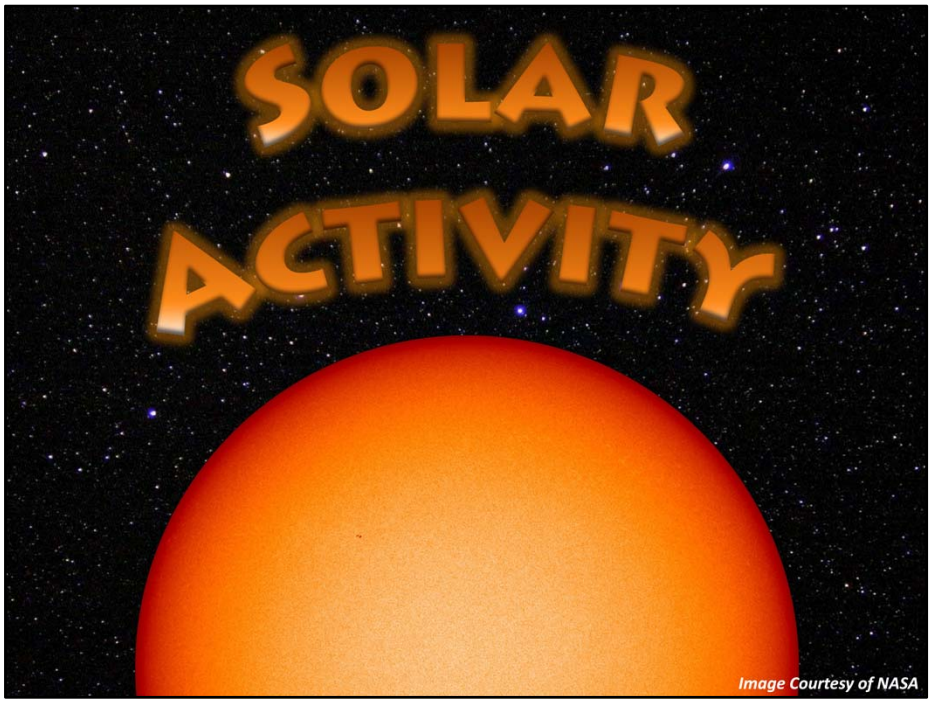
Module 4: Astronomy - The Solar System
Topic 2 Content: Solar Activity Presentation Notes



The Sun, the largest body in the Solar System, is a giant ball of gas held together by gravity. The Sun is constantly undergoing the nuclear process of fusion and creating a tremendous amount of light and heat. The energy from the Sun travels so quickly that it reaches the Earth in a little over eight minutes. That is a distance of 93 million miles!

With a large amount of energy, the Sun is prone to eruptions that are enormous in size. The energy of the Sun also produces darker areas called sunspots.

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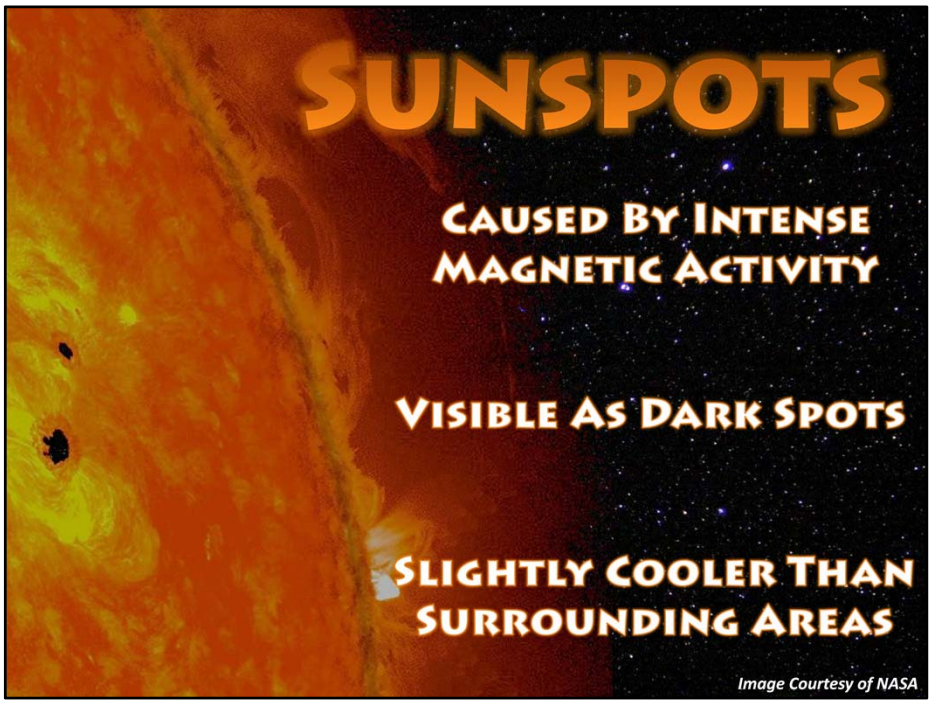

The Sun's photosphere includes darker regions called sunspots. Sunspots are caused by intense magnetic activity and are visible as dark spots on the surface of the Sun. Why do sunspots appear dark? It is because they are slightly cooler than the surrounding areas of the Sun. With the Sun, a small difference in temperature equals a large difference in brightness. The intense amount of magnetic activity in these regions prevents convective currents from producing heat and energy.

