Afterschool Activity
Comet on a Stick

Overview
During this activity, your youth:

- Learn about what comets are, how comets behave in space and why scientists care about them
- Learn that scientists use models on Earth to test some of their theories before we send missions to space
- Practice evaluating models and revising them to make a better model
- Use science skills of observing, classifying, communicating, modeling, inferring, team work

Time/number of sessions	Activity Type	Space Needed
Two 40-minute sessions (can be combined if students are model builders)	Hands-on, interactive, reading, art (sing/rap)	Tables and chairs for teams of 4-5, a table for materials

Activity Goals
Youth will:

- Understand the strengths, weaknesses, benefits and limitations of a model for its use in science and engineering
- Learn how to negotiate as a team to create a clear model of a comet
- Learn about comets

Where's the Science and Engineering?

- Generally, comets are referred to as having three main parts: the nucleus, the coma, and the tails.
- The nucleus is a black icy body filled with remnants of the rock, ice, and dust from the formation of the solar system – like a dirty snowball. Since it is so old, the nucleus holds frozen preserved clues to the way the solar system formed. It is the only large, solid part of a comet. It can be as big as a city is wide.
- Looking at many comet pictures, it isn't easy to tell that the nucleus is hidden inside the coma. When a comet is far from the Sun, it is mostly just a nucleus, and is very difficult to see from the Earth.
- The coma forms from the gases and debris that shoot out of a comet when it heats up close to the Sun and its strong radiation. This halo-looking coma can sometimes be as big as the Sun!
- Comet tails are made from gas, dust, and ice spewing from all sides of the nucleus. Tails can be hundreds of millions of miles long! A "dust tail" is made of dust particles pushed behind the comet by the pressure of radiation from the sun. A comet's gases are "charged" ("ionized") by this radiation, and form a second tail, an ion tail that is swept to point directly away from the Sun by high-speed charged particles from the Sun (called the "solar wind"). The dust tail and ion tail usually point in slightly different directions, and are sometimes different colors.
- Scientists believe comets and asteroids that exist today are those that were not swept into the formation of our planets 4.6 billion years ago. Most comets that we target for space missions come from the Kuiper Belt area, which is beyond the orbit of Neptune. Short-period comets travel around the Sun in an elliptical (long oval-shaped) orbit, going once around the Sun every 200 years or less! There are other comets orbiting the Sun even beyond the Kuiper Belt that form part of the Oort Cloud. They may only come inside Neptune's orbit if the gravity of nearby galaxies disturb them, and they may only come near the Sun once!

Science as Inquiry

Activity-based learning that is multifaceted and multisensory. The process of learning is encouraged and guided by questions that engage interest and require the observation and manipulation of objects, and assessments that encourage creativity of thought and diversity of results.

National Science Education Standards

K-4

Physical Science

Materials can exist in different states: solid, liquid, and gas.

Earth and Space Science

Weather has measurable quantities such as temperature, wind, and precipitation.

5-8

Physical Science

Gravity is the force the keeps the objects of the solar system in orbits.

Earth and Space Science

Atmospheres are mixtures of gases and vapor.

Mathematics

Problem solving — use of quantitative reasoning and mathematical skills to reach a goal that is not immediately or intuitively attainable.

Patterns and functions — conclusions that are based on perception, empirical evidence, and deductive reasoning.

Classification — conclusions that are based on perception, empirical evidence, and deductive reasoning.

Common Core English Language Arts, grade 5

Reading Informational Text

Determine two or more main ideas of a text and explain how they are supported by key details; summarize the text.

Comprehension and Collaboration

Summarize a written text read aloud or information presented in diverse media and formats, including visually, quantitatively, and orally.

Equity/Leveling the Playing Field

- This activity is as much "minds-on" as "hands-on." Challenge teams to think of it as an engineering and science project rather than an art project.
- Remember that science is done by consensus and not by vote. When modifying the model be sure that all team members share feedback on suggested revisions.
- Frequently students who want to have the "right" answer will attempt to take over the activity. Create an environment that allows for more than one way to be successful.

Materials

From Your Supply Closet

Session	For Leader	For Students
1	• Chart paper / whiteboard / chalkboard and markers / chalk to create "Notice/Know/Wonder" chart • A small ball or round piece of clay, string (ribbon or yarn, if available), clear tape, a pencil or stick (such as Popsicle™ stick) on which to mount the initial comet model	For each student team of 4-5: • 3"x5" index card • Pencils and paper
2	• "Notice/Know/Wonder" chart from the first session and markers/chalk	At a separate table, for comet models: • Scissors • Markers • Tape (clear or colored) • Glue, glitter glue • Sharpened pencils, Popsicle™ sticks, or straws • Aluminum foil • Cotton balls • Bubble wrap, eco-packaging • Garbage bags • Art supplies such as small styrofoam balls, clay, pipe cleaners, thin ribbon, shiny paper • Whatever you can scavenge and/or students can bring in

