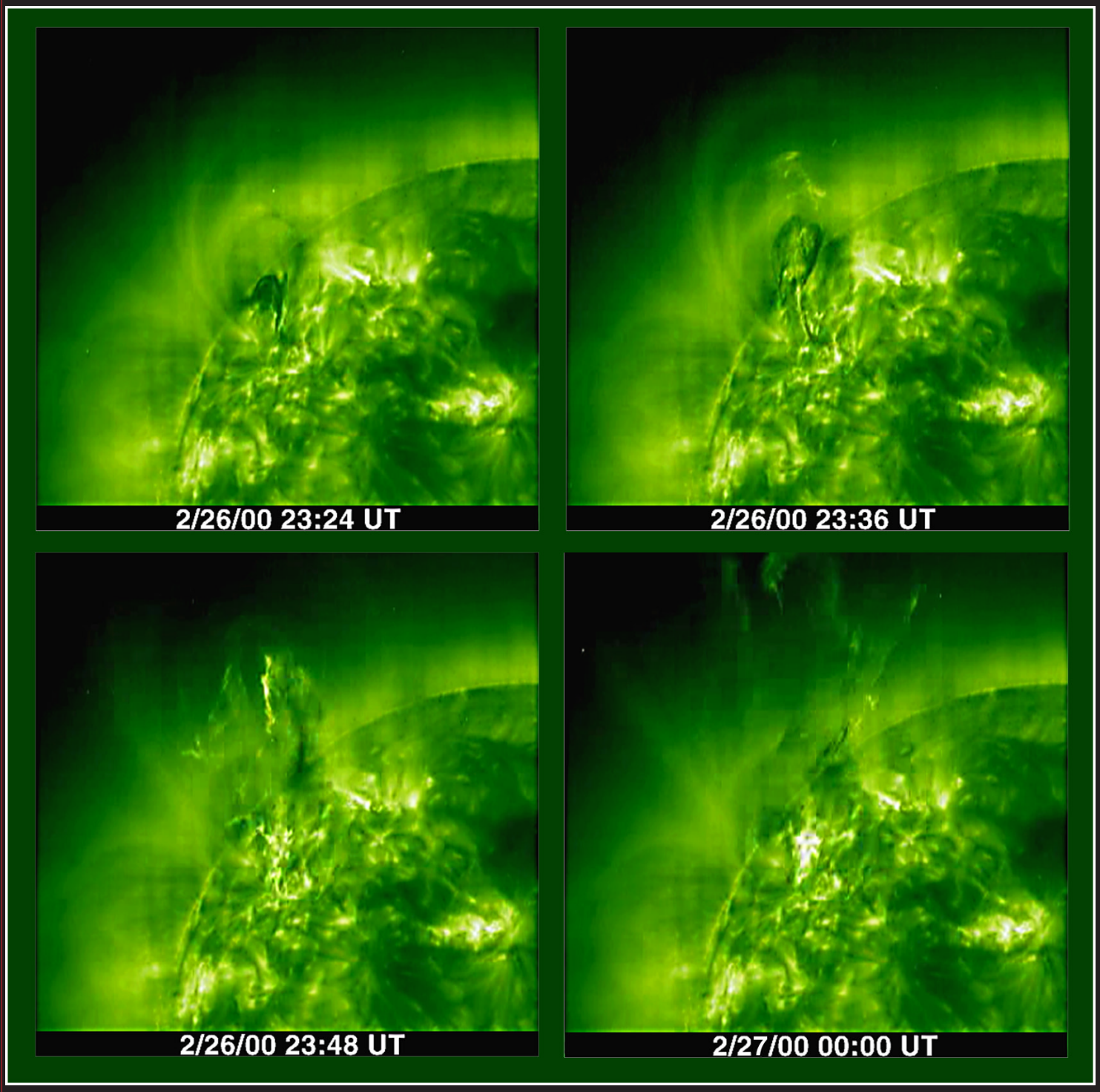




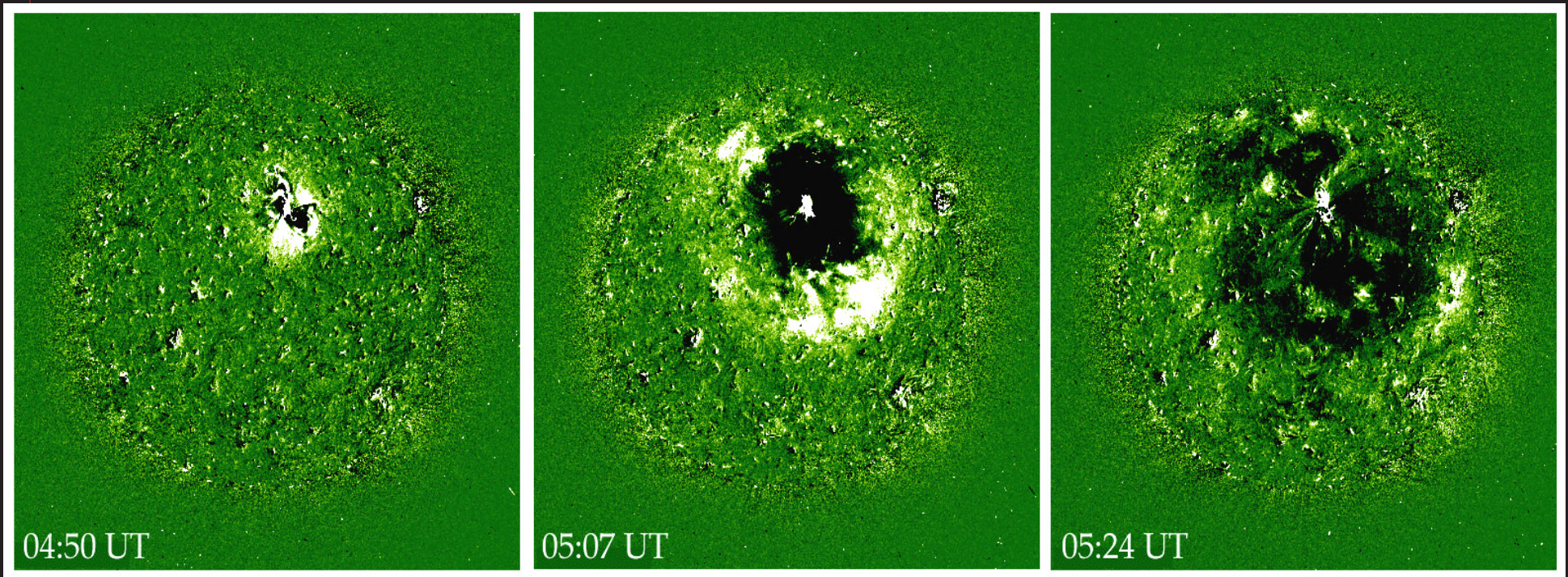
Large solar prominences, plasma extended along magnetic field lines, sometimes break away

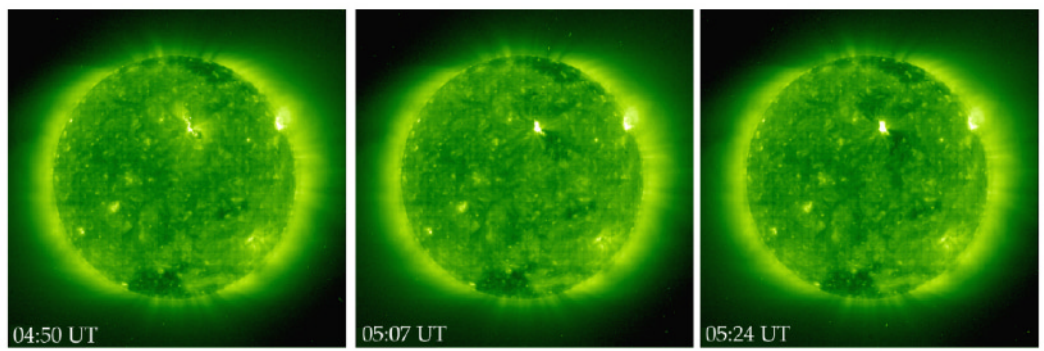


This close-up of a coronal mass ejection in extreme ultraviolet light shows a mass of particles being blasted into space over a 35-minute period



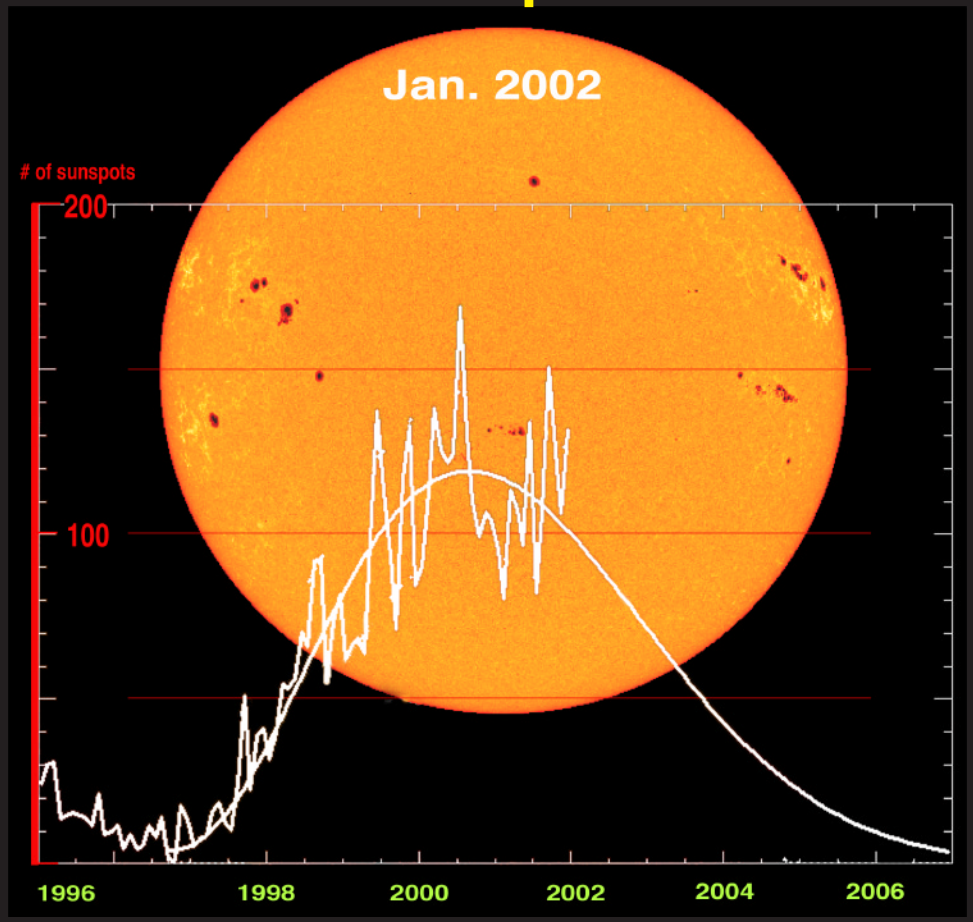
A special imaging technique highlighting change shows a wave front, driven by a CME, as it expands over much of the Sun's surface

