SUGGESTED REFERENCES

- Banana's Handout
  Simple Sun Experiments for Children
  www.bananasinc.org/uploads/1134508314.pdf
- Energy Quest Science Projects
  http://www.energyquest.ca.gov/projects/index.html#solar
- Sun, Earth, and Sky by Kenneth Lang
  http://space.com
- SOHO website
  http://sohowww.nascom.nasa.gov/

NATIONAL SCIENCE EDUCATION STANDARDS

Grades K - 4

Physical Science
Properties of objects and materials

Earth and Space Science
Objects in the sky

Grades 5 - 8

Physical Science
Transfer of Energy

Science in Personal and Social Perspectives
Natural Hazards

**Source: National Science Education Standards, 1996, National Academy Press*

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SCIENCE SCREEN REPORT FOR KIDS

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THE SUN - CENTER OF OUR SOLAR SYSTEM

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www.jets.org

SYNOPSIS

The sun's powerful warm rays light up the sky with brilliant color and heat. The sun is similar to a living organism, just as we are constantly growing and changing, so is the sun. Just like us the sun was born and is growing older, and one day will die. When this happens the rest of the solar system will be gone too. This will not happen for a very, very long time and will not affect any of us. But the changing cycles of the sun can affect the earth and its living organisms.

In this edition of Science Screen Report for Kids, students will learn about the structure of the sun and the latest technology that enables scientists to study its storms. To help scientists learn more about the sun they have developed a special spacecraft, called SOHO. One of the space-craft's jobs is to study the in and out motions of the sun's atmosphere, or photosphere. SOHO has helped scientists determine the structure of the sun.

CURRICULUM UNITS	RUNNING TIME
■ ASTRONOMY	16:00
■ CHEMISTRY	
■ EARTH SCIENCE	
■ PHYSICS	
■ SPACE SCIENCE	

BACKGROUND

Students will learn the theory of how a supernova could have caused the formation of the solar system. An animation details how the shockwave from a supernova compresses a region of space containing a cloud of gas and dust. This huge explosion blasts the remaining material out into space. These pieces collide with gases and dust in space causing it to spin like a whirlpool. In the middle of this huge whirlpool the force of gravity took elements like hydrogen atoms and forces them together with other elements. This caused a chain reaction where more elements fused together until the sun was formed. This was the birth of the sun. The other matter that was left over and not captured by the sun formed the other planets and meteorites in our solar system.

Scientists have many ways of finding other clues regarding the sun's composition. For instance, scientists know the sun is made up of mainly hydrogen and they know this by using a technique called spectral analysis. You can see a spectrum of colors when you break up light into a rainbow with a prism.

To help scientists learn more about the sun they have developed a satellite called SOHO. It was launched into space in l995 and is positioned so it points right at the sun. One of the satellite's jobs is to study the in and out motions of the sun's photosphere. SOHO has helped scientists determine the structure of the sun.

The sun is made of three layers. The core is where the source of the sun's energy is located. All the heat and light that the sun releases is made in the core. Outside the core is a second layer which is packed so tightly that matter cannot even move. Energy that was made in the core bounces around like a ball in this layer until it finds its way out. This second layer is called the radiative zone because the energy radiates through this layer. The last layer is where the gases of the sun rise and fall. The gases get so hot that they rise to the surface of the sun, cool and fall back down. This is called the convective zone.

The energy that drives solar storms comes from something called nuclear fusion. Nuclear Fusion is the process powering the Sun and stars. In the core of the Sun, at temperatures of 10-15 million Kelvin, hydrogen is converted to helium by fusion - providing enough energy to keep the Sun burning - and to sustain life on earth. Billions of years from now, the sun will run out of hydrogen for nuclear fusion.

Even though the amount of hydrogen is decreasing, the sun must still keep producing enough pressure to keep gravity from collapsing the core. The only way for this to work is for the sun to burn hotter. The hotter the sun, the faster the nuclear fusion reaction will occur making the sun brighter. As the last of the sun's core burns, the star's surface will swell, engulfing Mercury and Venus. At this point, about seven billion years in the future, it will be hot enough to melt the rocks on earth. As the star continues its expansion, the force of gravity weakens its hold and pieces of the sun will break off and drift into space. Looking from earth, the sun will fill one quarter of the daytime sky!