From a Photocopier/Printer

Session	For Leader	For Students
1	• *Student Space Images* • *Comet Image Leader Reference*	Depending on the musical interest and reading level of your youth, choose one *Comet Information Sheet* to distribute to each student: • *C-O-M-E-T-S Song Sheet Music* • *C-O-M-E-T-S Rap Song Lyrics* • *Cool, Curious Comets* Handout

Getting Ready

For Session 1

- Decide in advance which one of the *Comet Information Sheets* best works for you and all of your students' interests, and reading and musical abilities.
  - Take a small foam ball or piece of clay, to model a comet nucleus, and mount it on a pencil, Popsicle™ stick, or straw
  - Attach string, ribbon, or yarn pieces to the ball so that they model a comet tail
- Create a "Notice/Know/Wonder" chart: draw with a large marker to divide a piece of large chart paper into three columns and label as follows – "What I Notice", "What I Know", and "What I Wonder". Hang it on the wall where students can see it.
- Hang each of the 4 *Student Space Images* up near the "Notice, Know, Wonder" chart. Use the *Comet Image Leader Reference* as your reminder of the actual content of the images
- Hang a blank piece of chart paper for recording students' ideas about models.

For Session 2

- Ask students to bring clean recyclable materials from home to be used as building materials for the comets, and/or supply your own.
- Spread the comet model building materials out on an extra table.
- Rehang the "Notice, Know, Wonder" chart.

Leader Tips

- Whichever Comet Information Sheet you choose to use with your students, going over it in advance will help you guide the children through the activity more confidently.
- The importance of this activity is in understanding the design process – to design, evaluate and improve the model, which is an ongoing process in science and engineering
- A model is not meant to represent everything about the original (otherwise, we'd call it a "copy"!). It is meant to represent a specific, limited number of traits, which make it easier to work with. Encourage teams to represent just 2-3 traits, rather than everything about a comet.

Glossary

Coma (COH – muh) — the atmosphere around the nucleus of the comet, made from the nucleus' dust, gas, and evaporated ice.

Comet — an icy planetary body that travels around the Sun in a highly elliptical (long oval-shaped) orbit (very different from the orbits of the planets). It has a nucleus and when close to the Sun, a coma and one or more tails.

Dust tail — dust particles pushed behind a comet by the pressure of radiation from the sun.

Elliptical (ee – LIP – tih- cuhl) — oval-shaped.

Ion tail (EYE – on) — a trail of gases from the coma, charged ("ionized") by radiation from the Sun, and swept to point directly away from the Sun by high-speed charged particles from the Sun (called the "solar wind").

Nucleus (NEW – clee – us) — the solid core of a comet.

Radiation — energy emitted as particles or waves. Sunlight and the heat from the Sun are examples of radiation.

Comet on a Stick

Student Activity

Session 1 • Learning about Models and Comets

1. Have the students "count-off" to form teams of 4 or 5. Have each team work at a separate table.

2. Lead the students in observing the *Student Space Images* and in thinking about questions they have. Ask them to look at the images (that you know are comets from the *Comet Image Leader Reference* page), and then say what they notice about the images. Write their observations in the "What I Notice" column of the "Notice/Know/Wonder" chart. Encourage the students to only record in the "Notice" column what they can actually notice by looking at the image. This will keep them from claiming any misconceptions they might have. (Some examples to be sure to include: Each image is of something with a different shape and color. The long objects in the images are bright on one end and dimmer on the other. The round object has dimples on it. The odd-shaped object has jagged edges. There are stars in the background of two of the images.) The "Know" part of the exercise is kept to the end of the activity so that they are recording knowledge that is backed by accurate information.

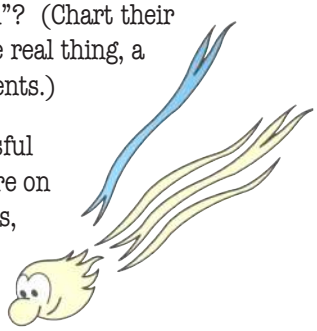
3. Next, ask them to think about what questions they have about what's pictured in the image, and about comets in general. Chart their responses in the "What I Wonder" column. (Following from the previous examples, they might wonder if the images are all comets, how far away the comets are, what the round object is made of and why it has dimples, and if all comets are the same.)

4. Help build the students' knowledge about models, and about how scientists and engineers use them, with this conversation guide:

- What kind of models do you use or make? (Chart their responses. Examples might include: model cars, a drawing of something, a clay sculpture, a globe of the Earth, a map)

- What are some words or phrases you think of to describe a "model"? (Chart their responses and guide them to include these examples: similar to the real thing, a different size, something simpler, an example, it describes, it represents.)

- When scientists and engineers are deciding how to make a successful spacecraft mission to a comet, they often have to make models here on Earth to test their plans or theories. When they make these models, they don't try to model everything that is true about a comet. They may make a model that only represents particular things about a comet so they can test their theories or mission plans.