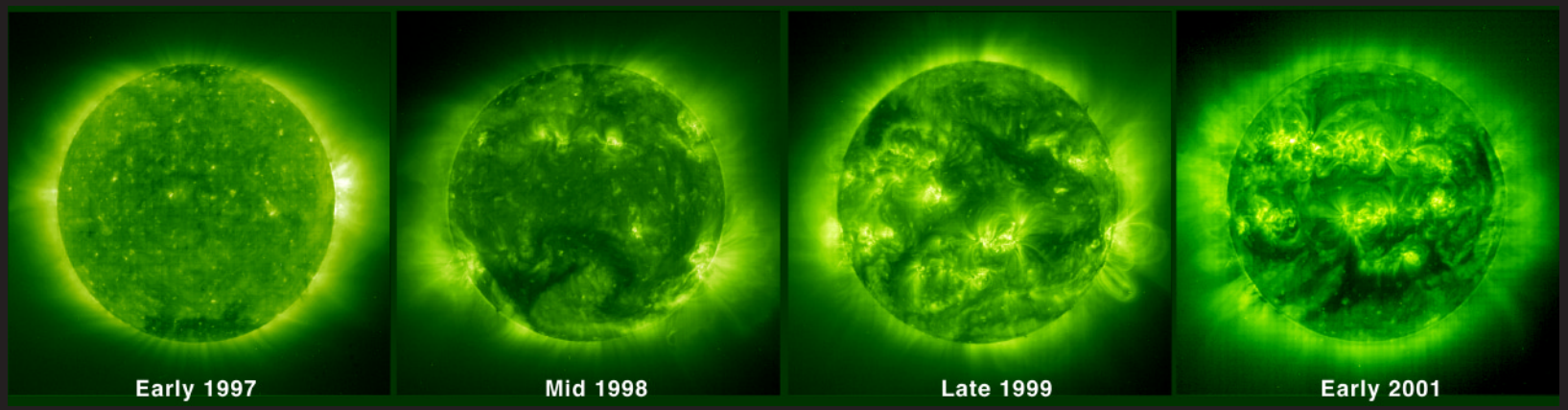




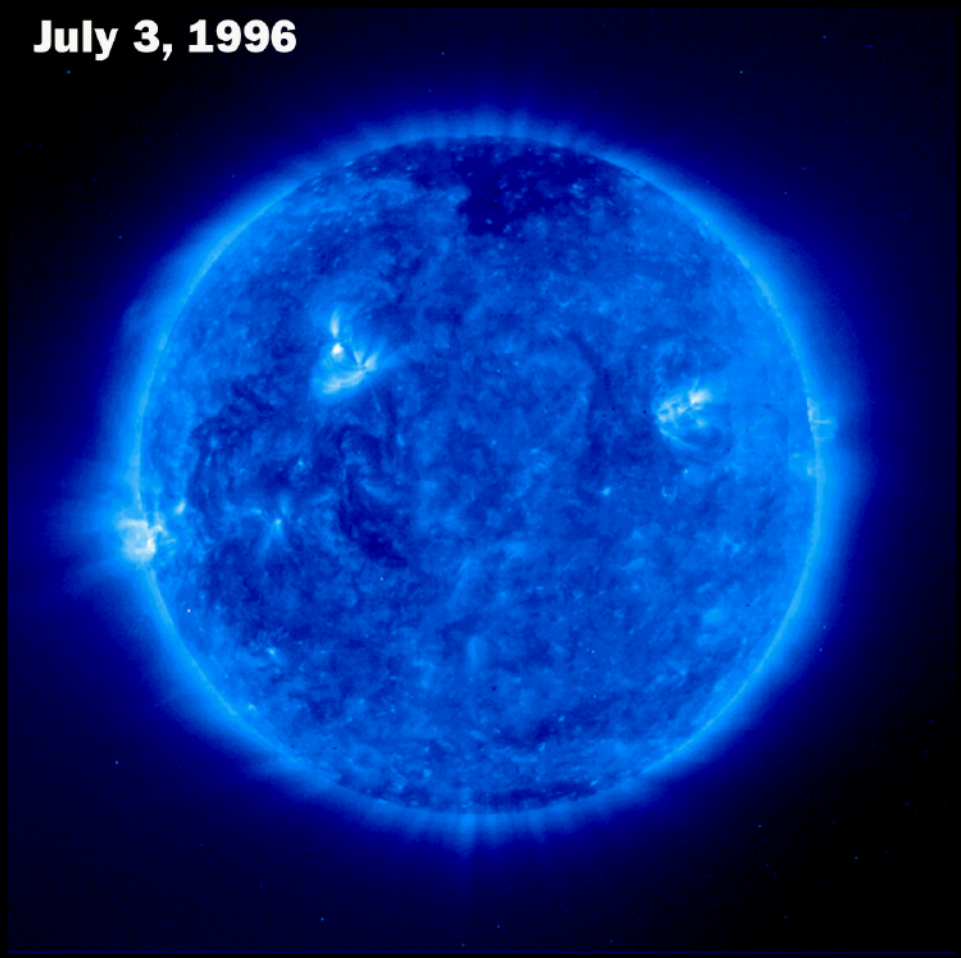
Source of this CME and wave as seen in an ultraviolet image

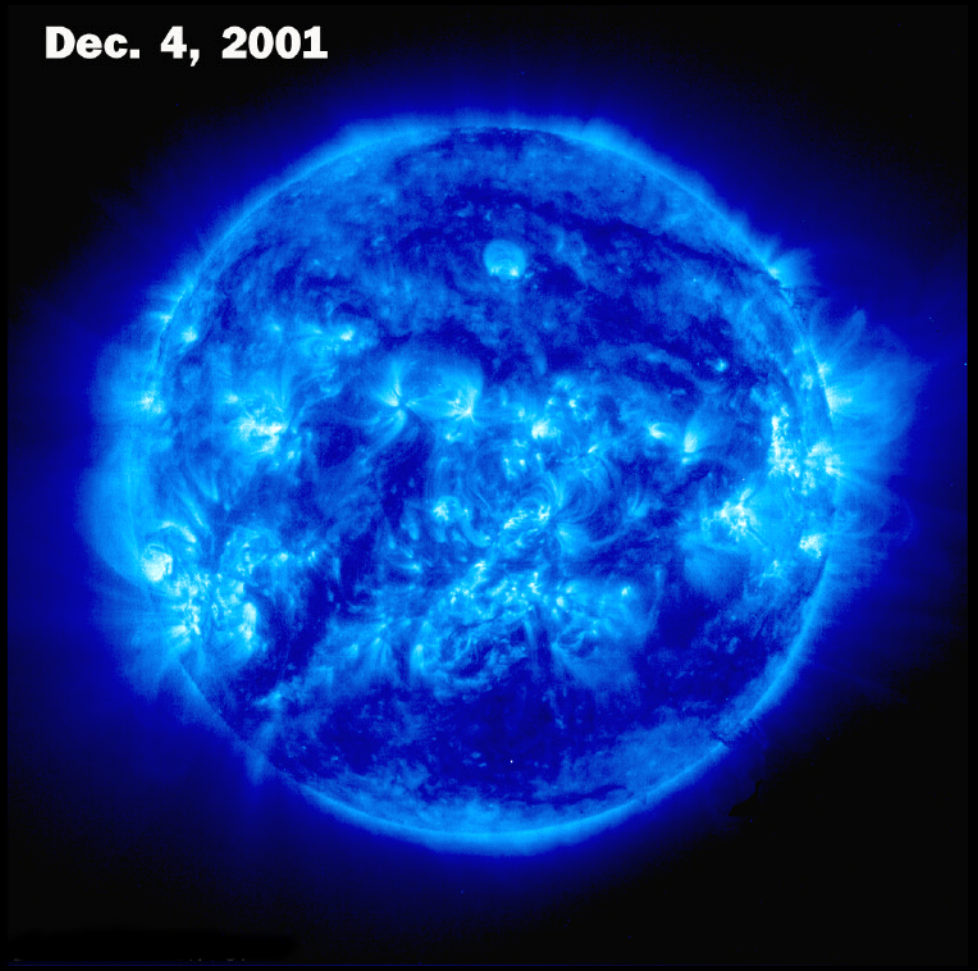
The current solar cycle (as measured by sunspot numbers) shows a double-peak of maximum activity





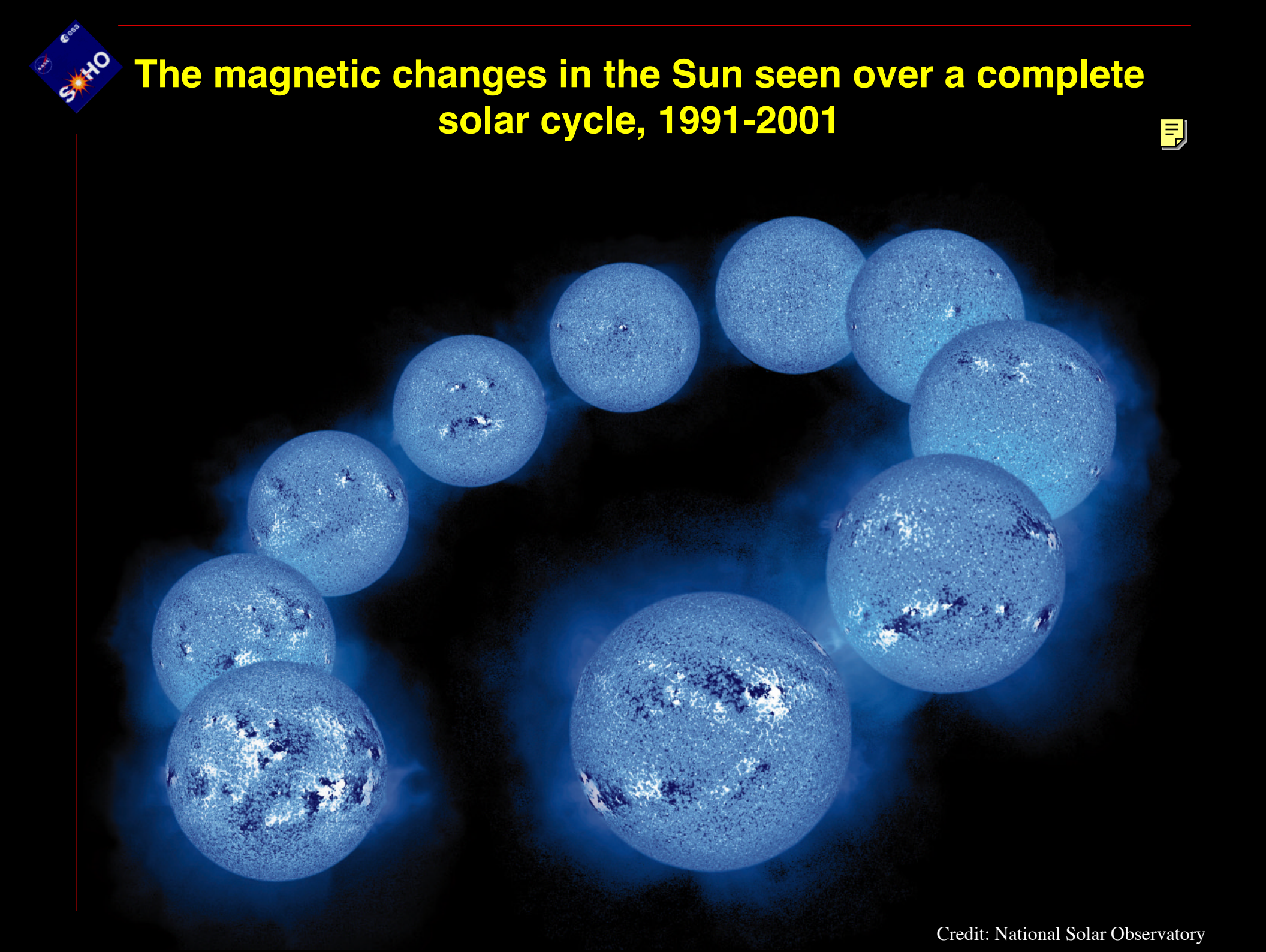
A comparison of two ultraviolet images over five years apart illustrates how the level of solar activity increases significantly from near solar minimum to near solar maximum





