# Helioviewer

The Helioviewer allows you to look at near real time images of the Sun taken by several space telescopes in various light wavelengths. Open your web browser and navigate to www.helioviewer.org. The Helioviewer images you see are current within the hour.

Take the short introductory interactive tour of the Helioviewer.

You will see the most current view of the Sun in the viewing screen in the center of the interface. You can zoom in and out. Are there any sunspots present today?

On the left you'll see the "Images" box. This is where you can select different satellites and wavelengths for viewing the Sun.
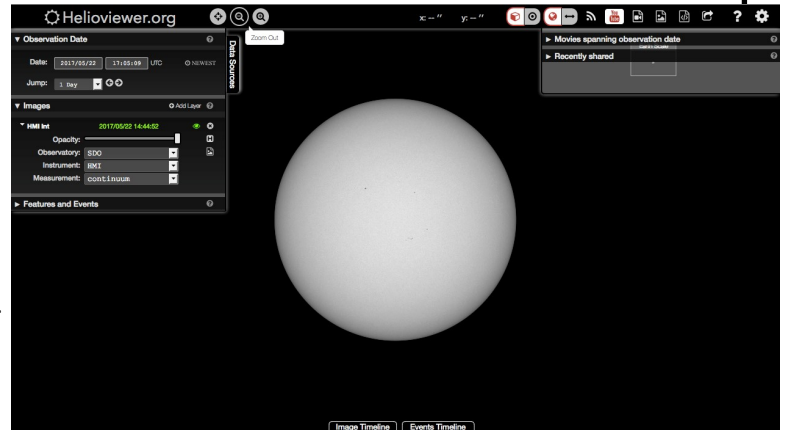
TRACKING SUNSPOTS

1. Begin with the latest images from the Solar Dynamics Observatory (SDO). In the *Images* box on the left side of the viewer, set the *Observatory* to **SDO.** Set *Instrument* and *Detector, (*if it is present on your menu) to **HMI**. Set *Measurement* to **continuum**. At this setting, the Sun looks very similar to what you would see through a telescope with a solar filter.

2.   Like the Earth, the sun rotates on its axis. By watching the movement of features, like sunspots, on the sun's surface, astronomers have determined the length of one solar day. Using Helioviewer, you can make a movie of the Sun's surface, and use it to repeat that process. To make them stand out, you can select **Sunspots** from the Features and Events menu. If there are no sunspots present try changing the Observation Date to **2014/06/10**.

3. Click the *Create a Helioviewer Movie* button at the top right of the viewer screen and select **Full Viewport**. In the *Movie Settings* box, set the *Duration* to **28 days**. Click **OK** to start processing your movie.
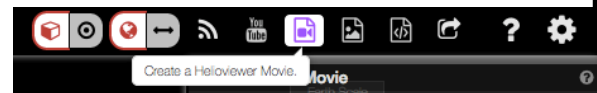
4. It may take several minutes for your movie to be processed. When it is done, you should now see your movie, **HMI continuum** in the *Movie History* section of the Generate a Movie panel. Click the title to view your movie.
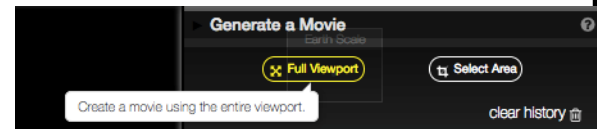
5. Do any of your sunspots make it around the Sun in your 28-day movie? How long did it take? How long is one solar day?

6. Helioviewer allows you to save your video to your desktop, share it on social media, or upload it to YouTube.

SUNSPOT CYCLE

Helioviewer has images of the Sun dating back many years. Find the *Jump* setting in the *Observations* menu. Set the time interval to 1 year. Then use the left arrow to step back time until 2010. What changes do you see?

The Sun has 11-year sunspot cycles. In 2019, we are nearing a sunspot minimum estimated to occur in 2020. The number of sunspots on the surface of the Sun peaked in 2012-2014. View data from these years and compare it to today's images of the sun. How do they compare?

