

Teachers' Guide to Comets: *Comet Siding Spring*

What are comets?

Comets are fascinating objects made of ice and rock that come from the very edges of the outer solar system. Comets may be as old as 4.6 billion years old, forming at the same time as Jupiter, Saturn, Uranus and Neptune. Some scientists speculate comets may be more than 4.6 billion years old – older than our solar system. Whatever their age, comets are frozen time capsules containing information about the very beginnings of our solar system, and may be responsible for delivering organic molecules – the building blocks of life – to Earth.

Where do they come from?

Comets come from two regions in the outer solar system: the Kuiper Belt (home to Pluto) and the Oort Cloud. The two billion mile-wide Kuiper Belt lies in the plane of our solar system and begins just past the orbit of Neptune. Halley's Comet comes from the Kuiper Belt. The Oort Cloud, a sphere of icy bodies that surrounds the solar system, is not well understood due to its extreme distance from the Earth and the rest of the planets. Though comets usually stay in these regions, they are occasionally "pulled" in towards the inner solar system by gravity.

Comet Siding Spring

Comet Siding Spring is a visitor from the Oort Cloud. It will pass close to Mars, coming within 82,000 miles (132,000 km) of the Red Planet at 2:28 P.M. Eastern Time on October 19, 2014. That does not seem very close, but consider that if Comet Siding Spring was to pass that close to Earth, it would be three times closer to the Earth than the Moon! When Comet Siding Spring was first discovered on January 3, 2013, scientists predicted there was a chance the comet could collide with Mars. After making more observations as Comet Siding Spring has come closer, scientists now do not expect it will collide with Mars. However, all of NASA's spacecraft operating at Mars will monitor Comet Siding Spring and the interaction of its dust with the planet's atmosphere to learn more about these infrequent visitors to our inner solar system.

Upcoming Events

Find information and resources about upcoming celestial events and NASA mission milestones to share with your students at http://www.lpi.usra.edu/education/look_up.

comets



Comets in Your Classroom!

Use the resources below to enable your students to explore comets, including Comet Siding Spring and its close encounter with Mars. Create a comet lesson or unit that fits into your classroom curriculum with hands-on activities, demonstrations, video clips, online exploration, and presentations by local scientists studying comets. Encourage your students to follow the news and explore more about comets and Comet Siding Spring's encounter with Mars!

Explore comets with hands-on activities!

Comet Mystery Boxes

http://stardustnext.jpl.nasa.gov/education/pdfs/CometMysteryBox_EducatorGuide.pdf

Grade Levels: K-8

Learners explore the physical characteristics of comets by reaching into a series of boxes and feeling the materials and structures within. They describe what they observe and speculate on comet characteristics, opening the discussion about the nature of these icy bodies and comparison to other members of our solar system. *NGSS Alignment - ESS1.B: Earth and the Solar System (Middle School); Obtaining, Evaluating, and Communicating Information.*

Comet on a Stick

http://epoxi.umd.edu/4education/mod_cometstick/Modeling_Comets_EG.pdf

Grade Levels: 4-8

Learners replicate the scientific processes of observing, forming an explanation, revising and communicating about a model of a comet. Learners construct a model of features of a comet using an assortment of common craft supplies. This activity relates to several NASA comet missions such as Deep Impact, Stardust, Stardust-NEXT, and EPOXI and can be used to emulate a process that scientists and engineers follow on all missions. *NGSS Alignment - ESS1.B: Earth and the Solar System (Middle School); Asking Questions, Developing and Using Models, Constructing Explanations, Obtaining, Evaluating, and Communicating Information.*

Comparing Comets

http://epoxi.umd.edu/pdfs/Comparing_Comets_TG.pdf

Grade Levels: 6-12

In this lesson about comets, learners will use images to observe and compare the surfaces of two comet nuclei from close range. Separate teacher guides and student guides are provided. Supplementary resources needed for the lesson are provided and include scientist and student audio tracks, and images of Wild 2, Tempel 1, and Hartley 2. *NGSS Alignment - ESS1.B: Earth and the Solar System (Middle School); Analyzing and Interpreting Data, Obtaining, Evaluating, and Communicating Information.*

The above activities, and other NASA educational activities, can be found at <http://nasawavelength.org>.

Clarifying Science Through Natural Events: Siding Spring Comet Encounter with Mars Lessons

http://marsed.asu.edu/stem-lesson-plans/natural_events

Grade Levels: Middle School, High School

Natural events happen around us on a daily basis and are frequently reported widely in the media. The students in our classrooms are aware of them, curiously engaged or often perplexed as to why they happen. Through this lesson, learn how to turn these timely natural events into NGSS-aligned teachable moments.

http://www.lpi.usra.edu/education/look_up



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@ESA_Rosetta

Websites

Comet Siding Spring at NASA's Mars Exploration Program
<http://mars.nasa.gov/comets/sidingspring/>

Comet Videos
<http://solarsystem.nasa.gov/multimedia/videos.cfm?&Object=Comets>

Comet Images
<http://solarsystem.nasa.gov/planets/profile.cfm?Object=Comets&Display=Gallery>

Missions to Comets: <http://solarsystem.nasa.gov/missions/profile.cfm?Sort=Target&Target=Comets&Era=Present>

About Comets
<http://solarsystem.nasa.gov/planets/profile.cfm?Object=Comets&Display=OverviewLong>

10 Need-to-Know Things About Comets
<http://solarsystem.nasa.gov/planets/profile.cfm?Object=Comets>

Comets vs. Asteroids Fact Sheet
http://solarsystem.nasa.gov/planets/docs/Comet_factsheet_4-25-12_b.pdf

Night Sky Viewing Events

Consider holding an evening observing session at your school! While Comet Siding Spring's encounter with Mars may not be visible from most telescopes on Earth, telescope viewing can still be a great way to learn about different objects in the night sky and to talk about the event. Ask your local astronomical society to bring their telescopes for an evening viewing. Use the links below to locate a local astronomy club and/or speaker.

Night Sky Network
<http://nightsky.jpl.nasa.gov/clubs-and-events.cfm>

The Night Sky Network is a nationwide coalition of amateur astronomy clubs bringing the science, technology, and inspiration of NASA's missions to the general public.

NASA/JPL Solar System Ambassadors
<http://www2.jpl.nasa.gov/ambassador/directory.htm>

Solar System Ambassadors is a nationwide program consisting of volunteers who communicate the excitement of NASA/JPL's space exploration missions and information about recent discoveries to people in their local communities.

http://www.lpi.usra.edu/education/look_up

Add a Creative Twist

“The “why” of space exploration is a matter of emotions and instincts... It takes a variety of languages, including, those of art, music, and literature, to teach.”

- Piers Bizony, “The Bigger Pictures”

Ever read a good science-fiction book or watch a futuristic movie like “Star Wars,” “Star Trek,” “Ender’s Game” or “The Time Machine?” Science fiction is storytelling that reflects scientific thought and foresees and communicates a future based on the reality of today. Literature, movies, music and works of visual art all have the power to communicate an idea and elicit emotion from an audience.

Encourage your students to create an artistic interpretation of the Comet Siding Spring encounter with Mars!

A Comet Encounter

Jacqueline Moliner is an avid science fan and professional artist. Her enthusiasm for all things Space inspires her to research the science behind celestial events and create her Cosmic Funnies series. This combination of art with science is a great example of a fun way she shares her passion with others. *A Comet Encounter* was motivated by Comet Siding Spring’s close encounter with Mars.

You can see more of the Cosmic Funnies and follow Jacqueline’s other work at <http://cosmicfunnies.tumblr.com/>