5. Set the students up for the comet model design challenge. Use this conversation guide if you wish:

- Both NASA and the European Space Agency have sent several missions to comets to learn more about them. There is a lot we know, but there is still a lot we don't know, too. And, not all comets are the same.
- Today, you become scientists and engineers that NASA has asked to design comet models to represent key things they might need to know to help plan a future mission. NASA wants you to make several kinds of models that clearly and accurately show different features of comets.
- In your team, you are going to select 2-3 different things about comets that you want to model. Before we actually build the models, we need to learn more about comets.

6. Pass out copies of the *Comet Information Sheet* you selected for the group to use (*C-O-M-E-T-S Song Sheet Music, C-O-M-E-T-S Rap Song Lyrics*, or *Cool, Curious Comets Handout*). Use the next 10 minutes to either teach them the song from the sheet music, OR have different students learn lines from the rap lyrics and perform it, OR have them read the *Cool, Curious Comets Handout* and take notes about things they are interested in and they think scientists would want to know.

7. Next, show them the model of the comet that you have pre-made, and lead them in a discussion of the strengths and weaknesses of that model in representing a comet. Ask them what 2-3 features of a comet they think your model represents (lead them towards: comet nucleus and comet's ion tail). Continue the critique of the model with this conversation guide:

- I modeled the nucleus and the tail. I didn't try to make a model for everything that might be true about a comet. I just chose the nucleus and ion tail. Remember that tails exist only when the comet is close to the Sun! There, the Sun charges and pushes away the comet's gases, to form an ion tail. If I gather the model's tail and hold it away from myself as if I were the Sun, it makes a pretty good model of this.
- Now, what do you see that's not right about this model of a comet? (Look for answers like: there is no coma, a nucleus isn't white and it isn't a ball, a comet isn't on a stick, the model shows that there is a long tail but it isn't millions of miles long).
- This can still be a successful model though, if it models the two things that I wanted it to show in a clear and accurate way.

8. Give each team a 3"x5" index card, and tell them to write the team name on the top. Next, tell them to decide on the 2 or 3 things they would like their comet model to show about what a comet is, or what a comet does in space, and write them on the index card. Suggest they do it quietly so the other teams don't hear, because next time other teams will be trying to determine what their model represents.

9. Once the teams have recorded their 2 – 3 comet model characteristics, collect their cards and their comet information for the next session.

Session 2 • Building a Comet Model

1. Using the teams' index cards from the previous session, divide the group into the same teams as in Session 1. If there are students who missed the earlier session, assign them to the smaller teams, and have the rest of the team describe to them what they are trying to model about comets. You can review the last session and introduce today's session with this conversation guide:

- In the last session we talked about what models are and why they are important. What can you remember about that? (Chart their answers).
- We also talked about why engineers and scientists make comet models before they send any comet missions to space. When a NASA team works on a model, they agree on what the model will look like and many voices are involved in the choice. They need everyone's input to get the best model and then they have to agree on what the model will look like and how it will work.
- Today is our comet model design challenge; each team will build a model of a comet to represent the 2-3 things you already chose. Each team will then silently show their model to the other teams who will try to guess what is being represented.

2. (Optional) Leader Reading: When you were younger, NASA sent a mission called Deep Impact to a comet to make a big crater in the nucleus, so that scientists could tell what the surface, and below it, is like. They already knew that comets have some very valuable resources, which we could use someday if we send humans to live in space. But they wondered, "Is the surface of a comet soft or hard? Are there layers?" So, NASA sent an "impactor" riding on another spacecraft to make a crater in the comet so that they could look inside it and also see what dust and ice came out of it. The impactor had to hit the side of the comet lit by the Sun, so that scientists could actually see the comet in images the spacecraft took of the impact. Before the mission, scientists weren't quite sure of the shape of the comet nucleus, so what do you think they did? They used a visual computer model of a comet nucleus that other spacecraft had visited, and turned it in all directions to see what parts would be lit by the Sun. This helped them decide how to program the spacecraft's computer to help the impactor "look" for a sun lit place on the comet at which to aim.

3. Give each team their index card and show them the table of materials available to make their comet models. Give them a verbal tour of the choices of materials and give them 5 minutes at their own table to decide what they want for their model.

4. Ask teams to send one member to pick up their materials from the table and tell them they have 20 minutes to build their models. It's important that they work as teams and negotiate and have consensus on the final product. It is also important that they stick to the 2 - 3 choices they originally made.

5. Pass among the tables to identify several things:

- How well are they working together as teams? Do they need reminders about group consensus and input?
- Are they building models with the characteristics they committed to, rather than building models with the materials they liked best?
- If they are having a hard time with the materials they chose, can you help them think creatively about a new material that will show their comet characteristics?

6. Give them a 5-minute warning and then gather them back. Gather each team's index card so that you are aware of their choices. Prepare them to share their models with other teams.

