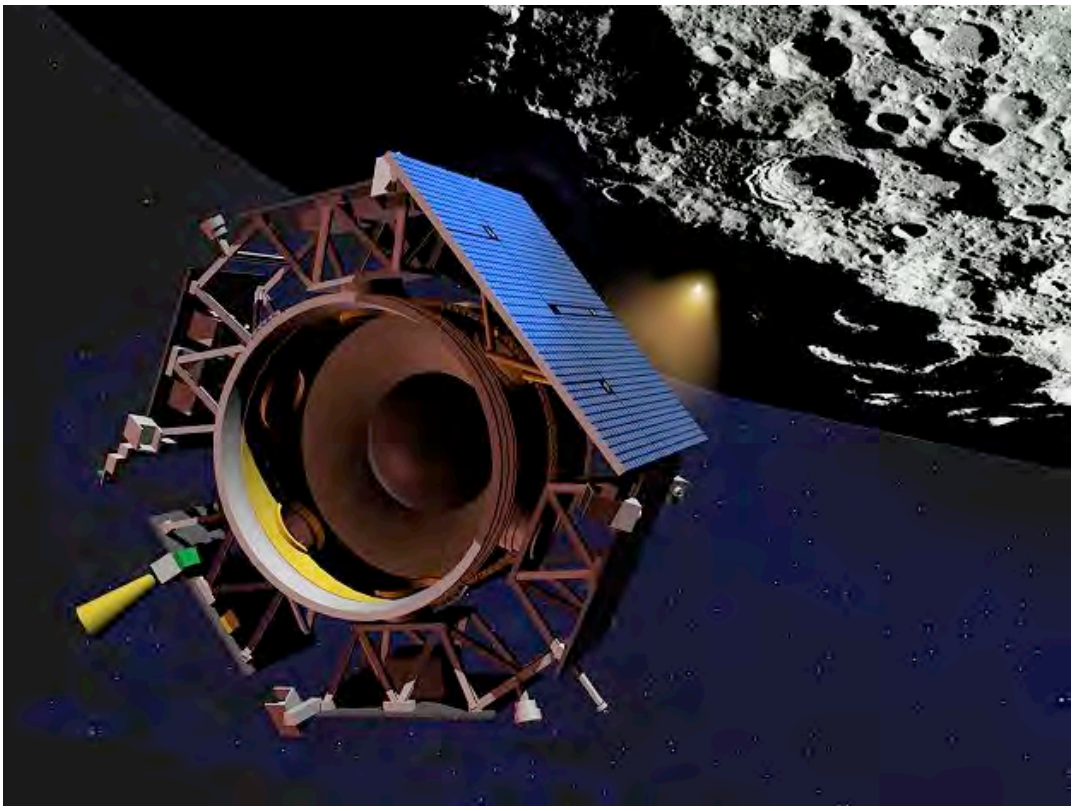
LCROSS Activities: Targeting Shadows on the Moon



Activities for amateur astronomers and other informal educators to share the science and excitement of the LCROSS mission with the public

Activities provided by the Astronomical Society of the Pacific

LCROSS Activities: Targeting Shadows on the Moon

What's the LCROSS Mission about?

The mission objectives of the Lunar Crater Observation and Sensing Satellite (LCROSS) include confirming the presence or absence of water ice in a permanently shadowed crater at one of the Moon's poles. The identification of water is very important to the future of human activities on the Moon.

LCROSS will excavate the permanently dark floor of one of the Moon's polar craters with two heavy impactors to test the theory that ancient ice lies buried there. The impact will eject material from the crater's surface to create a plume that specialized instruments will be able to analyze for the presence of water (ice and vapor). (From the LCROSS website: http://lcross.arc.nasa.gov/)

What's this set of activities about?

This set of hands-on activities helps your visitors discover the answers to common questions regarding the LCROSS Mission.

Big Questions:

1. Where will LCROSS impact the Moon?
2. To what degree will the impact affect the Moon?
3. Why do scientists think water ice will be at the north or south lunar poles?
4. Where would the water come from?
5. Why do we care if there is water on the Moon?

Big Activities:

1. ***Cook Up A Comet:*** Assemble a model of a comet nucleus from household ingredients to illustrate where water on the Moon could have originated.

2. ***Finding the Right Crater:*** Using simple props, quickly show why craters at the poles of the Moon never see the Sun and might harbor frozen water.