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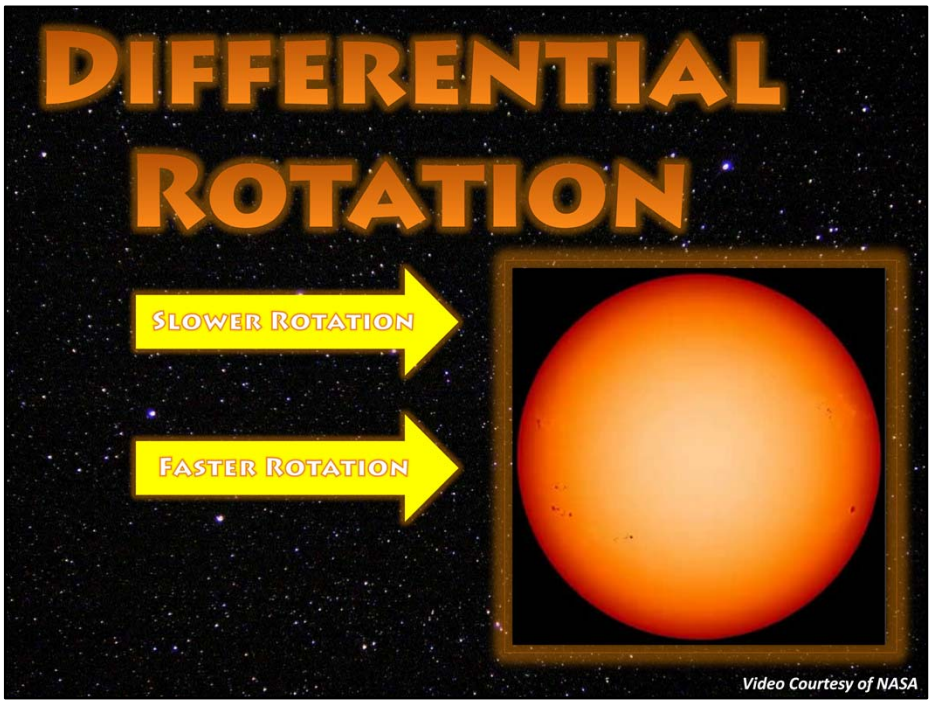

The sunspots will last for few days, and during this time they will rotate with the Sun, as seen in this video. The Sun does not rotate as one body, like the Earth does. Instead, the Sun has bands of gases that rotate at different speeds. Gases near the equator rotate faster than gases near the poles. This is called differential rotation. The study of sunspots is what lead astronomers to this interesting find.

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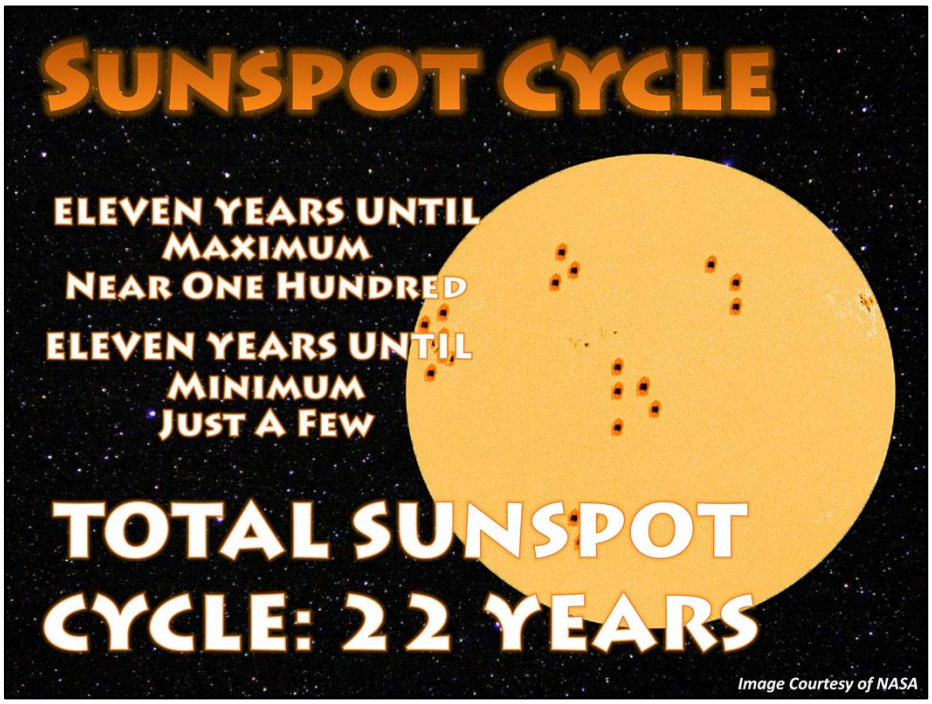