(Note: the bright areas represent more intense magnetic activity)

The magnetic changes in the Sun seen over a complete solar cycle, 1991-2001



Credit: National Solar Observatory

This detailed close-up of an active region shows multiple magnetic loops arcing above it

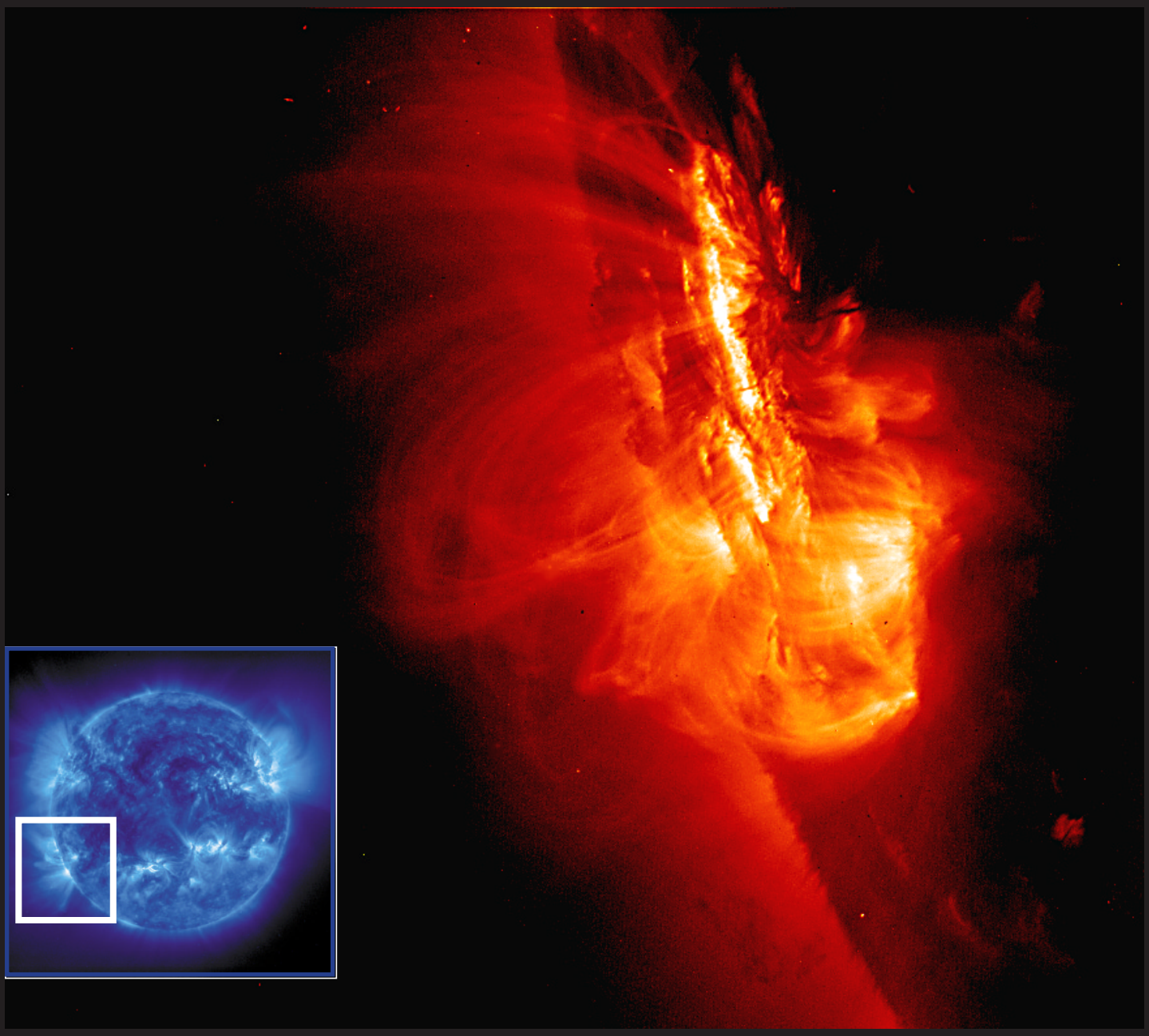
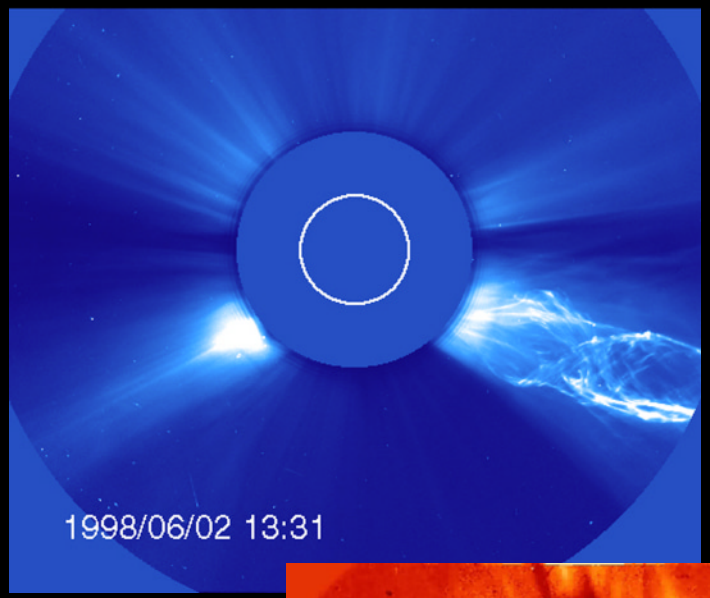
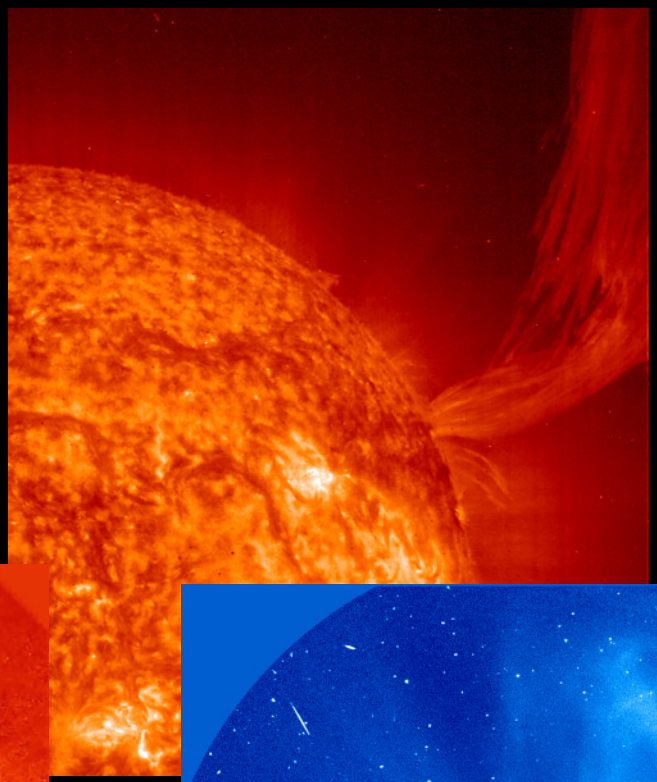
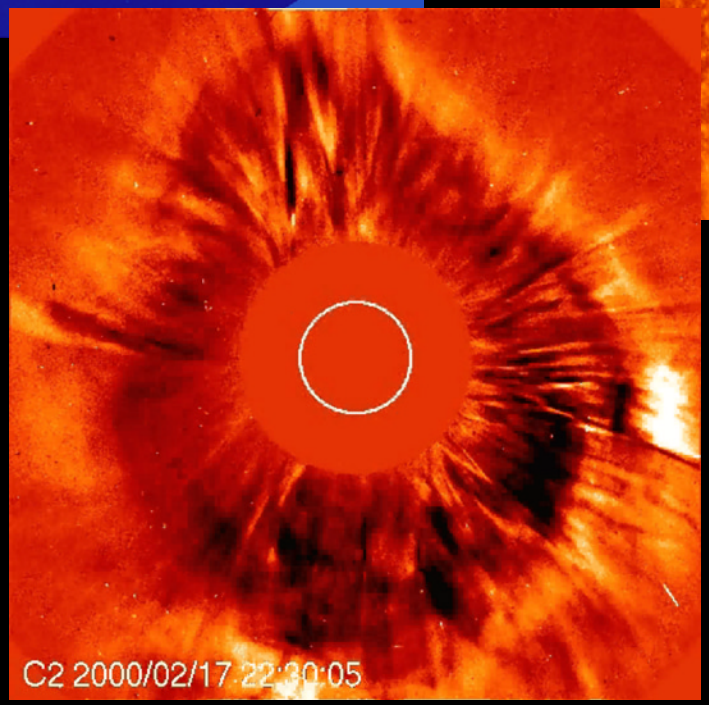


