THE SUNSPOT

All the news under the Sun

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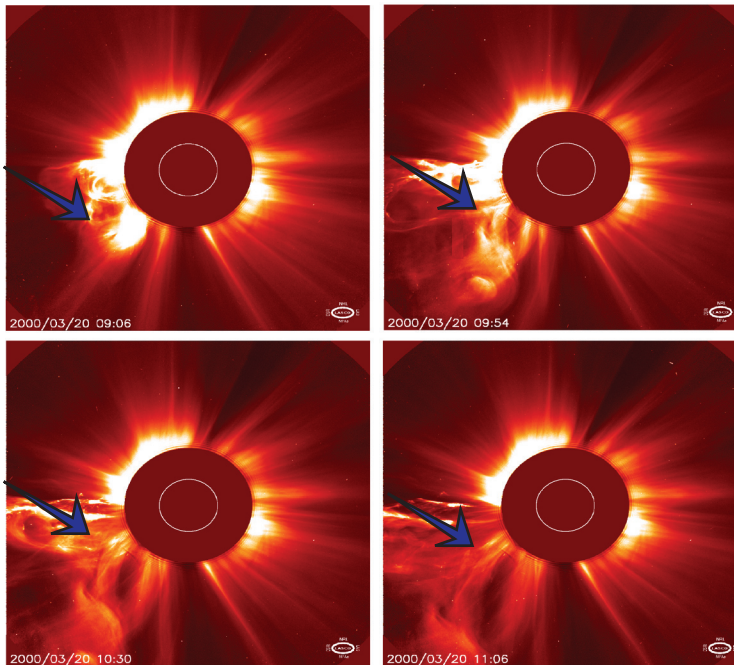


Image courtesy of SOHO/LASCO

The **blue** arrows in this picture show a Coronal Mass Ejection (CME) leaving the Sun. A CME is a violent eruption from the Sun. In this image, the center of the Sun is blocked out by the SOHO spacecraft so the outside of the Sun can be seen by SOHO's instrumentation.

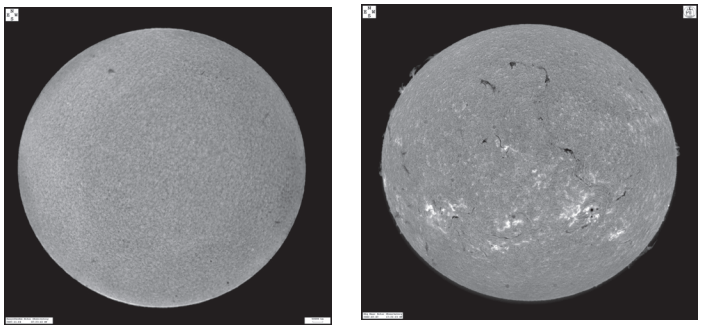
Scientists Study Solar Storms

You might think that the Sun never changes and that it's always a solid bright yellow disk in the sky. According to solar scientist Dr. Terry Onsager of NOAA's Space Weather Environment center (SWPC), the Sun is a ball of hot, burning gas that is very active.

The Sun produces a solar wind, which carries material into the Solar System. The Sun also has flares and Coronal Mass Ejections (CMEs), violent eruptions that fling solar material into space. Sometimes, if a flare or CME comes from the side of the Sun facing Earth, a large amount of solar material reaches the Earth. This can disrupt cell phones, satellites, and the radios of airplanes flying over the poles.

"Airlines work closely with SWPC and use information we give them. They can reroute flights so they don't loose radio communication during a solar storm," Onsager explains. NASA, the International Space Station, the Airforce, and satellite companies also look for SWPC's help if, for example, they have a computer malfunction or a glitch. "They'll come to us to see if a solar storm was the cause so they can create designs that can withstand them in the future," he says.

Scientists have studied the Sun's 11-year cycle and we are about at solar minimum right now, so the Sun is less active. When the Sun is at the peak of activity there are more solar flares and CMEs. The Sun also has sunspots and has more spots during the peak of activity.

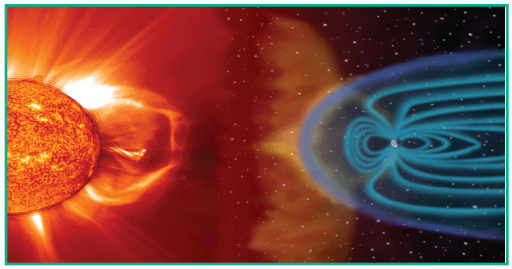


Images courtesy of BBSO

Above left is an image of the Sun at solar minimum taken in 2007. No sunspots appear. At right, the Sun is more active (2002).