7. Guide each team to get up and show their comet model, but without them describing anything about it. Have the other teams act as a science community by saying what they think the model is meant to show - about what a comet is, or what a comet does in space.

8. As each team shows their model, and other teams guess about the characteristics, check their card to confirm that the proper choices are being stated. Congratulate each team on their work, and encourage the other teams to applaud. Don't allow student statements that are negative. Make your own notes about any misconceptions the students might be showing in their models, but use these to make general comments about the strengths and weaknesses of the groups' models – without mentioning a specific team.

9. After all the teams have shared, lead into the assessments with this conversation guide:
   - We see how important it is that a model be clear and accurate. That's the only way it becomes useful to the science and engineering community.
   - Sometimes a NASA team puts together a model that doesn't work for the challenge they need answered so they go back and improve the model until it does. That is a part of the teamwork to put a successful mission into space.

Questions for the Youth (Informal Assessment)

Fill in the "Notice/Know/Wonder" chart with the students' responses to:

- What have we modeled in our comets that we can put in the "Know" column?
- Is there anything from our "Wonder" column that we feel we have answered?
- What else do you wonder about?

Sharing the Findings (Informal Assessment)

Ask students to give feedback on the models:

- Can you think of an experiment or challenge that your comet model might be used to solve?
- If you could make a new model, what kinds of characteristics about what a comet is or what it does in space would you like to include?

Leader Reflection/Assessment

1. Did the students work well together as teams to come to consensus?

2. Were answers revealed to some of what they wondered, and were there new questions?

3. Are there any misconceptions that you can correct by sharing new information at a later time?

Information for Families

In the week prior to this activity, alert the students that they will be building a model of a comet – encourage them to describe to their families what a comet is and what it does, to get their family's ideas about what kinds of household recyclable material to use, and to ask them to contribute to the collection of materials.

Families wanting to organize a donation to a favorite charity can collect enough pennies to equal the weight of the Deep Impact copper impactor – about 300 pounds (50,000 pennies)! Read one teacher's story of her class "Making a Deep Impact" at http://solarsystem.nasa.gov/deepimpact/community/pennies.cfm

Hold a nighttime star party and invite families to come. Several planets, the moon, and occasionally a comet can be viewed even from an urban area. Invite a local member of NASA's Night Sky Network to participate or host. The Night Sky Network is a nationwide coalition of amateur astronomy clubs bringing the inspiration of NASA's missions, sharing their time and telescopes to provide unique astronomy experiences under the real night sky – http://nightsky.jpl.nasa.gov

NASA Resources

Careers at NASA

Leticia Montanez is drawn to ice. She plays ice hockey on traveling teams. She decided to work on Jet Propulsion Laboratory's Deep Impact mission because it was exploring icy comet Tempel 1! The mission is "really cool" and "challenging" because "not only did we have to catch up to the comet, but the impactor also had to hit it sunny side up". Her job was to run a spacecraft simulation on a testbed, which is a really good model right here on Earth of the real spacecraft's computer in space, and watch for trouble spots. "I got the opportunity to pretend that I am actually flying the spacecraft by running rehearsals of what commands are to be executed onboard." She loved art, science, and math from a very young age, and her art background helps her to visualize what she tries to simulate with her testbed.

Resources

The Deep Impact mission was the first experiment to probe beneath the surface of a comet, attempting to reveal never before seen materials that would provide clues to the internal composition and structure of a comet. More at: http://solarsystem.nasa.gov/deepimpact

On February 7, 1999, the Stardust spacecraft was successfully launched aboard a Delta 2 rocket from Cape Canaveral Air Station, Florida, and thus started Stardust's journey to be the first NASA mission to return particles from beyond the Earth Moon orbit. Learn about this exploration into comets and how Stardust captured comet dust and sent them back to Earth at http://stardust.jpl.nasa.gov

For the model builders in the group looking for a real challenge, give them the instructions for assembling a model of the Stardust Spacecraft https://solarsystem.nasa.gov/kids/models/Stardust_Instr.pdf

Test your knowledge about NASA's Stardust spacecraft, which captured comet dust and brought it back to Earth! http://spaceplace.nasa.gov/tails-of-wonder/

Serious game-players may want to try to free "Comet Quest" app from iTunes™, and "take over" the Rosetta spacecraft in it's mission to learn about a mysterious comet – you must land and avoid the chunks of rock and ice coming off the comet.

Taking the Science to the Next Step

The Deep Impact mission made a crater in the nucleus of Comet Tempel 1 with a copper projectile. A sister spacecraft nearby took optical and spectrometer data during the encounter and for 14 minutes after impact. What do they need to consider about a comet in order to successfully gather their data?

Make a new model or improve your team's current model. Or, as a team, decide what kind of comet mission you would design. Take one of the challenges you will face and try to create a model that will help you find a solution for your challenge.