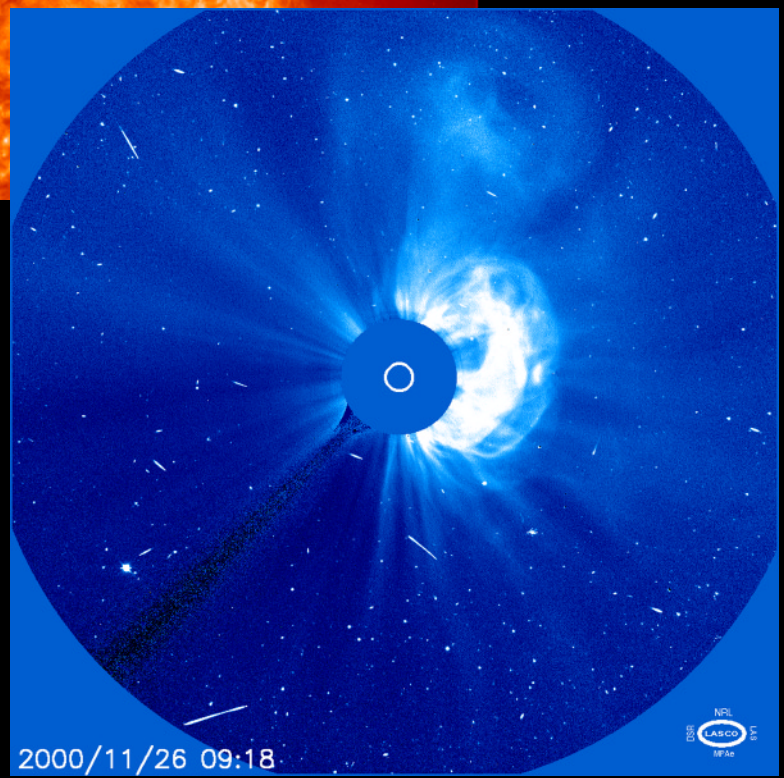
Image: Courtesy of NASA's TRACE (Transition Region and Coronal Explorer) spacecraft

Coronal mass ejections are huge explosions that send out billions of tons of matter at millions of km per hour



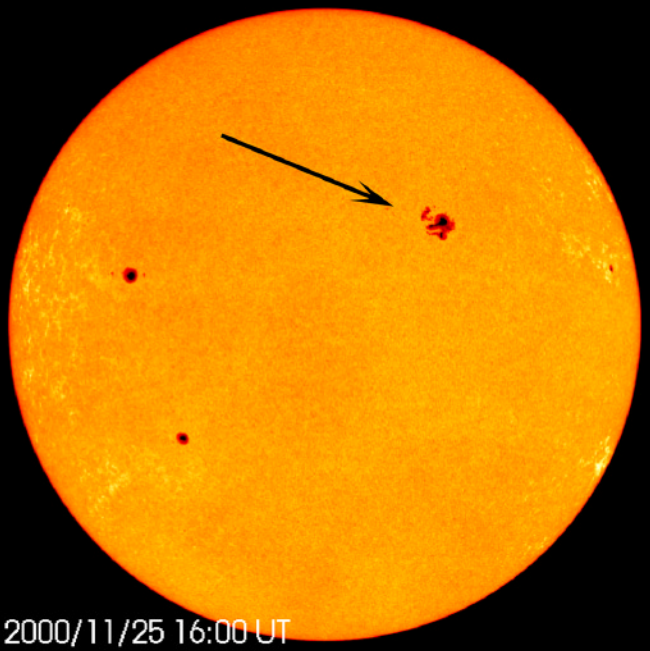


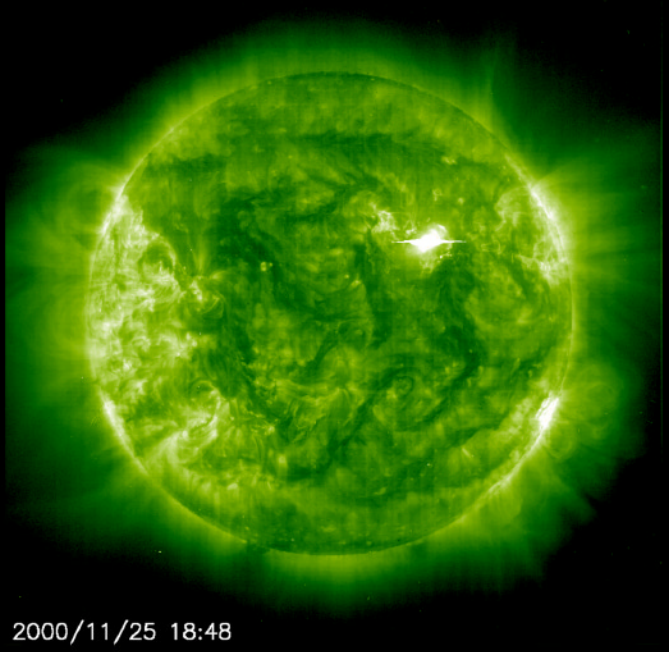


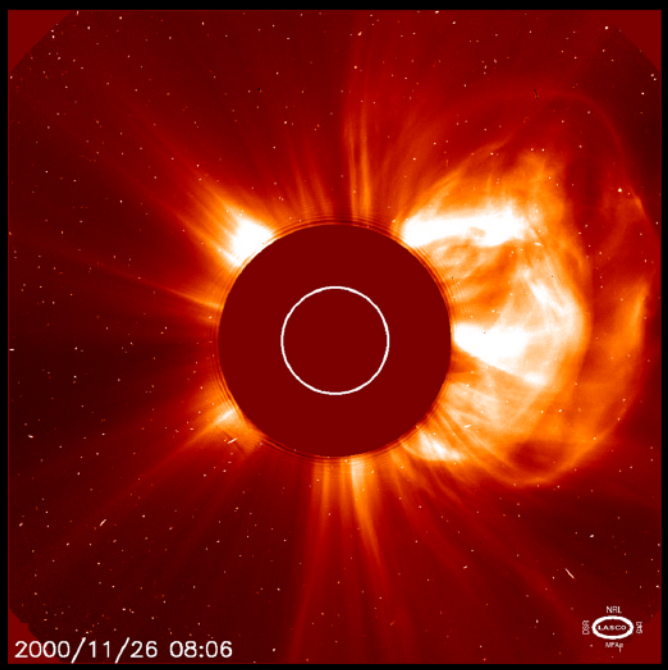


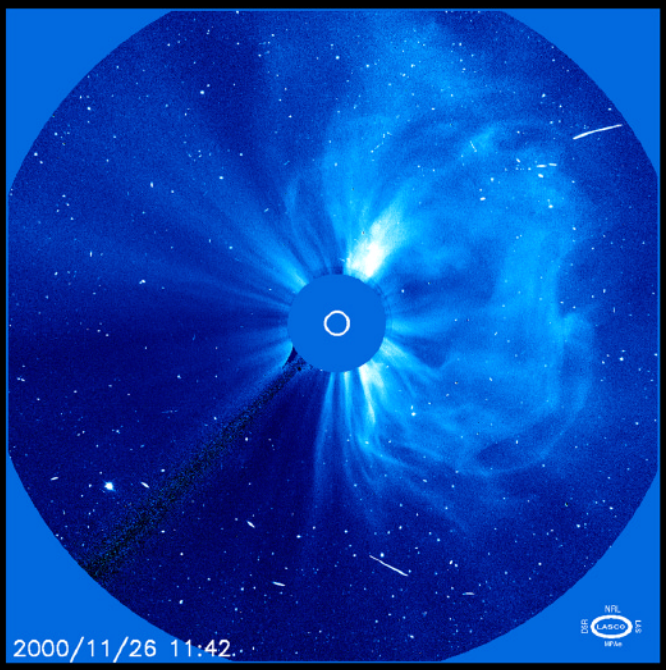
Note: In all but the upper right image, the Sun is blocked out by an occulting disk and the white outline indicates the size of the Sun.

A flare and coronal mass ejection are shown from their initial active region source to the expanding CME cloud.



