SciFri Sun Camp Educator's Guide

What can I expect from Sun Camp?

Science Friday Sun Camp is a heliophysics program designed to engage children in the science of the Sun, encouraging them to understand the ways the Sun affects our life here on Earth. **The program consists of two main parts.**

- **Asynchronous** hands-on STEAM activities that guide students to explore fundamental concepts about the Sun, Earth, and space. These use inexpensive, easy-to-find materials. Background science content, project instructions, discussion questions, additional resources, and NGSS curriculum standards are provided with each activity. Each activity should take about 30-45 minutes of active time and there are 2-3 activities per week to choose from.
- **Synchronous** Q&A sessions held online to provide students the opportunity to interact with a diverse group of Sun scientists, outreach educators, and other experts. Registered participants are invited to a Zoom webinar each week on Wednesday at 4 pm PT / 7 pm ET. Each week features a different theme. These casual, conversational sessions will run 30-45 minutes each. Those who cannot attend the live event can send questions in advance. The session will be live-streamed on the Science Friday YouTube channel. They will also be recorded.

All materials will be linked and archived on the Sun Camp page at sciencefriday.com/suncamp. Registered participants will also receive a weekly newsletter on Friday nights with all the information about the upcoming week as well as additional resources and information.

As you complete the projects, you can share your work with us and we'll feature it online. Share photos of your projects with the hashtag **#SciFriSunCamp** or tag **@SciFri** on social media. Or send your photos directly to Science Friday using the Sun Camp photo submission form. When Sun Camp is over, there will be a brief optional survey about your experience.

What if I have more questions?

Please email *educate@sciencefriday.com* with the subject line "SciFri Sun Camp." For updates, we suggest you register for Sun Camp, subscribe to our Science Friday Educate Newsletter, join the STEM Educator's Lounge on Facebook, and/or follow Science Friday on social media. Please check sciencefriday.com/suncamp regularly for updates. (Or use the QR code.)

Date/Time	Topic (Synchronous stream)	Activity (Asynchronous project)	Materials
Wed. 10/19/22 Q&A: 4 pm PT / 7 pm ET Subject Matter Expert Host: Dr. Pat Reiff, Associate Director for Outreach Programs, Rice Space Institute.	**The Sun 101** **Essential Questions:** ● What are the properties of the Sun and how do they affect its function? ● What forms of energy does the Sun provide? ● How does the Sun produce different forms of energy? ● What changes does the Sun experience over time? **Key Concepts:** ● Solar cycle ● Sun structure and composition ● Core, corona, photosphere, chromosphere ● Sunspots, solar flares, CMEs ● Sun safety **Resources:** ● Sunspots and Solar Flares ● Where does the Sun's energy come from? ● What Is the Solar Cycle?	**Model the Sun** **Objective:** To model the surface features of the Sun. **Time:** 30-45 minutes **Activity 1 Procedure:** Apply food coloring to a layer of shaving cream. Use toothpicks to create shapes and features with the dye. Press paper gently onto the shaving cream to create a print. Allow the paint to dry. **Activity 2 Procedure:** Encourage participants to think about the features of the Sun they have learned about and to reference pictures of the Sun's surface. Can they add sunspots or solar flares to the model? Can they model the layers of the sun? Can they create a series of prints to represent the solar cycle? **Extension:** Try using a different medium, such as clay, to make a more realistic model.	**Supplies:** ● Provided ○ Shaving cream ○ Food coloring ○ Toothpicks ○ Copy paper ○ Disposable plate with rim ● Not Provided ○ Scrap Cardboard **Book suggestion:** ● *Once Upon a Star,* by James Carter and Mar Hernandez **SciFri Related Content:** ● Spot the Sunspots ● #ExplainTheSun