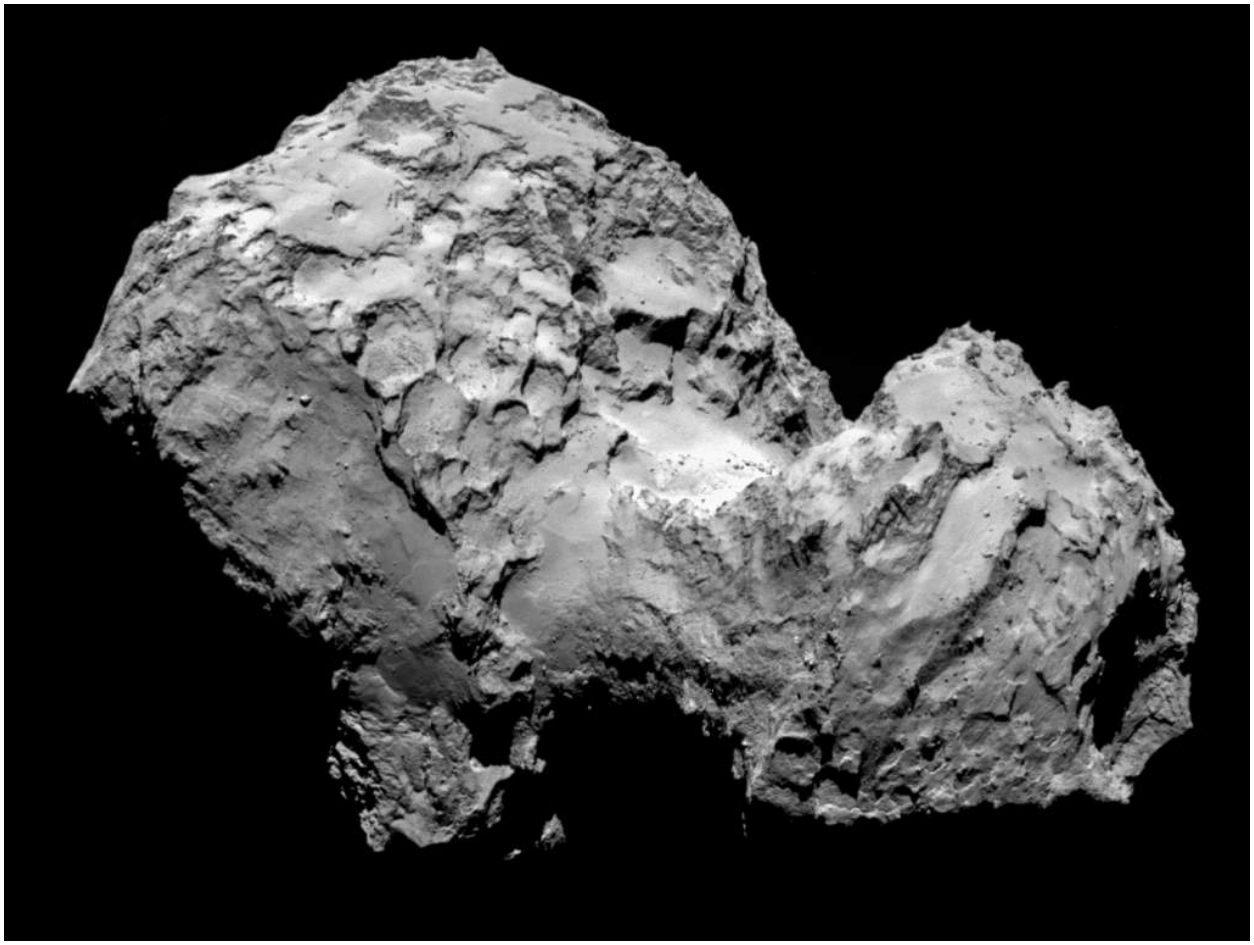
Once your team has designed your comet model, show it to the other teams without explanation. See if they can identify what you were trying to show about a comet. How well did you collaborate as a team to build a clear and accurate model?

Be a comet hunter using NASA images! For detail-oriented, visual-learning students really interested in contributing to science, with some help from a patient adult they can go through images of the sky to look for signs of "sun-grazing" comets:
http://sungrazer.nrl.navy.mil/index.php?p=guide

Literacy

Read the fictional story "Comet Sisters" to the students. Have them tell you what clues they hear that are buried inside the story - about what comets are, and what they do in space.
http://solarsystem.nasa.gov/deepimpact/educ/storysong.cfm

Activity Materials



Comet Image Leader Reference

Student Space Image 1 of 4 Comet Lovejoy passing behind the Earth, as seen from the International Space Station.	**Student Space Image 2 of 4** Nucleus of comet Tempel 1

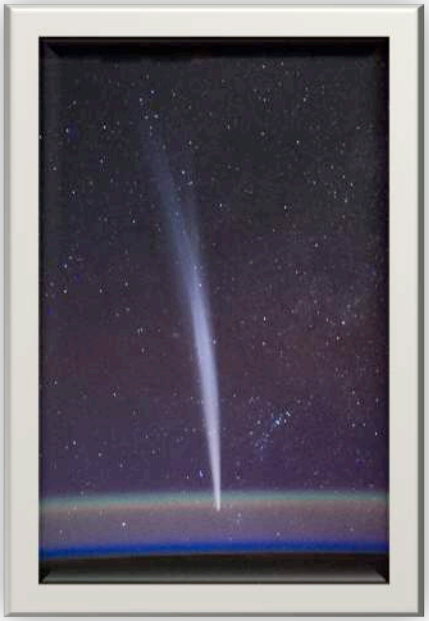



Image taken by astronaut Dan Burbank	taken by NASA's Stardust-NExT mission when the comet was beyond the orbit of Earth.