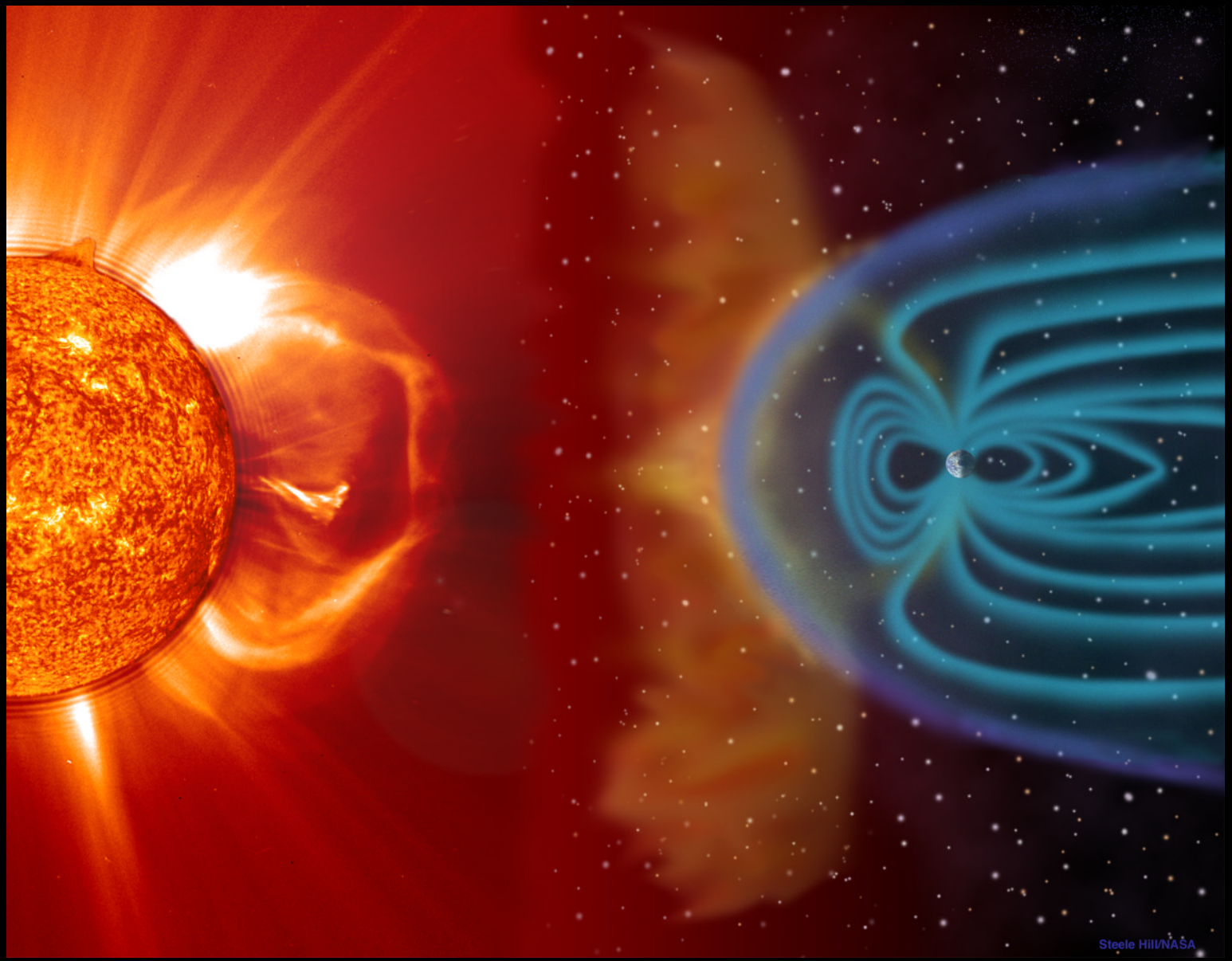






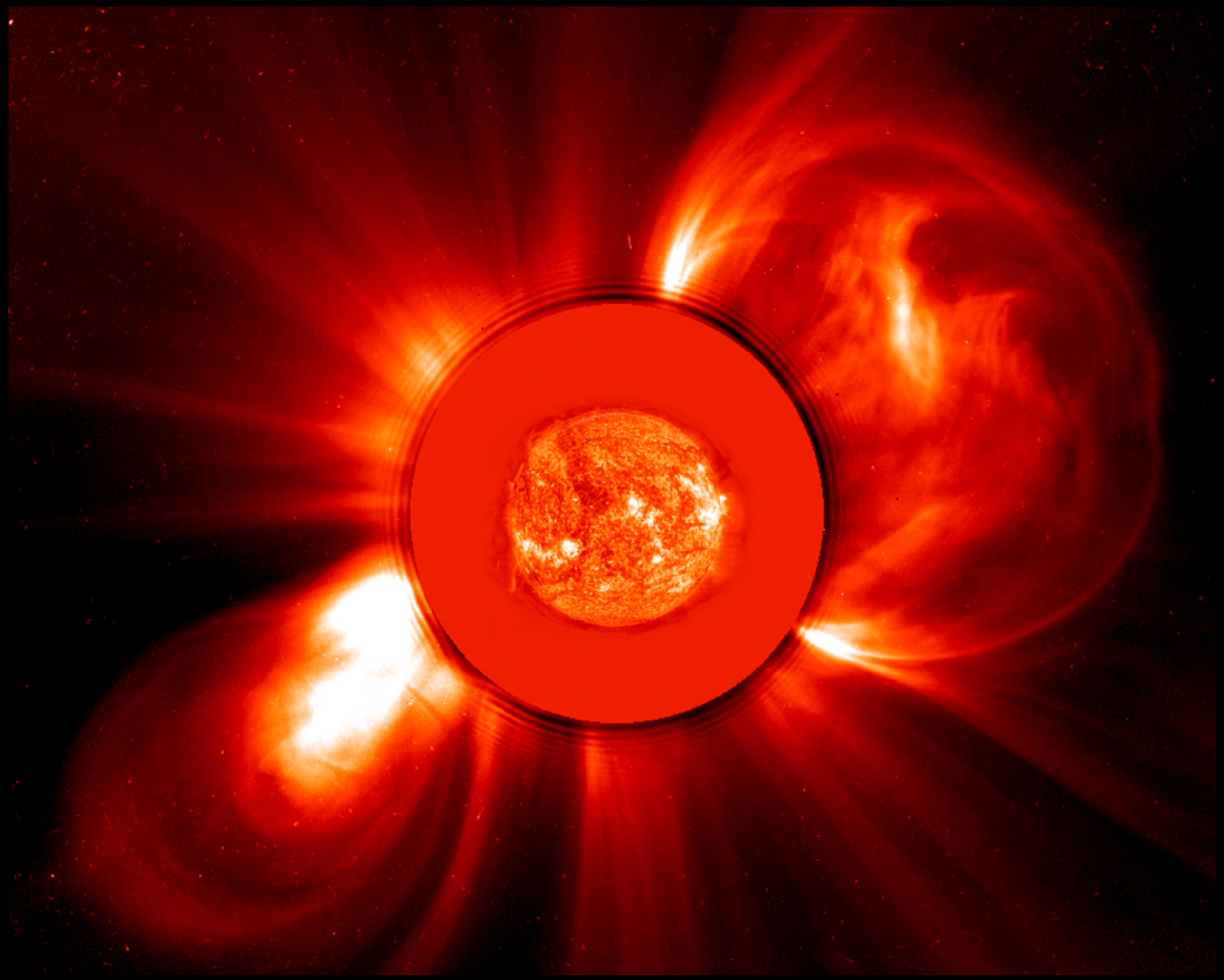
The white speckles in the last image are protons hitting SOHO.

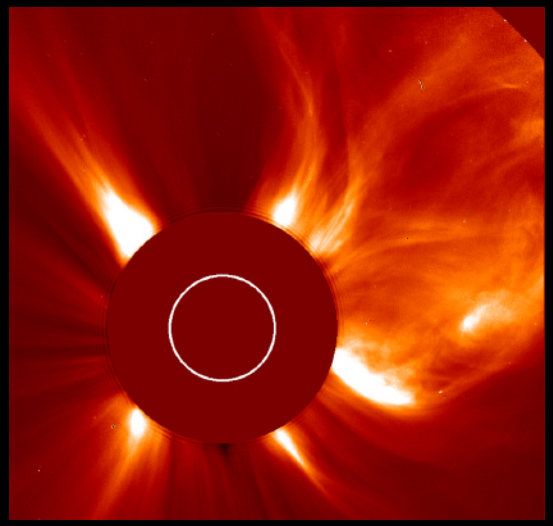
After a CME blasts from the Sun towards Earth, a cloud of charged particles impacts our magnetosphere in 2 - 4 days. Thus, the Earth is electrically connected to the Sun.

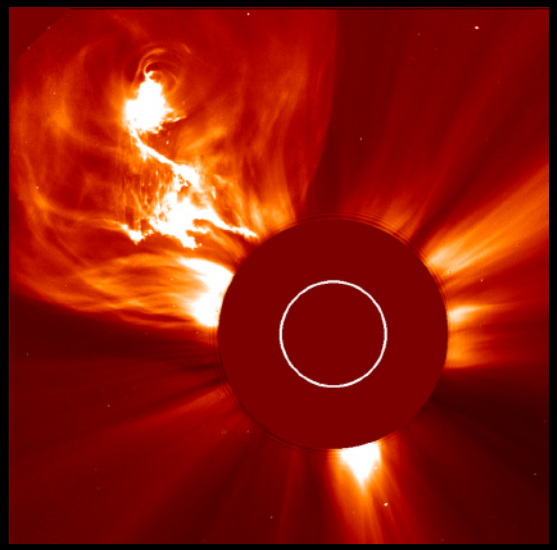


Note: The distance and size of the Sun to earth is not to scale

A double CME blasts particles out in opposite directions, one just minutes after the other