3. ***Making an Impact:*** Using a pan full of flour and some rocks, your visitors create a moonscape then illuminate it with a flashlight to illustrate why scientists think water ice could remain frozen in always-dark craters at the poles of the Moon.

Where can I use the activities?

ACTIVITY	Star Party	Pre-Star Party –Outdoors	Pre-Star Party –Indoors	Girl Scouts / Youth Group Meeting	Classroom			Astronomy Club Meeting	Gen Public Presentation (Interactive)
					K-3	4-8	9-12		
1. Cook Up a Comet		√	√	√		√	√	√	√
2. Finding the Right Crater	√	√	√	√	√	√	√	√	√
3. Making an Impact!	√	√	√	√	√	√	√	√	√

Background Information

These activities provide ways to show where water ice on the Moon may have originated – comets – and where the water ice might be found on the Moon – at the poles.

The first activity “Cook Up a Comet” allows you to demonstrate the ingredients in comets and how they could have contributed to water ice on the Moon that the LCROSS mission is designed to detect. You may choose one of the other two activities to demonstrate why scientists are targeting the poles of the Moon as potential reservoirs of water ice. “Finding the Right Crater” provides a quick demonstration. “Making an Impact!” involves your visitors in creating craters in a moonscape and goes on to explain the comparative size of the crater the LCROSS impactor will make.

Comets have a variety of different orbital periods, ranging from a few years, to hundreds of thousands of years, while some are believed to pass through the inner solar system only once before being thrown out into interstellar space.

An astronomer named Fred Whipple suggested in 1950 that comets were a lot like "dirty snowballs." He was right--they are mostly frozen water, with some other gases and other interplanetary debris – leftovers from the formation of the solar system. Some comets end up crashing into planets or moons, blasting their ingredients – including the water – in all directions over the surface of the planet or moon.

If comets have impacted Earth’s Moon in the past, scientists predict that some of the comets’ ejected water vapor could have fallen into the bottom of the always-dark craters at the poles. The water could have frozen and still be there as water ice. These impacts could have happened over and over again since the Moon formed, building up a good reservoir of ice. LCROSS is designed to see if that prediction is correct.

Why is finding water on the Moon important?

NASA is making plans to send humans back to the Moon and establish a permanent base there. This means that people could be living there for weeks or months at a time.

Water is not only essential to human survival, but it could also be used to grow plants for food. Water is made of the elements hydrogen and oxygen. Using solar power, the water could be separated into hydrogen and oxygen, using hydrogen for rocket fuel and oxygen for the humans to breathe.

If there were no water on the Moon, any water needed would have to be shipped by rocket to the Moon from Earth. All the weight of that extra cargo would make the missions more costly. So finding water already on the Moon would eliminate a potential barrier to extended Moon missions.

For more information, visit the LCROSS website: http://lcross.arc.nasa.gov/

Detailed Activity Descriptions

1. Cook Up a Comet

PREPARATION

Learning Objectives:

- What is a comet made of?
- Why might comets be a source of water on the Moon?

About the Activity:

Cook Up a Comet gives insight into the "dirty snowball" model of comets- composed of material from the early solar system in the form of frozen water and gases, simple organic compounds, and dust.

Comets impacting their surfaces may have been the primary source of water on planets and moons in the early solar system.

You can do the demonstration yourself as the participants watch and listen, or you can have small groups of participants each make their own comets. If many groups will be making their own comets, it is important that these groups are over the age of 9 and able to follow directions closely to reduce risk of injury. With school and youth groups, it is recommended that an adult supervise each group.

Using dry ice and simple household materials, this comet concoction is a big hit with kids and adults alike.

This activity is adapted from a classroom activity. Learn more here: http://cse.ssl.berkeley.edu/SegwayEd/lessons/cometstale/com.html

MATERIALS:

Materials Needed (per comet):

- Measuring cup
- Large spoon
- Mixing bowl
- 4 black garbage bags
- Newspapers
- Work gloves (gardening gloves with nubs or heavy leather work gloves)
- Protective goggles
- Hammer

OPTIONAL: Heat lamp

Ingredients for each comet:

- Dry Ice – 2 cups
  - To find dry ice in your area: http://www.dryiceDirectory.com/
- Ammonia (or window cleaner that contains ammonia) - 2 Tbsp.
- Dark corn syrup (or cola – with sugar – don't use diet) – 1 Tbsp.
- Water – 2 cups
- Dirt or sand – 1/4-cup

Comet Recipe adapted with permission from Dennis Schatz, Pacific Science Center (www.dennisschatz.org 1985 by Dennis Schatz)

PREPARATION

Setting and Duration:
You can make a comet in a classroom, before a star party, with youth groups, and the general public. It can get a bit messy so it is good to have newspaper to put down if you are inside. It takes about 10-15 minutes for you to do the demonstration.