One average, the sunspot cycle occurs every eleven years until maximum, followed by another eleven years until minimum. This gives a total sunspot cycle of twenty-two years. During this cycle, the maximum number of sunspots is around one hundred. The lowest number is just a few spots on the surface of the Sun.

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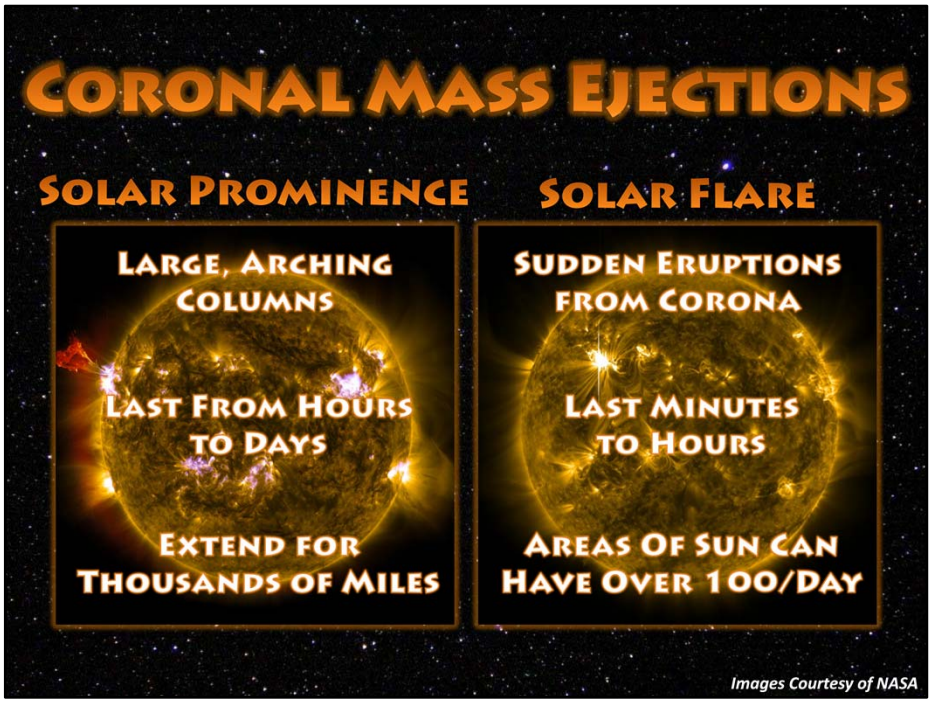

Not only do extremely magnetically active sites show up as dark regions, but they are also explosive. These eruptions are known as coronal mass ejections, or CMEs. There are two types of coronal mass ejections: solar prominences and solar flares.

A solar prominence is a very large, arching column of gas that erupts from the Sun. A solar prominence can last for a few hours or a few days. While the size of solar prominences varies, most will extend thousands of miles beyond the Sun. Solar flares are sudden eruptions of magnetic energy being released from the corona, usually around a sunspot. Solar flares are short lived. They generally reach maximum within a few minutes and stop within a few hours. Certain active areas of the Sun could have over one hundred small flares per day.