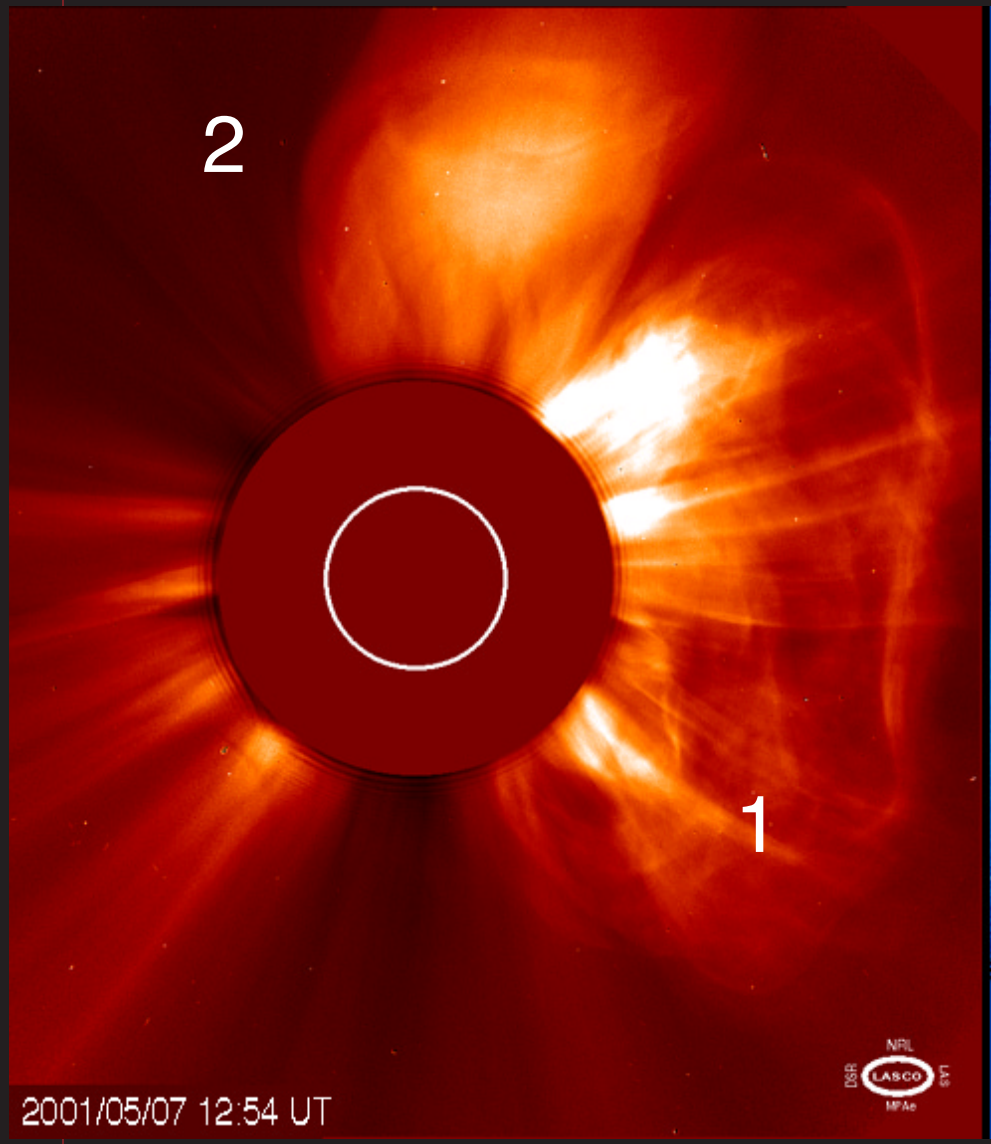


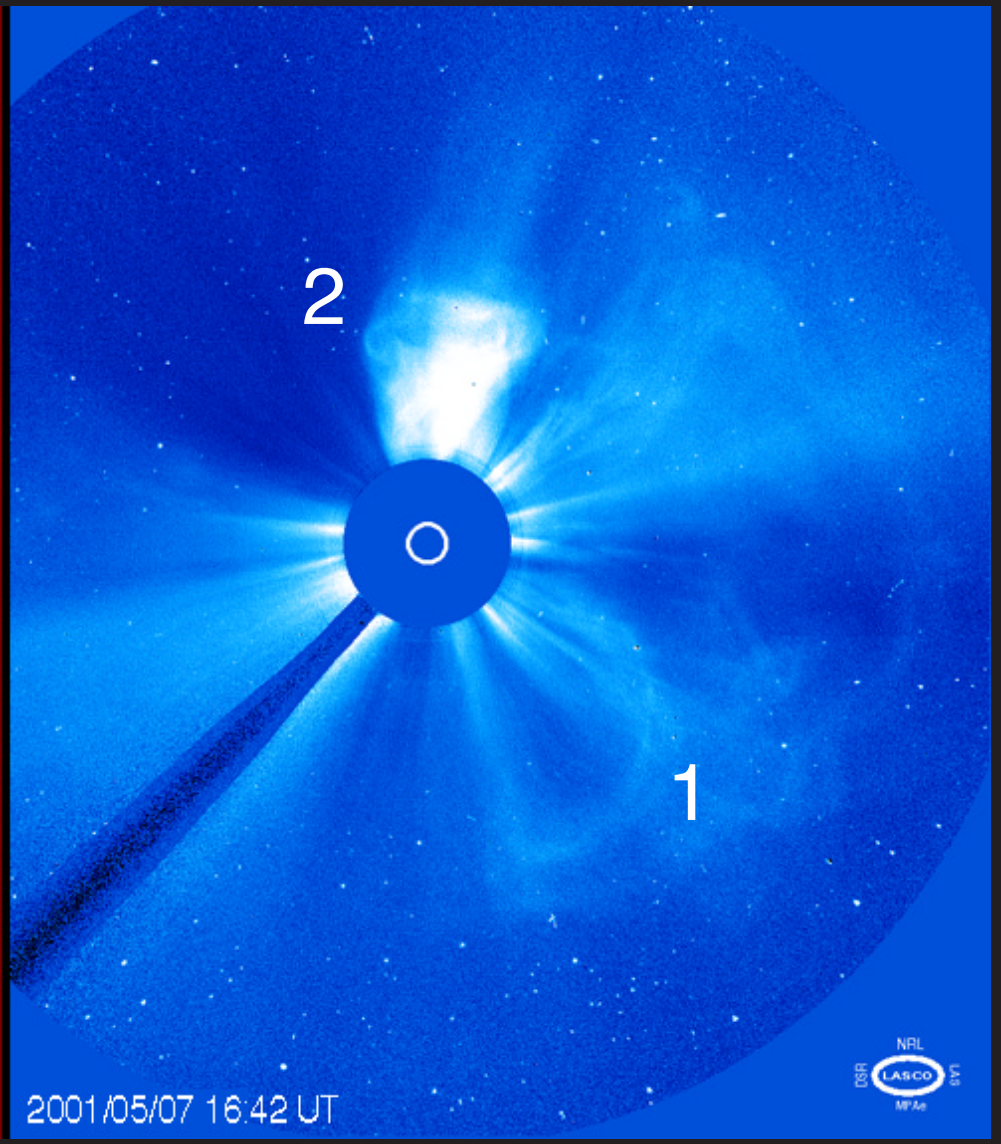




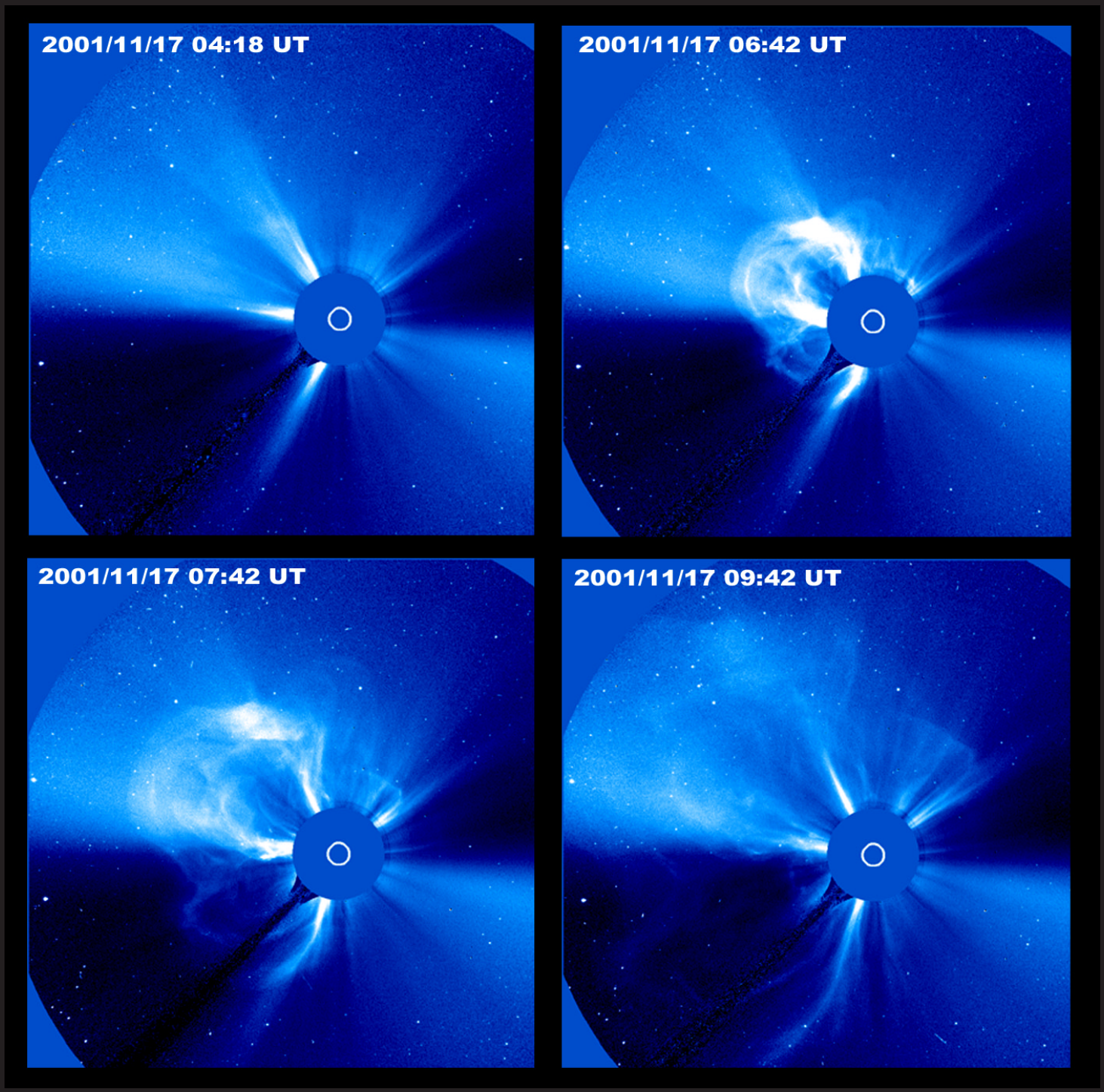
Note: An ultraviolet image of the Sun has been superimposed on the image's occulting disk to show the Sun

Two coronal mass ejections (CMEs) almost at the same time, an uncommon event

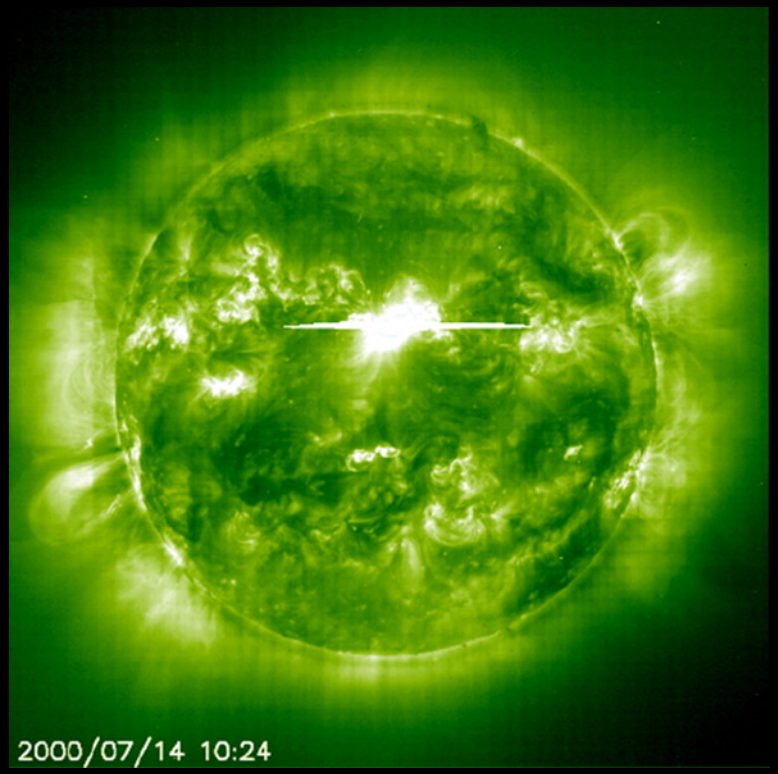




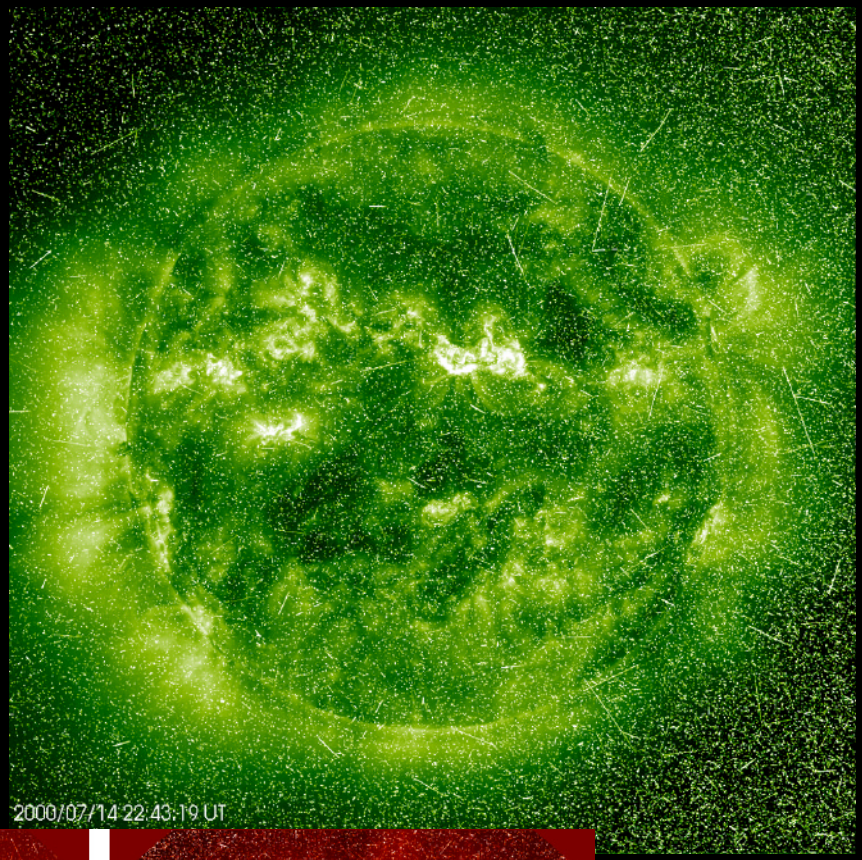
A CME cloud expanding over a four hour period as viewed by the LASCO C3 instrument