If you are having several small groups of participants each make their own comets, the process could take 30 – 40 minutes.

Audience:
Use this activity as a demonstration for families, the general public, and school groups ages 9 and up. You will need a helper to wear the goggles and the gloves.

With school and youth groups, if you are having several small groups make their own comets, it is recommended that an adult supervise each group. In this case, remember to obtain multiple sets of materials and ingredients, including goggles and gloves. (One heat lamp is sufficient for the whole group.)

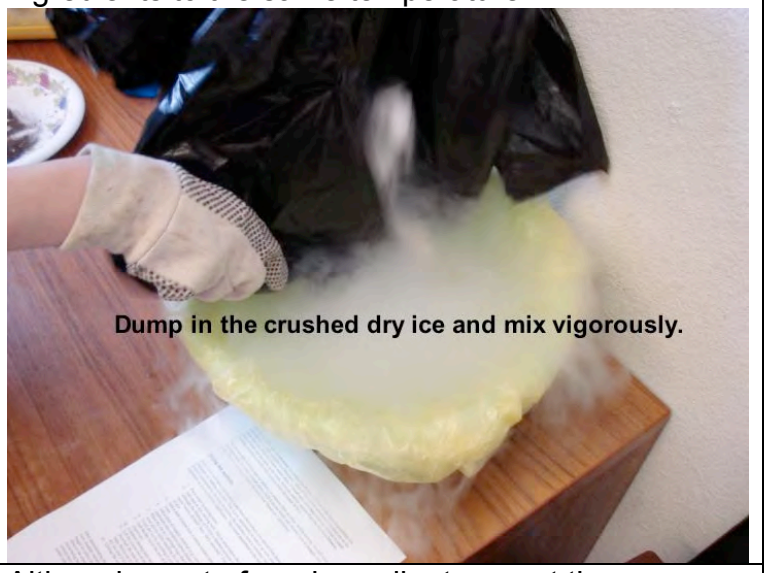
To Prepare:
Collect all materials and ingredients in advance. It is strongly advised that you try the activity yourself before doing it with a group.

Tips for working with dry ice:

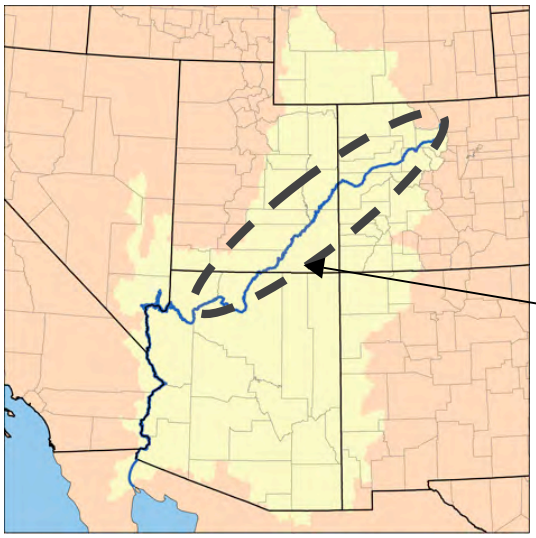
1. Day old dry ice is much more brittle than fresh and will crush better
2. It is recommended that you pre-crush your dry ice to the consistency of snow.
3. After crushing, you don't want any chunks left that are bigger than the size of a pea. Large chunks affect the cohesiveness of your comet.

