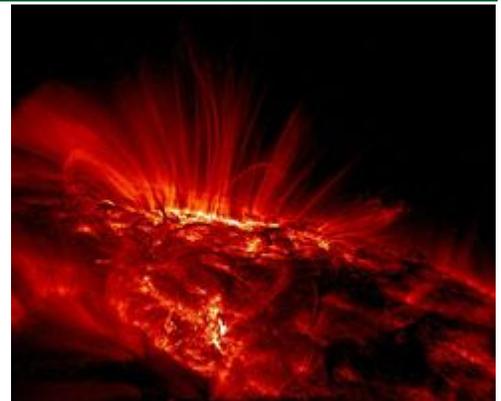


What Are Sunspots?

By Cindy Grigg

¹ *Caption (Original NASA description): It was a quiet day on the Sun in September of 2000. The above image from NASA's sun-observing TRACE spacecraft shows, however, that even during "off days" the Sun's surface is a busy place. Shown in ultraviolet light, the relatively cool dark regions have temperatures of thousands of degrees. A large sunspot group is visible as the bright area near the horizon. The bright glowing gas flowing around the sunspots has a temperature of over one million degrees Celsius (1.8 million degrees Fahrenheit). The high temperatures are thought to be related to the rapidly changing magnetic field loops that channel solar plasma. Photo credit: NASA.*



² Our sun is a star. Like all stars, it is a mass of very hot gases. It is matter in a state that is called plasma. (On Earth, most matter exists in one of three states: solid, liquid, or gas. On the sun, a fourth state of matter is found -- plasma.) On Earth, burning fossil fuels like gasoline or coal gives us energy for our cars and heating our homes. But the sun's energy doesn't come from burning fuels. The sun's energy comes from nuclear fusion. The nuclei (plural form of nucleus) of different atoms of gases in the sun fuse or join together. Most of the sun's fusion happens when atoms of hydrogen smash into each other. The atoms join or fuse together. This creates helium atoms. Every atom releases heat and light when it fuses with another atom.

³ The sun has different layers. The outer part of the sun is called the **photosphere**. This means "sphere of light." This is the part of the sun that we can see. Dark spots on the photosphere are called sunspots. They look dark because they are cooler than the areas around them. **Sunspots** are caused by twists and loops in the sun's magnetic field. This magnetic activity slows down fusion, so less energy is being released in these spots.

⁴ People have observed sunspots for thousands of years. Galileo published a description of sunspots in 1613. The number of sunspots increases and decreases over time. This has been called a sunspot cycle. The cycle lasts about eleven years.

⁵ Sunspots can cause **solar flares**. These are short bursts of energy above a sunspot. This energy is in the form of ultraviolet waves, radio waves, and X rays. Solar flares shoot fast-moving streams of particles into space. This is called the **solar wind**.

⁶ When the solar wind reaches Earth, these particles of energy can cause magnetic storms. Such storms disturb magnetic compasses as well as energy and communication systems. They also produce magnificent auroras in the northern skies.

⁷ You may have seen messages about sunspots on your TV. TV stations and satellite and cable companies sometimes advise customers that sunspots may disrupt broadcast signals. Cell phones, communication satellites, and GPS systems may be affected by sunspots, too.

What Are Sunspots?

| | |
|---|---|
| 1. _____ are dark spots on the sun caused by twists and loops in the sun's magnetic field. _____ | 2. What are short bursts of energy above a sunspot called? _____ |
| 3. The solar wind is _____. <input type="radio"/> A Wind caused by a fast-moving comet <input type="radio"/> B Really fast winds on Earth caused by tornadoes <input type="radio"/> C Wind on Earth blowing from the east <input type="radio"/> D Fast-moving streams of particles shooting from the sun into space | 4. The layer of the sun that we see is the _____. <input type="radio"/> A Core <input type="radio"/> B Radiation zone <input type="radio"/> C Photosphere <input type="radio"/> D Convection zone |
| 5. Cause and effect: Solar flares are the effect. What is their cause? _____ | 6. What state of matter is found on the sun? <input type="radio"/> A Plasma <input type="radio"/> B Liquid <input type="radio"/> C Solid |
| 7. The sun's energy comes from _____. <input type="radio"/> A X rays <input type="radio"/> B Magnetic energy <input type="radio"/> C Burning natural gas <input type="radio"/> D Nuclear fusion | 8. Fusion is nuclear energy. In this sentence, what does "nuclear" mean? <input type="radio"/> A Relating to the nucleus of an atom <input type="radio"/> B The "control center" of a cell <input type="radio"/> C A type of fuel used in cars <input type="radio"/> D All of the above |
| 9. What are some problems on Earth caused by sunspots? _____ _____ | 10. In the last paragraph, what does "disrupt" mean? <input type="radio"/> A To dislocate or put something out of its usual place <input type="radio"/> B To cause confusion <input type="radio"/> C To upset the usual order of something <input type="radio"/> D Disturb or interrupt something |