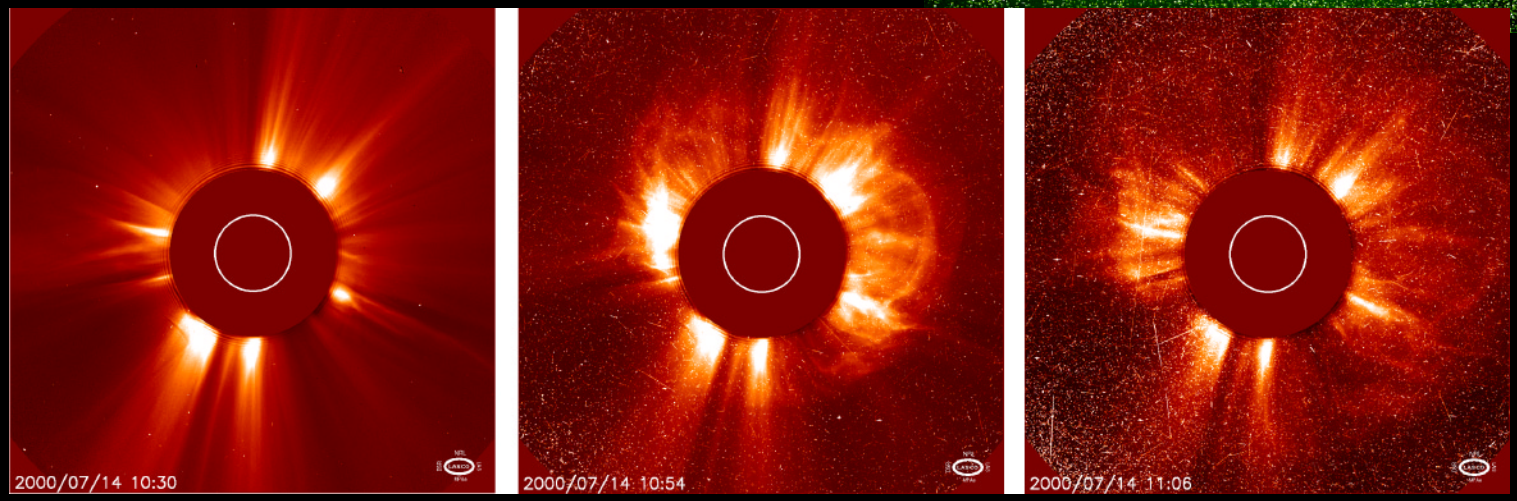
A strong solar flare triggers the largest particle storm of this solar cycle near solar maximum



A powerful flare flashes . . .



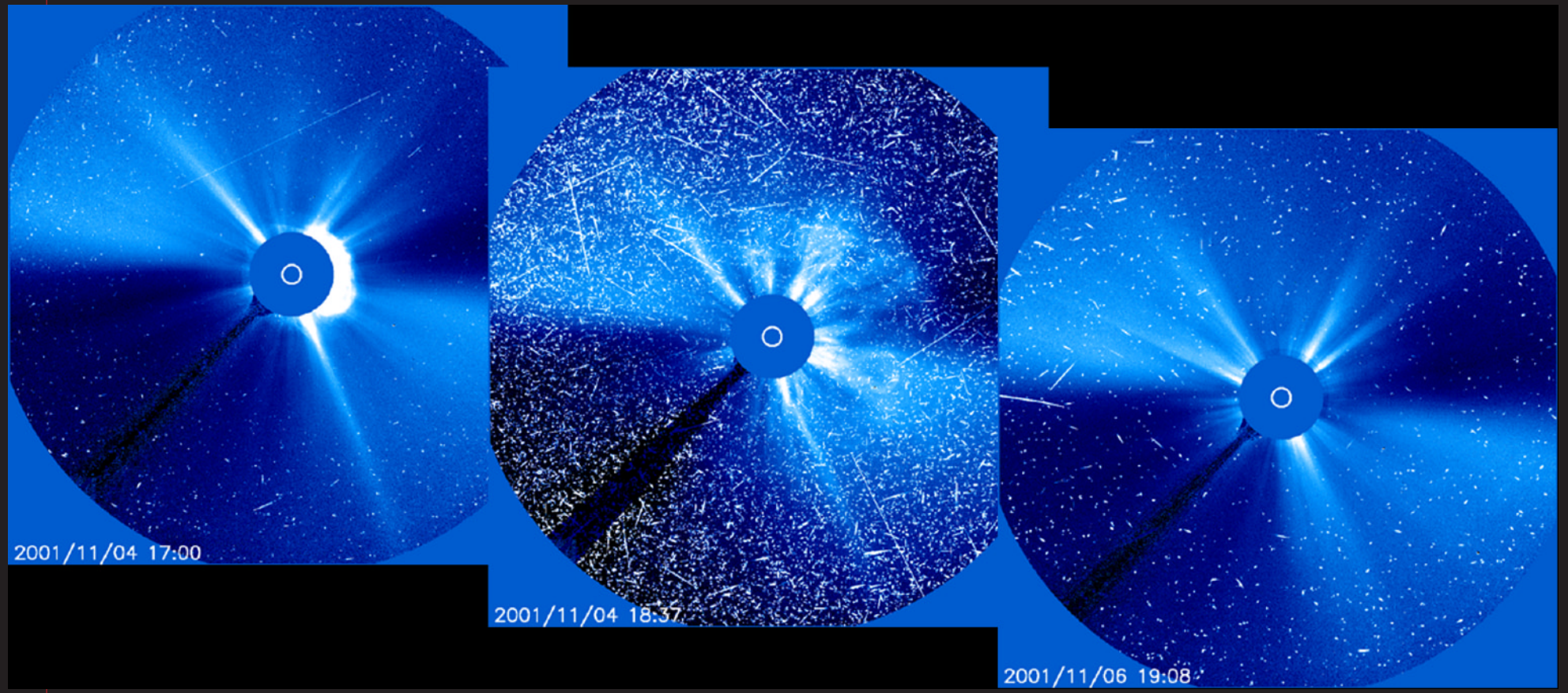
and hours (even days) later high-energy protons were still smacking SOHO



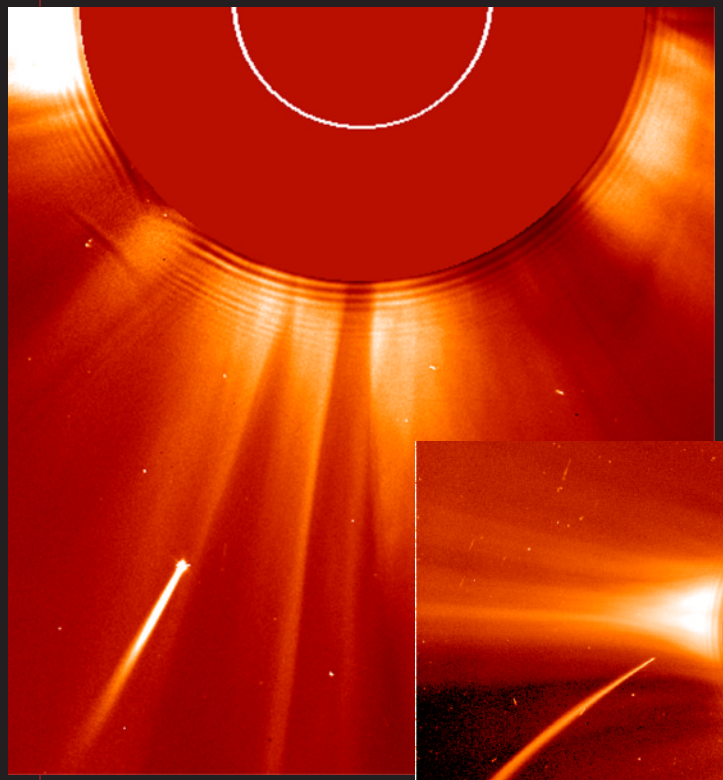
Protons unleashed by the flare begin striking SOHO in minutes

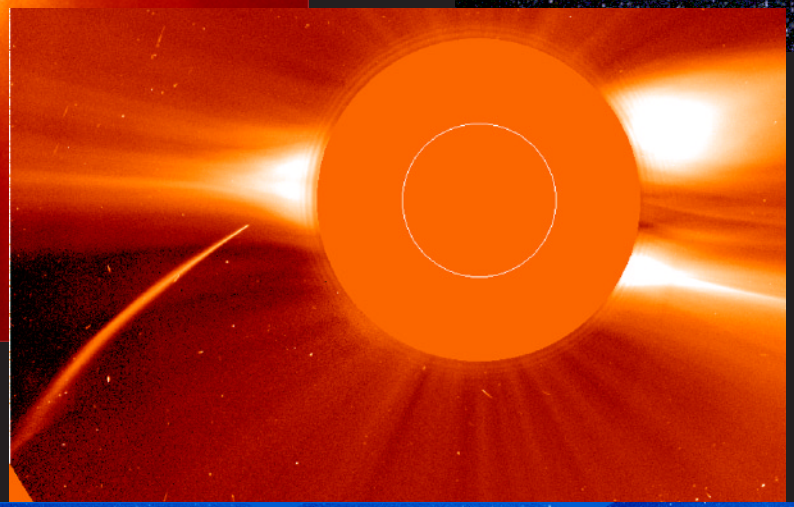
A high-energy proton event associated with a CME

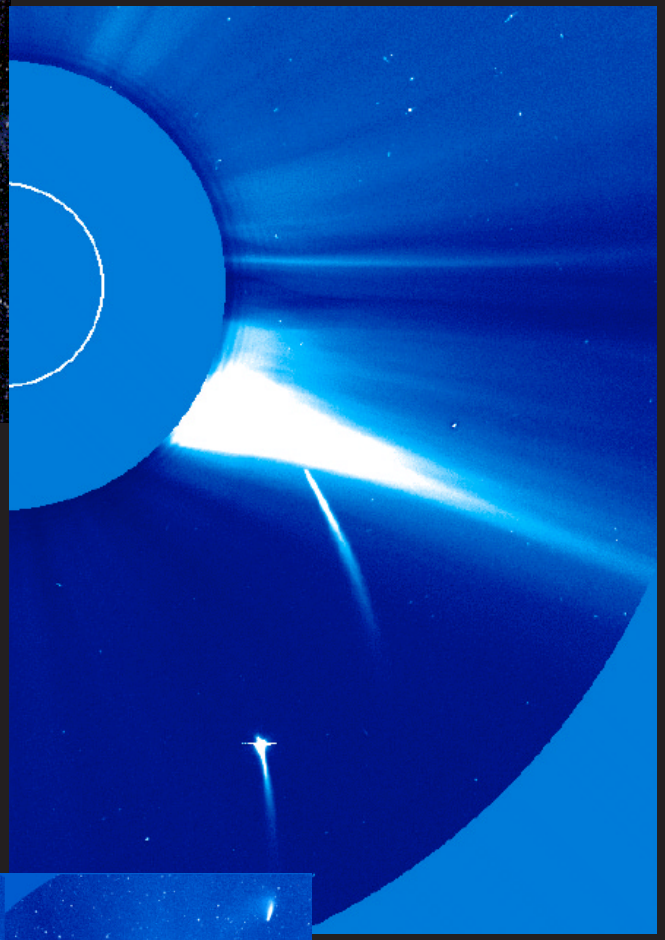
(Note that the protons are still hitting the spacecraft two days later)