Wed. 10/26/22 Q&A: 4 pm PT / 7 pm ET Subject Matter Expert Host:	**The Solar System** **Essential Questions:** ● Why is our solar system a system? ● What are the patterns of the motion of the Sun, moon, and stars in the sky that we observe, describe, and predict? ● How do the components of our solar system move and interact with one another? ● How does the Sun affect other planets? **Key Concepts:** ● Planets in the solar system ● Planetary revolution ● Orbits, orbit shape ● Forces and motion ● Gravity ● Mass versus weight ● Circular motion, centripetal force **Resources:** ● All About the Planets ● Where Does the Solar System End?	**Exploring Gravity** **Objective:** To explore the effects of forces, such, as gravity and centripetal force, on the Earth and the solar system. **Time:** 30-45 minutes, can be split into 3-15 minute activities (stations) **Activity 1 Procedure:** Participants will add a different number of marbles to each of two plastic easter eggs and seal with stickers. They will then drop the egg simultaneously and observe when they land. Participants will experiment with different amounts of marbles in the eggs and different dropping heights. **Activity 2 Procedure**: Participants will take one marble and place it on the plate. They will experiment with moving the plate until they can move the marble in a circular motion around the edge of the plate. Then they will cut a wedge out of the plate and try to move the marble with enough force to "jump" the gap. **Activity 3 Procedure:** Participants will attach a plastic egg to a string. They will then spin the string with the egg attached. Participants will try spinning it at different speeds and in both horizontal and vertical directions. They can experiment with letting go of the string to see in what direction and how far the egg travels. **Extension:** Using what you've learned, modify a plastic egg to be a shuttle that you can launch into orbit.	**Supplies:** ● Provided ○ 2 plastic split eggs ○ Marbles ○ Color coding labels, round ○ Tape measure ○ Embroidery floss ○ Disposable plate with a rim ● Not Provided ○ Scale (optional) ○ Scissors **Book suggestion:** ● *The Magic School Bus Lost in the Solar System* by Joanna Cole **SciFri Related Content:** ● Scale Solar System Orbits—And Satellites! ● Model Eclipses

Wed. 11/2/22 Q&A: 4 pm PT / 7 pm ET Subject Matter Expert Host: Dr. Cherilynn Morrow, Outreach Director for Southwest Research Institute and PUNCH and Joe Aragon Jr., Math and Science Educator and Cross-cultural consultant for PUNCH Native American Outreach.	**The Sun and The Earth** **Essential Questions:** ● Why is the Sun important to Earth? ● How does light from the Sun behave on Earth? ● What are the properties of light? ● How does sunlight affect living and nonliving things? ● What accounts for day and night and seasons on Earth? **Key Concepts:** ● How light travels ● Properties of visible light ● The electromagnetic spectrum ● Light as a source of life on Earth ● Rotation on an axis ● Sun safety **Resources:** ● What Causes the Seasons? ● Explore the Electromagnetic Spectrum	**Exploring Light** **Objective:** To observe that the rotation of the earth changes the ways light hits its surface. To explore spectrums of light that are not visible. **Time:** Active time 30-45 minutes, Passive time several hours of daylight **Activity 1 Procedure:** Using their own bodies as markers, participants trace their shadows in the same location while standing in the same direction at various times of day (morning, noon, evening) to observe and measure the movement of the sun. Participants are encouraged to measure the length of the shadow each hour and record the data to observe a pattern. **Activity 2 Procedure:** Participants explore the effects of ultraviolet light (UV) from sunlight to increase their awareness of sun safety. Participants will test UV-sensitive beads by making a bracelet and wearing them under different weather conditions, different outdoors spaces (i.e. shade, full-sun, etc.), and indoor spaces. They will also be instructed to try covering beads with sunblock and observe the results. (And alternative activity with construction paper will be provided.) **Extension:** Using what you've learned create a design for an astronaut's space suit that will protect their skin and eyes from the intense ultraviolet light produced by the Sun.	**Supplies:** ● Provided ○ Chalk ○ Tape measure ○ UV-sensitive beads ○ Embroidery floss ● Not Provided ○ Compass or GPS app on phone (optional) ○ Sunscreens (different SPFs) **Book suggestions:** ● *Light: Shadows, Mirrors, and Rainbows* by Natalie Myra Rosinsky **SciFri Related Content:** ● A Human Sundial ● Map Sun Trails ● Make a UV Detector ● Shedding Light on the Science of Sunscreen