PROCEDURE

TO DO	TO SAY
Step 1: Begin this activity by arranging all the ingredients and utensils in front of you on a sturdy worktable. You will need a helper who is wearing goggles and gloves.	Everyone needs to be conscious about safety! We'll be using dry ice today. It can cause cold "burns" and flying chips can be damaging to eyes, so whoever handles the dry ice must always wear protective gloves and goggles.
Step 2: Open up one garbage bag and use it to line your mixing bowl. This will help you shape your comet, and make cleaning up easier at the end.	Today, we'll be making a model of the nucleus of a comet – just its central core, how it would look without its coma and tail. In our solar system, comets were part of what nature didn't clean up after the solar system was formed from a swirling disk of gas and dust called the solar nebula. As this nebula of gas and dust swirling around the sun cooled, it formed small rocks or planetesimals, which then gathered together to make bigger rocks, which ended up forming the planets and moons. Comets were the leftovers. You can think of them as the bits of dough left in the bowl when you make cookies.
Step 3: Add the 2 cups of water to the mixing bowl.	Comets have water in them. Water is made from just 2 elements – hydrogen and oxygen. The gases hydrogen and oxygen, as well as water vapor were probably all present in the solar nebula.
Step 4: Add 1/4-cup sand or dirt, stirring well.	You can't buy interplanetary dust at the store, so we have to use sand and dirt in its place. Sand and dirt have the minerals, and simple compounds that are found in comets. But dirt also contains bacteria, and mold, which are not found in comets. These living things have been created over the eons since the earth was formed.
Step 5: Next, add a dash of organic material (e.g. corn syrup – a common ingredient in soft drinks), stirring until well mixed.	Organic material means anything made up of carbon, hydrogen, nitrogen, and oxygen. Sugar, alcohol, and methane are all organic compounds. All living things are made mostly of these four substances. Scientists have discovered that our Milky Way galaxy actually contains a very simple kind sugar that probably existed before the planets were formed! Corn syrup represents simple organic compounds that were probably present in the solar nebula, and these helped form life later on.

TO DO	TO SAY
Step 6: Add about 1/8 cup (2 Tablespoons) of ammonia (or window cleaner with ammonia) and stir some more. You should have a muddy, slightly icky-smelling, mixture.	Ammonia, the same compound we use to clean windows, is another organic compound that existed in the solar nebula. The atmospheres of the giant planets Jupiter and Saturn contain large amounts of ammonia.
Step 7: Make sure your helper is wearing goggles and heavy gloves to handle the dry ice.	Dry ice is frozen carbon dioxide, The same gas that makes bubbles in soda pop. Most of the atmosphere of Mars is carbon dioxide. When a comet is far from the sun, its carbon dioxide is frozen into dry ice.
Step 8: (If your dry ice has already been crushed, read the narrative and go immediately on to Step 9.) Put the dry ice inside several plastic bags and crush it by pounding it with a hammer. You will need 2 cups of the crushed dry ice.	We crush the dry ice to make it mix with the water, dirt and organic material. All the "ingredients" in the original solar nebula were pretty evenly mixed, so your comets' ingredients should be well mixed with no really big lumps.
Step 9: Add the dry ice to the other ingredients in the mixing bowl while stirring vigorously. Be sure to mix the ingredients quickly, for about 30 seconds. Move fast, as the dry ice will start to freeze the water right away.	Your stirring is like the rotation of the solar nebula that "mixed" the original batch of comets as it whirled through space. Mixing also brings all the ingredients to the same temperature.  Dump in the crushed dry ice and mix vigorously.
Step 10: Now take your spoon out and check your mixture. Lift the bag out of the bowl and quickly feel the contents. If you still feel a lot of liquid water, add a little more dry ice and stir.	Although most of our ingredients are at the same temperature as the surrounding air, the dry ice is about -79 degrees Celsius (or -110 degrees Fahrenheit). The dry ice cools the other ingredients until they are frozen solid. In space, real comets are usually so far away from the sun, they are even colder than this.

TO DO	TO SAY
Step 11: Lift the comet out of the bowl by the plastic liner. Have one person hold the bag loosely. The person with the gloves should use their hands to compress and mold the contents for at least a minute. If you have more gloves, get others to help.	If the person holding the bag shuts it too tightly, the bag starts to blow up, or inflate. This is because some of the carbon dioxide is sublimating, or turning from dry ice directly into carbon dioxide gas. It's called "dry" ice because it never becomes a liquid. If a comet's orbit takes it near the sun and the sun heats it up, the surface of the comet starts to sublimate and break down. Some comets go so near the sun that they completely fall apart and burn up.
Step 12: Unwrap your comet from the plastic bag, and you're done! 	Don't worry if your comet doesn't look round and smooth. Real comets aren't either. Some comets don't make it all the way around the sun and crash into a planet or a moon. How much water did we have in our little comet? Right – 2 cups. Now imagine thousands to millions of comets hitting Earth during its formation billions of years ago. Do you think that's where a lot of the water on Earth could have come from? How about the Moon – do you think comets could have hit the Moon? Certainly!
Use one of the activities, "Finding the Right Crater" or "Making an Impact" to explain where water ice might exist on the Moon.	So could there be water on the Moon? Where would we find it? Let's do another activity to figure that out.