Student Space Image 3 of 4 Comet Hale-Bopp	**Student Space Image 4 of 4** Comet 67P/Churyumov-Gerasimenko
	
Image courtesy of Fred Espenak	from the European Space Agency's Rosetta mission

C-O-M-E-T-S

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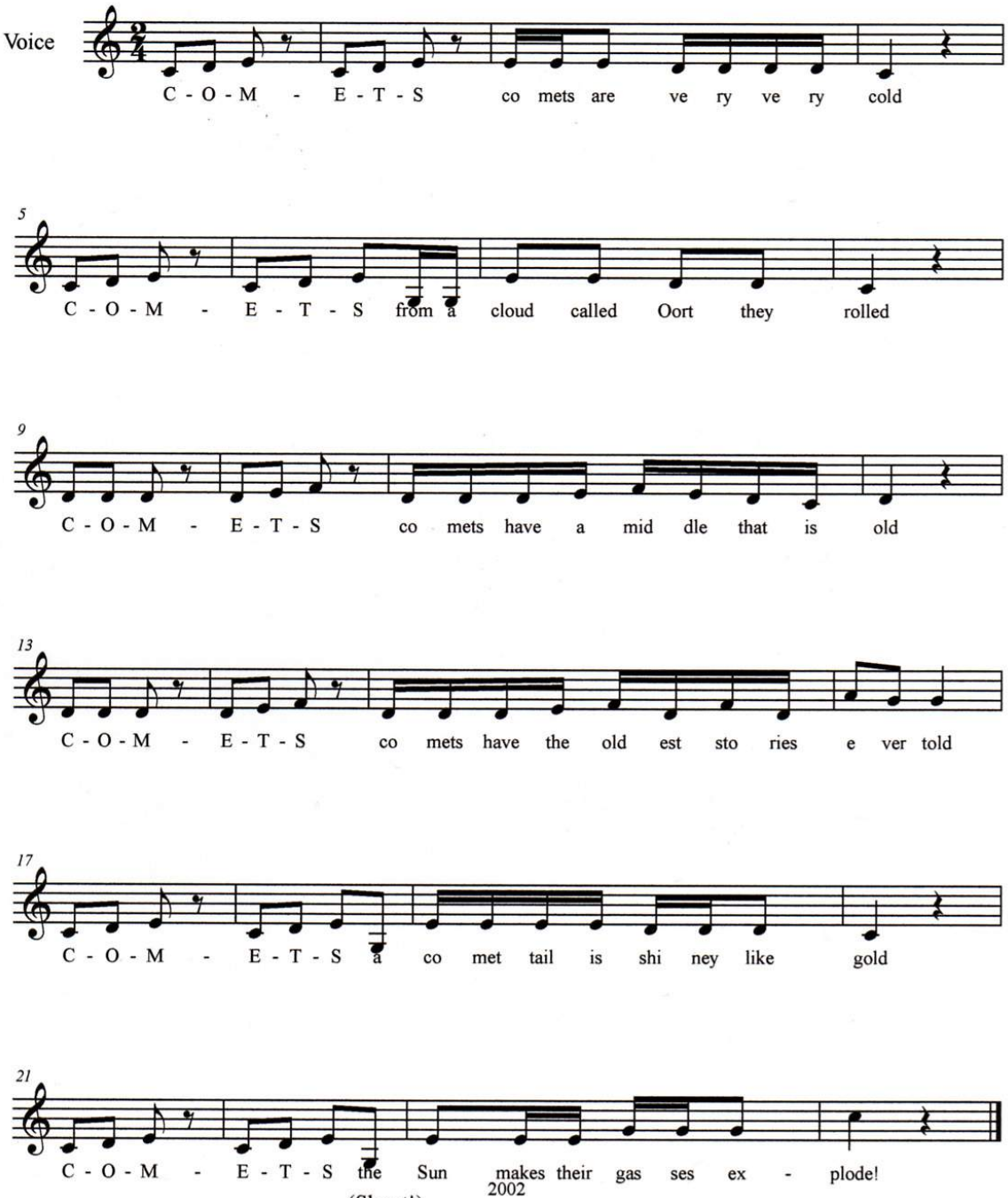
Maura Rountree-Brown



C-O-M-E-T-S

C-O-M-E-T-S COMETS ARE VERY VERY COLD
They're very very icy and they're very very cold
And rock, dust, gas a comet holds
They may be piles of rubble like a hiking trail
With an icy dust halo that becomes a tail.