Image Credit: NASA/SDO

AIA 304 - 2012/08/31 - 19:48:07Z
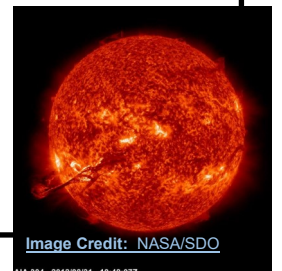
WATCH A CORONOAL MASS EJECTION (CME)

According to Space Weather Live, a coronal mass ejection is "a giant cloud of solar plasma drenched with magnetic field lines that are blown away from the Sun during strong, long-duration solar flares and filament eruptions."

By constantly taking images of the Sun, space telescopes are able to capture many of the Sun's exciting surface events. To view a CME, we need to add more image layers. Keep the *Observatory* set to **SDO**, and change the *Instrument* and *Detector* (if present) to **AIA** and set the *Measurements* to **304**. This image shows the Sun looks in ultraviolet light.
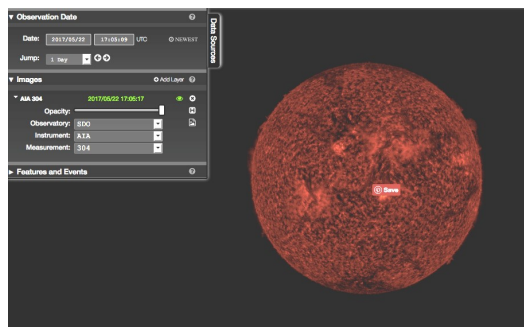

Next, add the second image layer by clicking on **add layer** just to the right of the *Images* label. A box for another telescope will open. For this new layer, set the *Observatory* to **SOHO**, the Solar and Heliospheric Observatory telescope. Choose the *Instrument* **LASCO**. Set the *Detector* to **C2** and the *Measurement* to *white light*. This image shows the Sun's corona, the dim outer layer of its atmosphere by blocking out most of the Sun and its bright surrounding region.
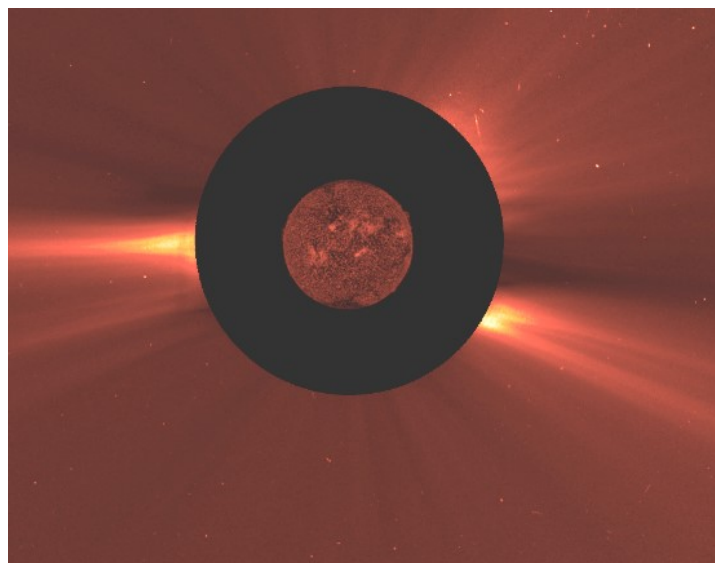
CMEs can happen up to 3 times a day and release as much energy as 10 million volcanic eruptions on Earth. While this seems like a lot of energy, it is only about 10% as much energy as the Sun releases every second!

To view a CME, set the *Observation Date* to **2013/08/20**. The time doesn't matter, but be sure that the time interval, or *Jump*, is set to **1 hour**. You can select **CME** from the Features and Events menu to make spotting them easier.
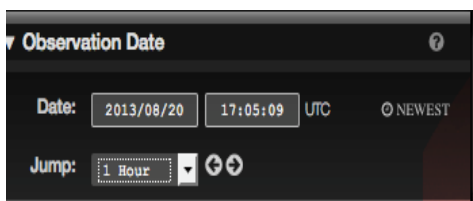
Can you view the date of the Quebec black out event on March 13, 1989? What can you find in Helioviewer?

Describe what you see.

A list of past solar storms is available at:

https://www.spaceweatherlive.com/en/auroral-activity/top-50-geomagnetic-storms/

You can learn more about the Sun and solar weather at: https://www.pbs.org/wgbh/nova/labs/lab/sun/research