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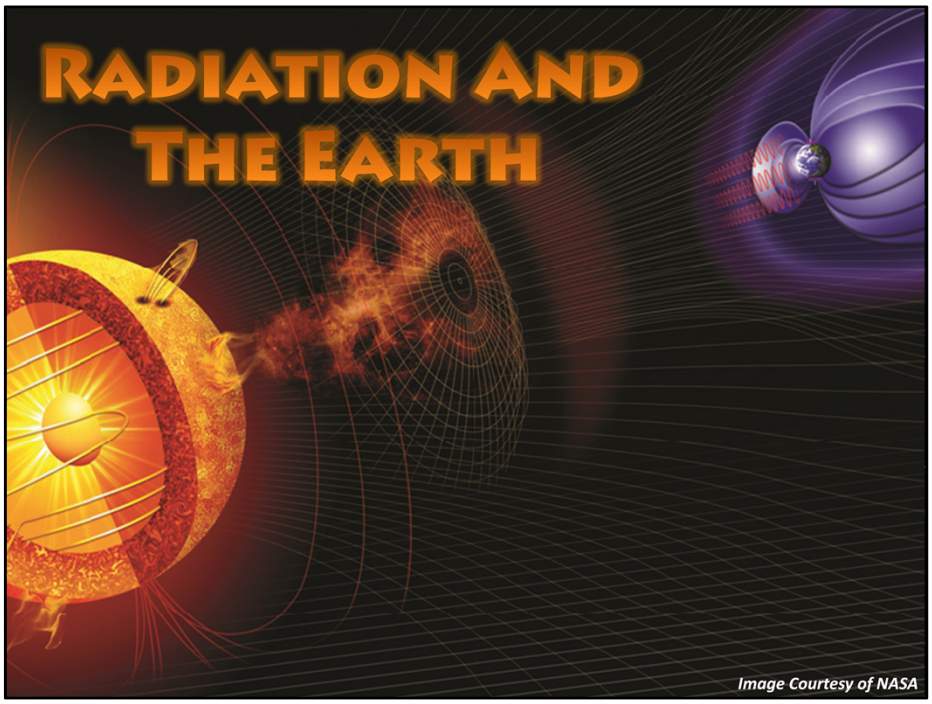

If a sudden eruption is large enough, it will send intense amounts of radiation toward Earth. When the radiation reaches Earth, it has the ability to interfere with communications. The radiation could absorb or reflect shortwave radio signals. This same radiation interacts with Earth's magnetic field and causes large amounts of electrical currents. This interaction excites the atmosphere and creates the auroras in northern latitudes and southern latitudes.

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This video shows how the radiation from the Sun comes into contact with the Earth's atmosphere to create an aurora. This is what the aurora looks like from space, as seen from the International Space Station.

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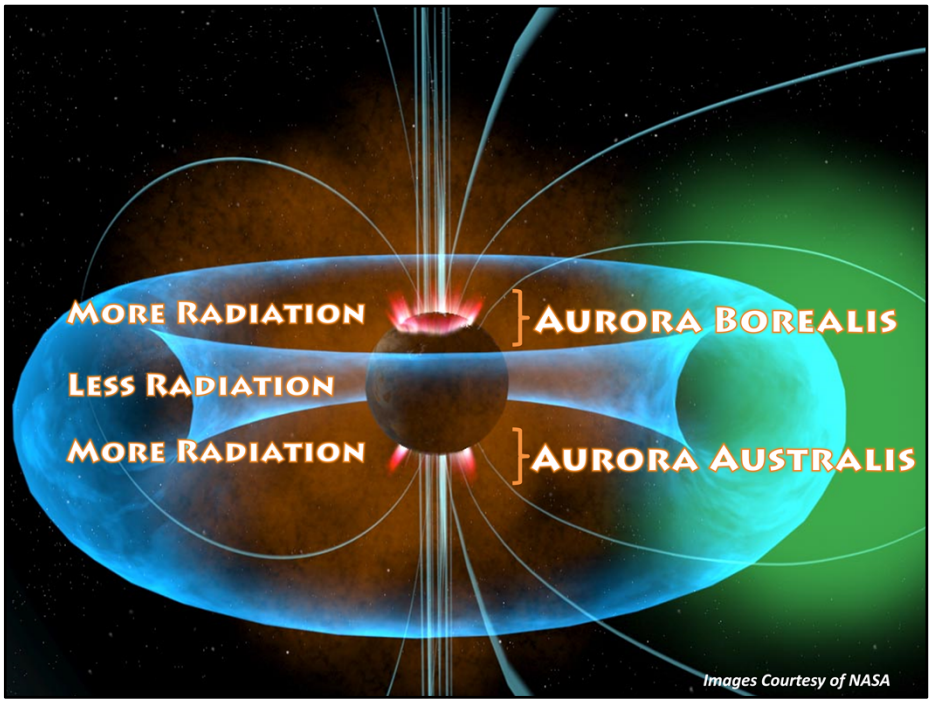

Shown here is an image of an aurora as seen from Norway. The colors of the aurora can vary, and the most common color is green. When the Sun's radiation reaches Earth, it can react with the Earth's magnetic field. The reaction causes atoms in the upper atmosphere to become excited and glow. The Earth's magnetic pole dips inward at the poles. This allows the radiation to come into contact with the upper atmosphere in the northern and southern regions of the world. People in areas near the Equator and mid-latitudes will rarely see an aurora because the Earth's magnetic field does not allow the radiation from the Sun to react with the atmosphere in these areas. In the Northern Hemisphere, an aurora is called *aurora borealis*, or northern lights. In the Southern Hemisphere the aurora is named the *aurora australis*, or southern lights.