C-O-M-E-T-S FROM A CLOUD CALLED OORT THEY ROLLED
Around our solar system like a candy shell
The Oort Cloud holds comets quiet and pale
Within the solar system in the Kuiper Belt run
The comets that are orbiting around the Sun.

C-O-M-E-T-S COMETS HAVE A MIDDLE THAT IS OLD
A middle in a comet, a middle you say?
I only see a shiny cloud of dust my way
But inside the cloud there's a snowy dirt ball
Called a tarry black nucleus that's short or tall.

C-O-M-E-T-S COMETS HAVE THE OLDEST STORIES EVER TOLD
You freeze your vegetables to keep them fresh
A comet freezes stories that we haven't heard yet
If we want to know the story of the solar system's past
Frozen in a nucleus the stories can last.

C-O-M-E-T-S A COMET TAIL IS SHINY LIKE GOLD
Our moon shines from the reflection of the Sun
So how else would you see a comet run?
The Sun shines on its million mile trail
And the ice, gas, dust make two kinds of tails.

C-O-M-E-T-S THE SUN MAKES THEIR GASSES EXPLODE.
Now here's the part that tells us why the tail can grow
The Sun heats the nucleus to make gas show.
When it shoots forward like a fireworks trail
The Sun's solar wind sends it back to form the tail.

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Cool, Curious Comets

What are comets?

Comets are part of our solar system family. Like Grandma's mystery meat pie, they are made of old leftovers after the Sun, the planets, and the moons were formed.

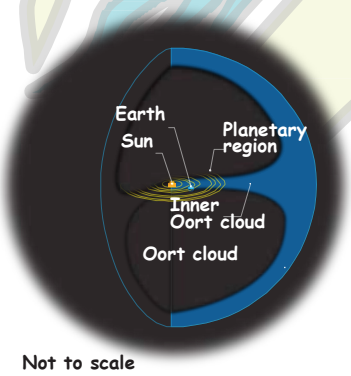
Can we see them?

About once a year some comet comes around that we may be able to see with our unaided eyes. It might look like a fuzzy cotton-ball—maybe faint, maybe bright—usually with one or two long tails.

Where do comets come from?

Most comets come from the Kuiper Belt, a region beyond the orbit of Neptune. Comets from this neighborhood usually take 200 years or less to make one orbit around the Sun. These comets are called *short-period comets*.

Two-hundred years sounds like a long trip, but that's nothing compared to the trips made by comets from their other hangout, the *Oort Cloud.*



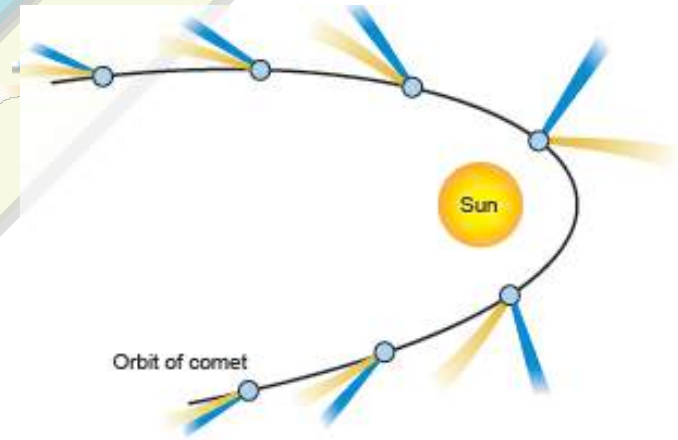
The Oort Cloud is a far-far-distant cloud of comets that surrounds the solar system. Scientists think there could be about a trillion comets orbiting way out there. One trip around the Sun could take one of these comets 30 million years! That's why they are called *long-period comets.*

What brings comets to the inner solar system?

Sometimes the gravitational pull of a passing star or galaxy stirs up comets in the Oort Cloud. Some might get sent flying into the inner solar system.

Sometimes the gravitational pull of a planet can disturb comets in the Kuiper Belt and fling one headlong toward the Sun.

The Sun's gravitational pull really takes over, shaping the comet's path into a very lop-sided orbit. The comet is pulled faster and faster toward the Sun, it swings around close to the back-side, then it heads out again to more or less where it came from. Some comets dive right into the Sun, never to be seen again. When the comet is in the inner solar system, either coming or going, that's when we may spy it in our skies.