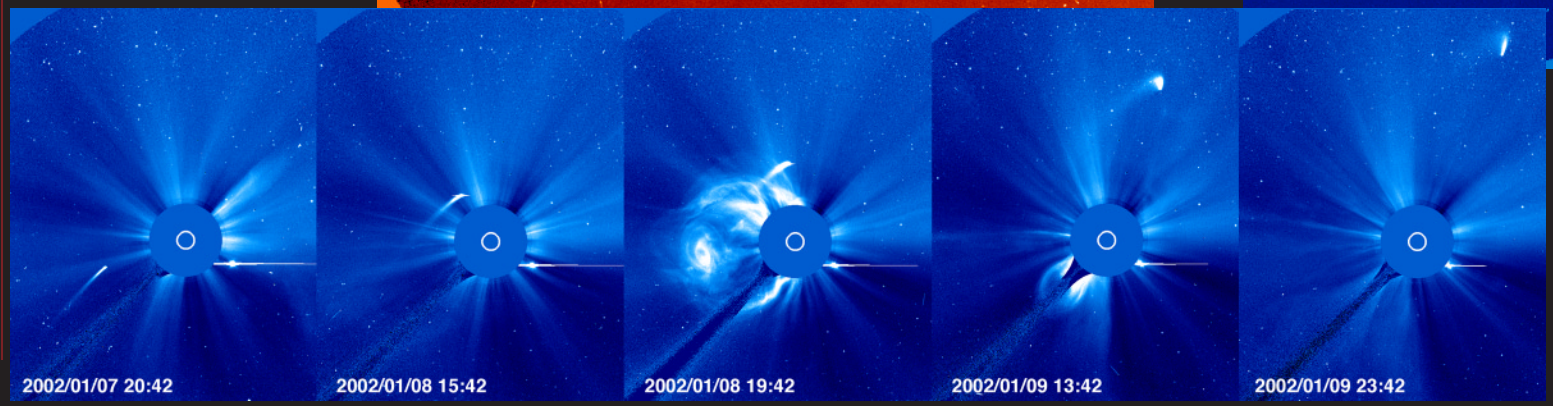


SOHO has discovered over 400 sungrazing comets streaking near and sometimes into the Sun

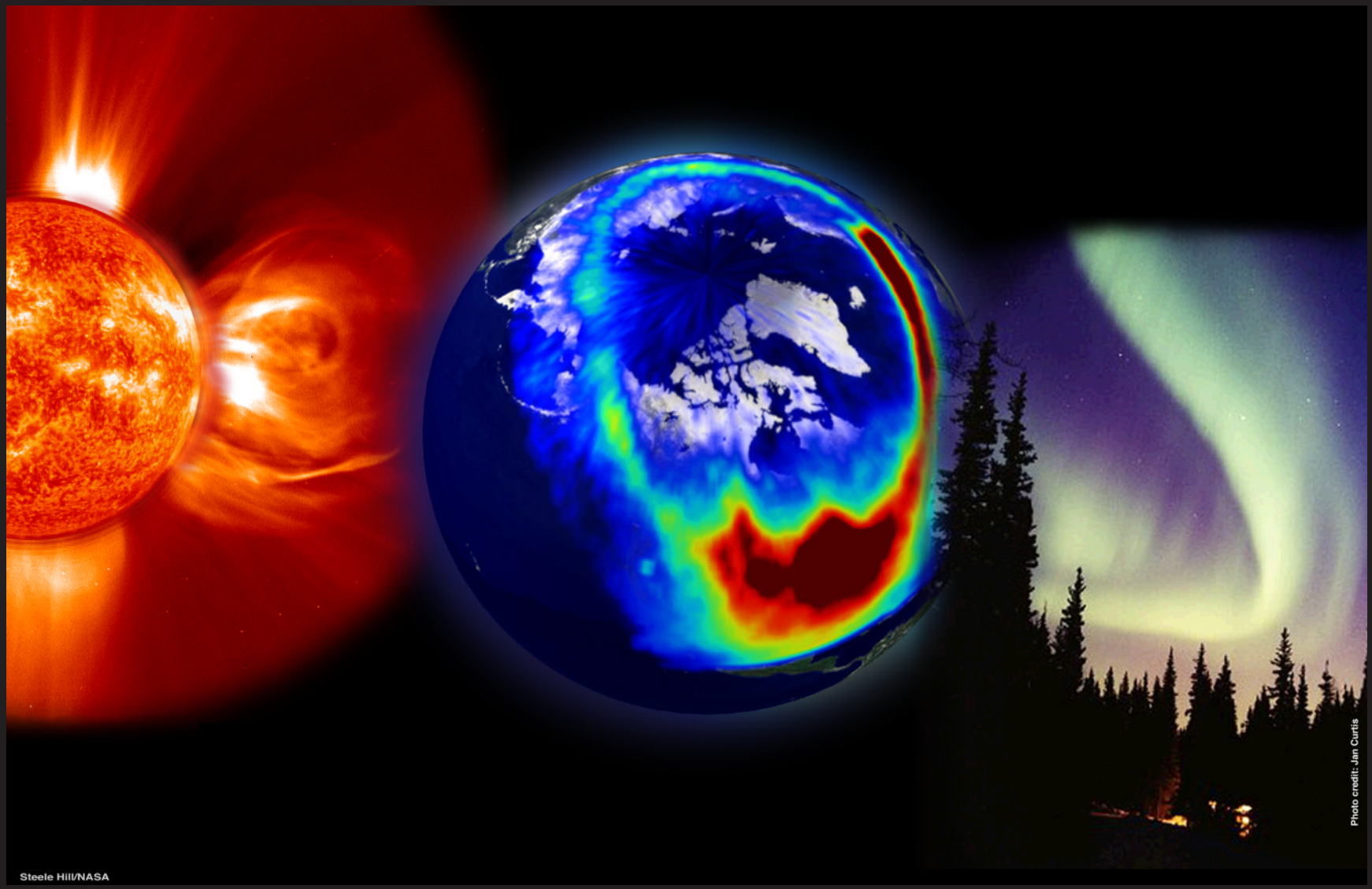




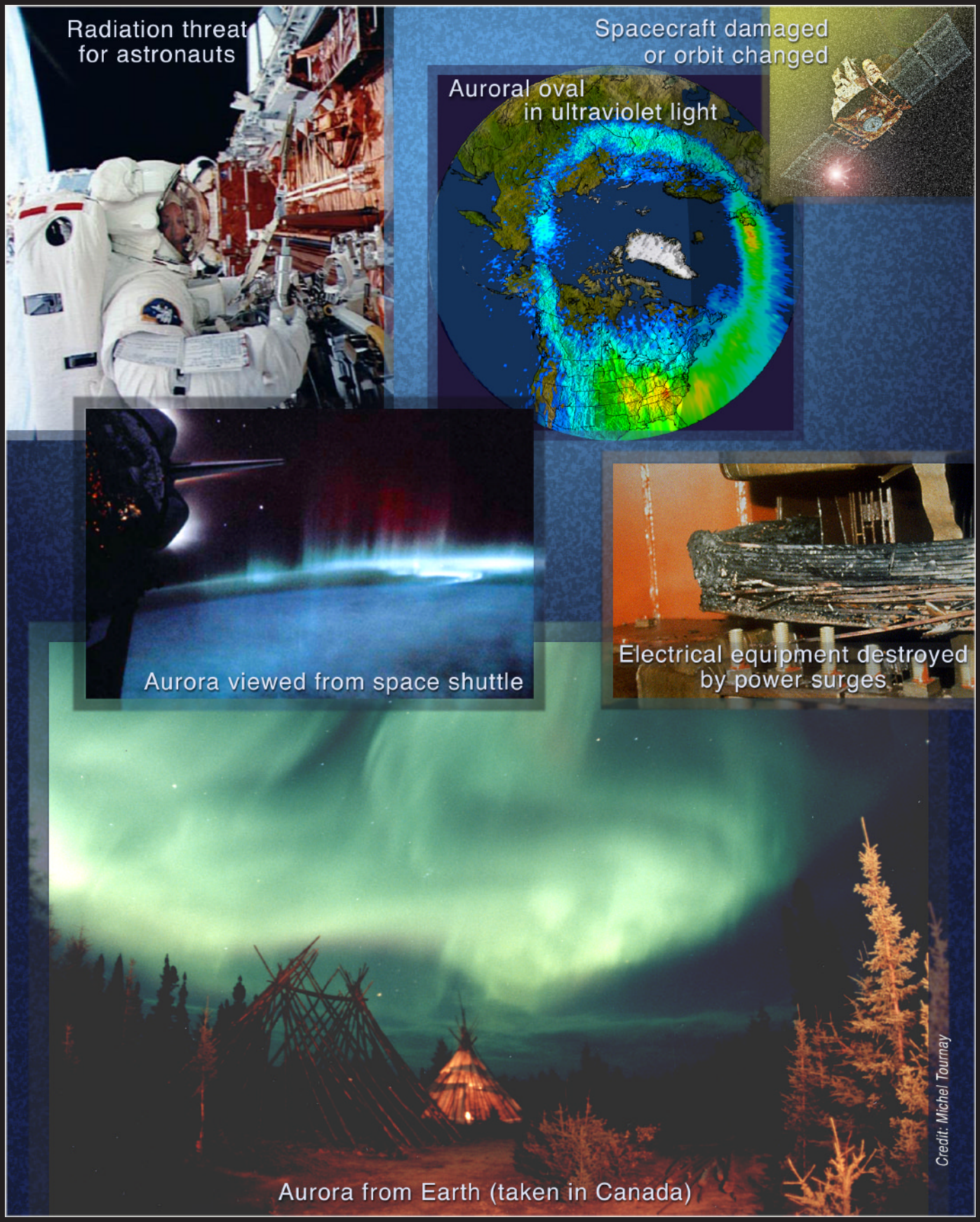




The three principal “visual” elements of space weather: solar storm, charged particles impacting Earth, and aurora



Some of the effects of “space weather” caused by the Sun



SOHO: major science results so far

- First images of a star's convection zone and the subsurface structure of sunspots
- Discovery of a "magnetic carpet" on the solar surface
- First measurements of how the slow and fast solar wind accelerates
- Discovered new technique for imaging the far side of the Sun
- Most detailed view to date of the dynamics in the outer solar atmosphere
- Most spectacular images and movies of coronal mass ejections
- Most comprehensive archive of images and data on the Sun which will continue to grow and serve as a treasure for future research

Visit the SOHO web site to learn more about the Sun and the SOHO mission: soho.nascom.nasa.gov or soho.estec.esa.nl

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