Science Facts

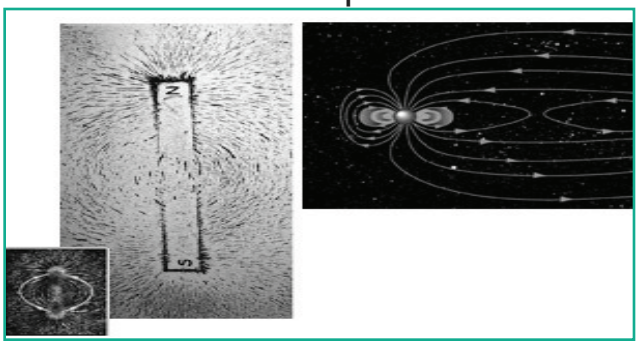
Earth's Magnetic Field



courtesy of SOHO/ LASCO

The Earth acts like a gigantic magnet. The center is made up of melted iron which moves around as the Earth spins, creating a magnetic field. It's sort of like having a giant bar magnet inside the Earth, and it's the reason we can use a compass. The dial in your compass lines up with the Earth's magnetic field telling you where north is located. If you lived on Mars, your compass wouldn't work because Mars doesn't have the same kind of magnetic field!

We're lucky to have our magnetic field, not just because compasses work, but also because the magnetic field protects us from the solar wind and other material that comes toward the Earth from Space.



Above left, iron filings poured over a piece of paper with a magnet underneath demonstrates what a magnetic field looks like. The iron filings follow the magnetic field in a circular pattern. The image on the right shows how the solar wind stretches the magnetic field of Earth–like a person with long hair walking into the wind.

How the Aurora Are Created

Jan Curtis, courtesy of NASA

The Aurora is a beautiful phenomenon–the sky glows with dancing ribbons of color. Mostly, the aurora can be seen at the north or south poles of Earth but occasionally is observed at lower latitudes.

How is the aurora created? The Sun has a solar wind that constantly sends material toward Earth. When the Sun is active, producing Coronal Mass Ejections (CMEs) and flares, even more material travels to Earth. Aurora can be most beautiful and reach lower latitudes if the Sun has a flare or CME that points our way. Some material that exists in Earth's magnetic field collides with the atmosphere close to the north and south poles during these events.

Aurora can be most beautiful and reach lower latitudes if the Sun has a flare or CME that points toward Earth.

Earth's atmosphere is just a lot of gas, mostly oxygen and nitrogen. The material interacts with the gases in the atmosphere and creates the aurora. Different gases in the atmosphere create different colors of auroral lights.

The aurora are created in a similar way a florescent or neon light bulb shines. They glow when the gases inside are excited by an energy source. The excited gases emit light. Different gases create different colors, which is why a neon light looks different from a florescent light.

The material creates energy when it collides with the atmosphere, giving some gases enough energy to shine. Oxygen gives off red or greenish light and Nitrogen gives off red or violet light.

Mission News

STEREO Studies the Sun in 3-D

Launched in 2006, STEREO (Solar TErrestrial RElations Observatory) is a set of two spacecraft designed to study Coronal Mass Ejections (CMEs) from the Sun. Using the information gained during STEREO's mission, scientists hope to understand the structure of CMEs and how they are created.

STEREO uses 3D imaging to help determine the structure of the CMEs. The two STEREO spacecraft orbit the Earth. One spacecraft is leading while the other one follows behind in the orbit. Because they are taking pictures of the Sun at the same time, 3D images are created by overlapping the two images. The images don't line up exactly and using 3D glasses, a 3D image is created.

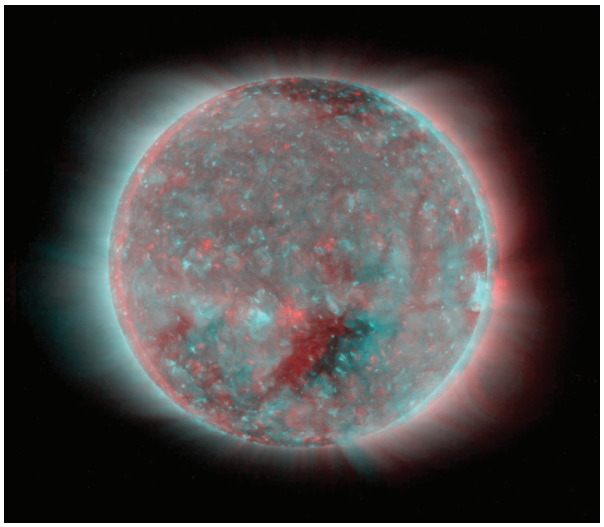


Image courtesy of STEREO

Since human beings can't travel to the Sun to see a CME, 3D imaging is the next best thing. Scientists get an idea of the shape, size, and position of the CME without ever having to leave Earth.