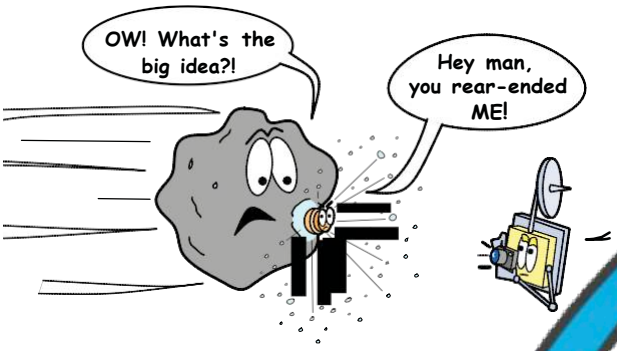
What do comets look like up close?

The *nucleus*, or solid part, of a comet is usually less than about 6 miles across, but may be as big as about 25 miles across. Recent space missions have given us some close-up views, so we don't have to guess what they look like anymore.

The Deep Space 1 mission flew close to Comet Borrelly in 2001. It found rugged terrain, smooth rolling plains, deep fractures and very, very dark material. A few years later, space mission Deep Impact flew very close to Comet Tempel 1. That comet also appeared very black on the outside.

What's inside?

Comets seem to contain a lot of ice, some rocks and dust, and frozen gases. Deep Impact crashed a "smart impactor" into Comet Tempel 1 and studied the debris that spewed out. It found that the surface of the comet is very fragile and weak. Inside it is spongy, with lots of holes. It has ice beneath its surface. It contains material from outer, middle, and inner parts of the solar system. Other comets may be different. The EPOXI mission studied Comet Hartley 2 in 2010.

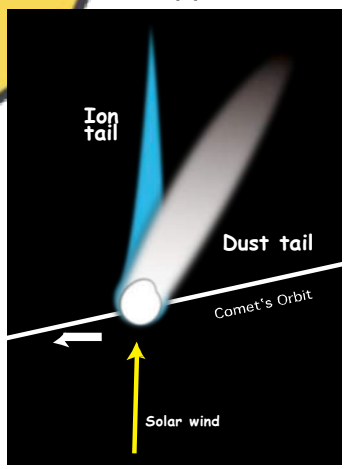


What makes comets look fuzzy?

When they are at home in the Oort Cloud or Kuiper Belt minding their own business, comets are just dull, dark chunks of ice, dust, and rock. In this state they may not be much different from asteroids. But as comets get closer to the Sun and begin to warm up, some of their materials start to boil off. This material forms a cloud around the nucleus. The cloud is called the *coma* and may be hundreds of thousands of miles across. One mission, called *Stardust*, gathered samples of the coma of Comet Wild 2 and returned them to Earth for study.

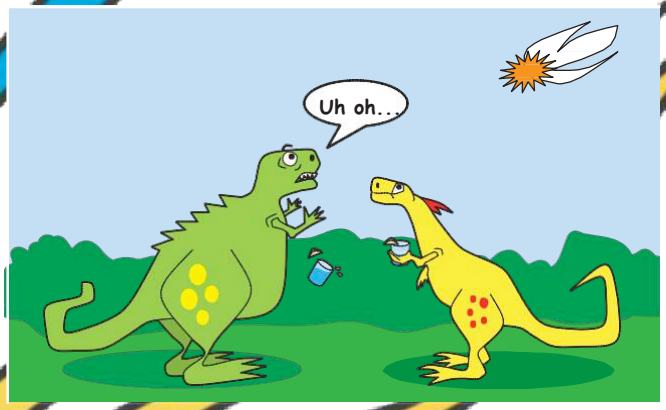
Why do comets have tails?

What do comets and lizards have in common? If either of them loses its tail, it can grow another one! Comet tails appear as the comet approaches the Sun and can grow to be millions of miles long. Tiny charged particles are constantly blasted out from the Sun. This solar wind pushes the small dust particles in the coma into a long curved path. This tail is known as the *dust tail*. Another tail, the *ion tail,* is made of electrically charged molecules of gas. he ion tail points directly away from the Sun. And a third tail, the *sodium tail,* we usually don't see. But what the Sun gives, the Sun can take away. In 2007, the STEREO spacecraft recorded Comet Encke's entire ion tail being ripped right off when the Sun got especially stormy.



Has a comet ever crashed into Earth?

Yes, indeed. In Earth's babyhood, comets often hit it. Planetary cruelty? No. Actually, scientists think comets may have contributed water for our oceans or even molecules from which life eventually evolved. Some believe it may have been an asteroid or, less likely, a comet collision that did in the dinosaurs.



How many comets have been discovered?

Humans have discovered thousands of comets. Comets used to be named mostly after the people who discovered them. Many comets are now named for the observatory or spacecraft used to discover them.

How will scientists learn more?

Several space missions have already been sent to chase comets and study them up close. Rosetta is a mission of the European Space Agency. It released a lander named Philae onto the surface of Comet Churyumov-Gerasimenko to study the comet nucleus its orbit while nearest the sun.

More comet fun:

Comet game, Tails of Wonder: spaceplace.nasa.gov/tails-of-wonder/en

Comet Wordfinds: spaceplace.nasa.gov/comet-wordfind/en

What's inside a comet: spaceplace.nasa.gov/comet-nucleus/en