OPTIONAL ACTIVITY EXTENSION TO SHOW THE COMA AND TAIL OF THE COMET:	
TO DO	TO SAY
If you have one available, set up a heat lamp to demonstrate how a comet's coma and tail form. Point the lamp at the ceiling and hold a comet over it (with gloves on!) and you may see faint plumes of steam coming off. This steam is really water vapor that is condensed by the super-cold CO2 sublimating from the surface (changing directly from a solid to a gas). This is a subtle effect.  (Colorado River watershed by Karl Musser http://commons.wikimedia.org/wiki/Image:Colorado_watershed.png)	If a comet's orbit takes it near the sun, the sun will heat it up. Then the surface of the comet begins to change directly from a solid into a gas and starts to form a long gossamer tail. As it heats up, and the ice that is holding it together disappears, it will shed some of its material leaving a trail of dust and small rocks in its wake. The nucleus of a real comet is usually several kilometers wide, with its coma about a million km wide and its tail over a 100 million kilometers long. If we use our model comet to represent a scale model of the nucleus of a real comet, our model's coma would span the Grand Canyon and its tail would extend from the Grand Canyon back to the source of the Colorado River in the Rocky Mountains (see illustration to the left). Approximate extent of model comet
CLEAN UP: When you are finished with them, the comets themselves can be placed in a large container like a detergent bucket. Participants should not touch the comets with bare hands except very briefly. After the comets have melted again, dispose of the sludge in a well-lined garbage can.	
Additional Information: The disappearance of the comet after a couple of hours might raise questions about what happens to real comets. You then have a chance to discuss how comets get close to the sun, how they are heated and "shed" material near perihelion in the form of gas, dust, and meteoroids, and thus gradually disintegrate.	

2. *Finding the Right Crater*

PREPARATION

Learning Objectives:

To demonstrate why the LCROSS mission is targeting craters at the Moon's north/south pole to search for signs of water ice.

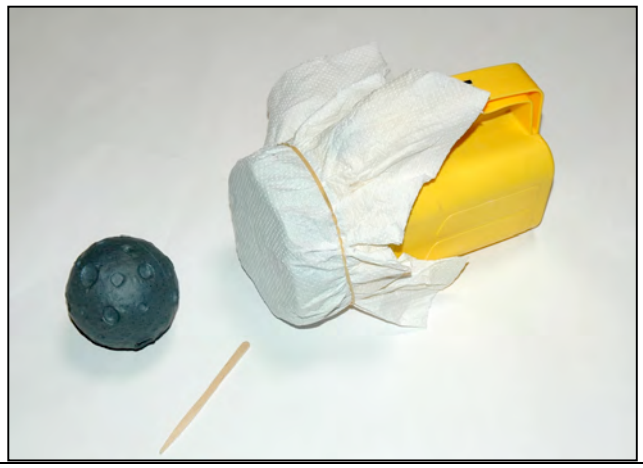
About the Activity:

Finding the Right Crater quickly allows your visitor to understand why scientists think water ice could remain frozen in always-dark craters at the poles of the Moon.

This is a quick demonstration that you can do with one person or several people in just a few minutes.

MATERIALS:

- Foam moon ball (search the Internet for "moon stress ball" to find sources for this ball)
- Skewer stick or toothpick
- Bare light bulb (40 – 60 watt) or a flashlight covered with a paper towel or wax paper and secured with a rubber band. The paper towel is used to diffuse the light.



Setting and Duration:

Do this at night or in a room where you can turn off all the lights.
The demonstration takes less than five minutes.

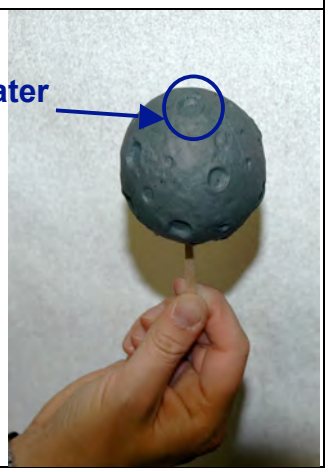
Audience:

Appropriate for any ages 6 and up.