Above, images from both STEREO spacecraft have been combined. The image in red does not align with the blue image exactly, allowing it to be easily viewed using 3D glasses. To learn more, visit: http://stereo.gsfc.nasa.gov/

SORCE Helps Scientists Measure How Solar Energy Affects Climate

Dr. Tom Woods

If there's one thing that really interests Dr. Tom Woods from the Laboratory for Atmospheric and Space Physics (LASP) at the University of Colorado, it would have to be how the Sun can affect Earth's climate. Woods uses the SORCE spacecraft, SOlar Radiation and Climate Experiment, to measure changes in solar energy.

Once thought to be constant, the amount of energy the Sun produces actually changes during the 11-year solar cycle and can even be different from cycle to cycle. SORCE will measure the amount of energy the Sun produces as it approaches solar minimum in 2008.

Image courtesy of NASA

According to Woods, climate change has two components. One component is greenhouse gases which take years to build up in the atmosphere. The other component is the Sun. If the Sun produces more or less energy, the climate can change.

During the upcoming solar minimum, Woods expects the Sun will begin producing slightly less energy. Could this mean the Earth will get slightly cooler than expected? Maybe, but it's difficult to say by how much. SORCE will give scientists data that will help answer this and other questions.

Woods says,"Data helps answer questions about why the Sun, climate, and atmosphere vary. Science is always changing. That's what makes it exciting."

To learn more, visit: http://lasp.colorado.edu/sorce

Who's Who Under the Sun

Meet Scientist Terry Onsager!

The Space Weather Prediction Center (SWPC) at NOAA gives warnings when the Sun has a flare or CME. Dr. Terry Onsager works as a scientist at SWPC. THE SUNSPOT got an exclusive interview.

What do you do at SWPC?

I do a variety of things, but the main one is to try and take what scientists all over the world are doing and come up with a solar storm forecast, similar to a weather forecast. We don't really fully understand how the Sun works, so we try to predict using computer models.

> "Trying to solve problems about things that really matter in our lives is very exciting."
> Dr. Terry Onsager, NOAA-SWPC

Why do people care about solar storms?

During some solar storms, very energetic particles can reach the Earth from the Sun. These particles can cause some problems and glitches with communication, computers, satellite equipment and other technology. Many commercial and government agencies are interested in our forecasts. Maybe a computer onboard a satellite will malfunction or something. They'll come to us to find the cause so they can improve the design of future satellites so they can withstand the harsh environment in space.

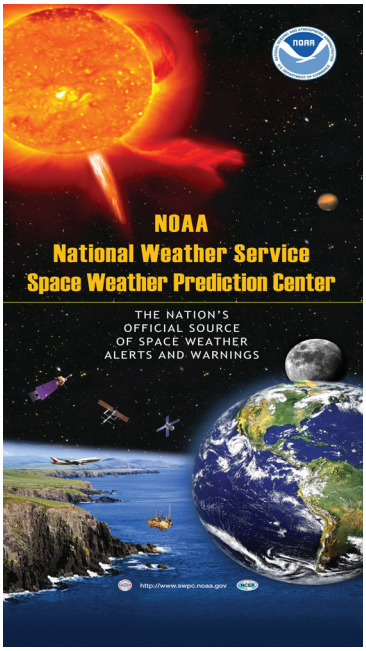


Image courtesy of NOAA

We haven't had satellites in space for that long. There is a huge amount we don't understand because we haven't been doing it that long. There are lots of basic discoveries to be made right in the space around Earth. At the same time, humans are depending on satellites more and more. It's a region that's gaining importance every day for our standard of living and the economy. There are new discoveries–everyday.

When did you decide to become a solar scientist?

In college I studied physics. I wanted to go to graduate school because I was excited to study new things. I met a professor who had an instrument on a satellite. I started looking through data the satellite was returning to Earth and I got fascinated by the puzzles. There are so many things we don't know about space.

What do you do in your spare time?

I like a lot of outdoor activities like running and hiking. I especially enjoy hiking up 14ers and running the Bolder Boulder race.

What do you like about being a scientist?

Scientists are fun people to work with. They're highly motivated and driven to collectively pursue making new discoveries and solving puzzles that we don't yet know the answer to. It's not the way you think of business. Everyone is supportive which makes the work a lot of fun. Trying to solve problems about things that really matter in our lives is very exciting.