As the process continues, more nuclear fusions take place and a white glow will emerge. The sun will have reached its final stage and become a white dwarf. Ashes from the sun may be swept up by a passing comet and all that will remain is a faint glow and a cloud of stardust. Though one day this will all take place, we are not to worry because that day is billions of years away.

ADVANCED ORGANIZERS

Prior to showing this program students should have some understanding of the following Benchmarks for Science Literacy, Oxford University Press, which are excerpted and, in some cases, abbreviated below. Refer to the Benchmarks for more information.

Benchmark 4: The Physical Setting

Section A - The Universe

Know by the end of 2nd Grade
- There are more stars in the sky than anyone can easily count, but they are not scattered evenly, and they are not all the same in brightness or color.

Know by the end of 5th Grade
- Stars are like the sun, some being smaller and some larger, but so far away that they look like points of light.

Know by the end of 8th Grade
- The sun is a medium sized star located near the edge of a disk-shaped galaxy of stars, part of which can be seen as a glowing band of light that spans the sky on a very clear night. The universe contains many billions of galaxies, and each galaxy is no more than a dim, fuzzy spot.
- The sun is many thousands of times closer to the earth than any other star. Light from the sun takes a few minutes to reach the earth, but light from the next nearest star takes a few years to arrive.

Section E - Energy Transformations

Know by the end of 2nd Grade
- The sun warms the land, air, and water.

Know by the end of 5th Grade
- Things that give off light often also give off heat.

Know by the end of 8th Grade
- Most of what goes on in the universe-from exploding stars...involves some form of energy being transformed into another. Energy in the form of heat is almost always one of the products of an energy transformation.
- Heat can be transferred through materials by the collisions of atoms or across space by radiation.

**Benchmarks can be found at www.project2061.org/tools/benchol/bolintro.htm*

CRITICAL THINKING EXERCISES

1. Assess background knowledge by having a class discussion about the sun. Create a KWL chart by discussing what the students already know about the sun and what they have learned. Read aloud a book about the sun. An example is The Sun, by Seymour Simon. After the story is read, complete the section of the KWL chart - what they learned.
2. Use a hands-on activity using apples or peaches to demonstrate the three layers of the sun. Draw and label a model of the structure of the sun. Complete with writing a paragraph about the sun.
3. Describe how scientists can determine the structure of the sun without being able to look inside it.
4. In cooperative groups, compare our sun to another star in the solar system. Create a visual aide to accompany the presentation.
5. Describe solar storms? How do sunspots form?
6. Have students write a 2 paragraph expository essay about the sun. Choose three main points to elaborate for the essay.

VOCABULARY

Convective zone	The last layer of the sun where the gases of the sun rises and falls.
Core	This is where the source of the sun's energy is located. All the heat and light that the sun releases is made here.
Gravity	The natural force of attraction exerted by a celestial body, such as Earth, upon objects at or near its surface, tending to draw them toward the center of the body.
Hydrogen	A colorless, highly flammable gaseous element, the lightest of all gases and the most abundant element in the universe.
Meteorite	A stony or metallic mass of matter that has fallen to the earth's surface from outer space.
Nuclear fusion	A nuclear reaction in which nuclei combine to form more massive nuclei with the simultaneous release of energy.
Photosphere	The visible outer layer of a star, especially of the sun.
Radiative zone	The second layer of the sun where the energy radiates through.
ROY G BIV	The colors in the sun's light appears in a spectrum from red to violet. Each letter stands for a color of the rainbow: red, orange, yellow, green, blue, indigo, and violet.
Solar flares	A sudden eruption of hydrogen gas on the surface of the sun, usually associated with sunspots and accompanied by a burst of ultraviolet radiation that is often followed by a magnetic disturbance.
Solar storm	Solar space weather where a large amount of energy is released by the sun and can travel through space.
Sunspots	Any of the relatively cool dark spots appearing periodically in groups on the surface of the sun that are associated with strong magnetic fields.
Supernova	A rare celestial phenomenon involving the explosion of most of the material in a star, resulting in an extremely bright, short-lived object that emits vast amounts of energy.
White dwarf	The remnant of a star that has collapsed, having an extremely dense state with no empty space between its atoms, but not reaching the extremely dense state of a neutron star or black hole.

CAREER POSSIBILITIES

- ASTRONOMER
- PHYSICIST
- SOFTWARE ENGINEER
- MECHANICAL ENGINEER