To Prepare:

Insert the skewer sticks or toothpicks into each moon ball such that a large crater is centered over the north (or south) pole of the moon ball, as indicated at the right.

Turn on the flashlight or light bulb. If you are outside at night and there are telescope operators nearby, be sure to shine the light away from the telescopes.



PROCEDURE

Leader's Role	**Participants' Role (Anticipated)**
To Say: NASA's LCROSS mission will be searching for signs of water ice on the Moon.	
If humans were to return to the Moon for days, weeks, or months at a time, why would finding a source of water be important?	Drinking! Washing.
How else would we get the water up there?	We'd have to send it by rocket ship.
Yes, and the more cargo that has to be launched by rocket, the more costly the mission.	
Where would you look for ice on the Moon?	Don't know.
Where the sun is shining on the Moon's surface, the temperature is hot, on average, about 107 C or 225 F. Would ice survive in the sunlight?	No.
Out of the sunlight, in the shade on the Moon, the temperature is around -170 C (-275 F). Could water ice survive there?	Maybe.
Yes, it could, provided that place never had sunshine. Because there is no atmosphere on the Moon, there is nothing to hold in the heat of the sun, like the Earth's atmosphere does at night. So craters that never see the light of day always stay extremely cold.	
So where on the Moon might there be craters that get no sunshine inside them?	Don't know.

Leader's Role	Participants' Role (Anticipated)
To Do: Hand the flashlight covered with a paper towel to a visitor. Hold the moon ball by the stick straight up and down and slowly turn the ball on its axis in the light (see photo at right). NOTE: The Moon's axis is tipped less than 2 degrees relative to the Sun, so for our purposes, the moon ball's axis can be held vertical. 	
To Say: The Moon orbits the Earth and over the course of a month, all sides of the Moon are at some point lit up by the Sun's light. Can you find any craters that don't get sunshine into the bottom of them? What about all the other craters on the Moon? So the craters at the poles could have water ice in them. And that's where the LCROSS mission will choose a crater that could have water ice in it – at one of the poles.	Yes, here at the top. No, all of those get sunshine at some time during the month.

3. *Making An Impact!*

PREPARATION

Learning Objectives:

To demonstrate:

- How the Moon acquired its craters
- Where water on the Moon could have come from
- Why the LCROSS mission is targeting craters at the Moon's North/South Pole to search for signs of water ice.
- The size of the LCROSS impactor compared to past lunar impactors

About the Activity:

Using a pan full of flour and some rocks, your visitors create a moonscape then illuminate it with a flashlight to illustrate why scientists think water ice could remain frozen in always-dark craters at the poles of the Moon.

MATERIALS:

- 5 cm (2") polystyrene ball (draw a small square on the ball with a pen or magic marker)
- Short skewer stick or toothpick
- Flashlight covered with a paper towel or wax paper and secured with a rubber band. The paper towel is used to diffuse the light.
- A few grains of sand or salt

"Pan with Flour" Method:

- Large pan or plastic tub similar in shape to a 33cm x 20cm x 7cm (13"x8"x3") baking pan.
- Several "meteoroids": rocks (you can also supply small balls of clay or even bite-sized wrapped candy).
- Packet of powdered hot cocoa mix
- 2-kg (5-pound) bag of flour

For sources of materials, see the listing "Where do I get materials?" at the end of this activity.

For easier cleanup, if doing this indoors:

- Broom, dustpan
- Newspaper

Alternate Method: "Play Dough Moonscape":

- See "***To Prepare***" below for "Play Dough Moonscape."

PREPARATION

Setting and Duration:
Do this outdoors at night or indoors in a room where you can turn off all the lights.

If using the "Pan with Flour" method, and this is done outside at night, do it downwind from telescopes, especially if there is a breeze. If very windy, do this indoors. Otherwise, the flour will blow around when participants brush flour off their hands and clothes.
The activity takes less than 15 minutes.

Audience:
Appropriate for ages 6 and up.

To Prepare:

Prepare EITHER the "***Pan with flour***" or the "***Play Dough Moonscape***".

For either method:
Draw a small 5mm (1/4") square on the side of the 5 cm (2") dylite/polystyrene ball and one square at the top of the ball. These squares mark the front of the Moon and the pole area of the Moon represented by the moonscape.

Place the 5 cm (2") ball on a skewer stick or toothpick and place it next to the pan.