Wed. 11/9/22 Q&A: 4 pm PT / 7 pm ET Subject Matter Expert Host: Cristian Ferradas Alva, Research Scientist in the Geospace Physics Laboratory at NASA's Goddard Space Flight Center and Laura Brandt, Project Manager for the Aurorasaurus at Goddard NASA Space Flight Center.	**Solar Weather** **Essential Questions:** ● How do the cycles of the Sun affect Earth? ● What kind of weather events occur in space? ● How can we observe the effects of the Sun on Earth? ● How do connections between the Sun and Earth affect us? ● How does the Aurora Borealis move in the sky? What patterns does it follow? **Key Concepts:** ● Solar cycle ● Electromagnetic spectrum ● Solar weather, solar flares, solar winds, solar storms ● Magnetic fields ● Auroras ● Magnetosphere **Resources:** ● What is Space Weather? ● Sunspots and Solar Flares ● What Is an Aurora?	**Explore Magnets** **Objective:** Explore the physical effects of magnetic forces. **Time:** 30-45 minutes **Activity 1 Procedure:** Using bar magnets, participants will explore attractive and repulsive forces. Participants will test common materials, such as coins, paper clips, enameled paperclips, keys, aluminum foil, canned food, small plastic toys, wine corks, etc. to see if the magnet attracts them. Participants are encouraged to draw conclusions about why some materials are and others are not. **Activity 2 Procedure:** Participants will test the strength of their magnet by seeing how many paper clips they can pick up with the magnet. Does the arrangement of paper clips matter? Does the size of the individual paper clips make a difference? Participants will be encouraged to test the strength of other magnets in their houses. Does the size of the magnet make a difference? Why or why not? **Extension:** Create a moving Aurora Borealis. Using dark construction paper and chalk create several layers of auroras. Create a base by folding the bottom of the paper into an "L." Attach paper clips. Use your magnet to move your Borealis.	**Supplies:** ● Provided ○ Two bar magnets ○ A box of paperclips (if possible in at least two sizes) ● Not Provided ○ Magnets from around the house ○ Several items to test–coins, paperclips, aluminum foil, keys, canned food **Book suggestions:** ● *Northern Lights* by Martha Elizabeth Hillman Rustad **SciFri Related Content:** ● Use Magnetic Fields To Navigate Like A Sea Turtle ● Go On A Hunt For Metals!

Wed. 11/16/22 Q&A: 4 pm PT / 7 pm ET Subject Matter Expert Host: Mike L. Wong, Postdoctoral Fellow at the Carnegie Institution for Science's Earth & Planets Laboratory and host of the Strange New Worlds podcast.	**Exploring Our Solar System and Beyond** **Essential Questions:** • How can we learn more about the Sun? • How can our understanding of the Sun help us learn more about other stars, solar systems, and planets? • How can patterns be used to describe the universe? **Key Concepts:** • Space exploration • Parker Solar Probe • Exoplanets • Goldilocks zones • Astrobiology Resources: • Where Does Interstellar Space Begin? • What Powers a Spacecraft? • Parker Solar Probe	**Invent a Space Probe** **Objective:** To design a model space probe that could explore the sun. **Time:** 30-45 minutes **Procedure:** After researching the Parker Space Probe, participants will design and prototype a model probe using common materials such as disposable cups, chenille stems, drinking straws, etc. Once complete, they will evaluate the design based on a rubric to see if it could survive the sun. Then they can redesign as desired. **Extensions:** Design a space probe for interstellar travel. How would it be different from your sun probe? Compare the Parker Space Probe to the Webb Telescope or Voyager I.	**Supplies (not provided):** • Disposable paper cup or cardboard tube • Pipe cleaners • Paper straws • Popsicle sticks • Sheet of foil • Scrap cardboard • Other materials as desired • Scissors • Glue • Tape **Book Suggestions:** • *Explore Space Probes* by Lola Schaefer **SciFri Related Content:** • The Parker Solar Probe Gives Us A New Glimpse Of The Sun • Webb Telescope Arrives To Its Final Home In Deep Space • Voyager 1 Bids Farewell To The Solar System

All guests and projects subject to change.

At Science Friday, we encourage you to explore, discover, and participate! That is why we provide you with all sorts of experiments, puzzles, challenges, recipes, and other projects (collectively, the "Projects"). Of course, when you participate in any of these Projects, we want you to be safe and understand what you're getting into, which is why we've established this Projects Consent and Release (the "Release"). Read it carefully, because by participating in any Project, you're agreeing to the terms and conditions of this Release.