Pan with flour:

- Fill the pan **to the rim** with the 2 kg (5-pound) bag of flour.
- Smooth the top with your hand.
- Sprinkle about half the packet of hot cocoa mix over the top.

STORAGE: If you want to save the flour for a later demonstration, you may want to store the flour in a sealed container in the freezer to reduce the likelihood of insect infestation.

PREPARATION

Play Dough Moonscape:

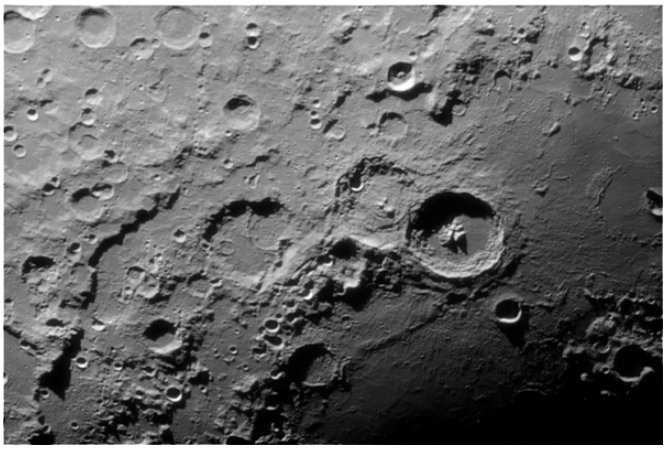
Play Dough Moonscape (see photo at right) for a pre-made moonscape:

1. Play Dough: purchase commercial children's clay or make your own (adapted from http://www.cooks.com/rec/doc/0,1611,147171-236192,00.html):

   Play Dough
   480 grams (4 cups) **flour**
   950 mL (4 cups) **boiling water**
   30 grams (1/4 cup or 1.5 ounces) **cream of tartar**
   600 grams (2 cups) **salt**
   60 mL (1/4 cup) **salad oil**

   Place all ingredients except hot water in a large bowl and stir. Pour in hot water and mix together with a spoon until well combined. When the dough has cooled, place the dough on a lightly floured surface and knead it to a smooth consistency. This dough is not sticky and does not dry out unless left open to the air for several days. Store in a sealed container (plastic tubs are good).

2. Use a plastic pan or tray. The type of foam tray used in grocery stores to package meat works well. Be sure to wash the tray thoroughly before use.
3. Spread the dough in the pan.
4. Fashion a moonscape in the dough with your hands to make mountains and craters. You might want to refer to a photograph of an area of the Moon, such as the one below.
5. Cover to store.



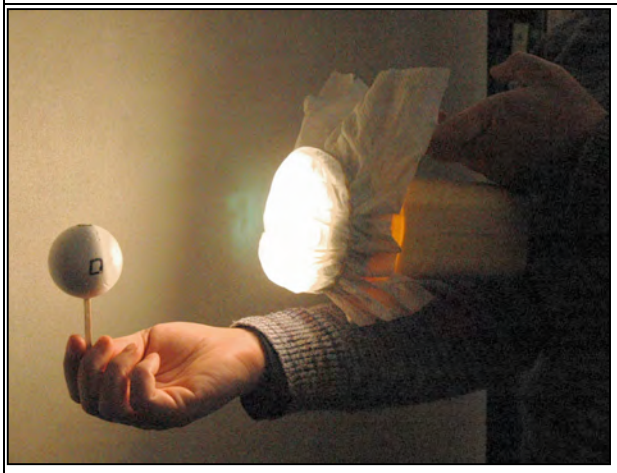
Moon image by Conrad Jung, Chabot Space & Science Center

PROCEDURE

Leader's Role	**Participants' Role (Anticipated)**
To Say: NASA's LCROSS mission will be searching for signs of water ice on the Moon.	
If humans were to return to the Moon for days, weeks, or months at a time, why would finding a source of water be important?	Drinking! Washing.
How else would we get the water up there?	We'd have to send it by rocket ship.
Yes, and the more cargo that has to be launched by rocket, the more costly the mission.	
Where would you look for ice on the Moon?	Don't know.
Where the sun is shining on the Moon's surface, the temperature is hot, on average, about 107 C or 225 F. Would ice survive in the Sun?	No.
Out of the sunlight, in the shade on the Moon, the temperature is around –170 C (-275 F). Could water ice survive there?	Maybe.
Yes, it could, provided that place never had sunshine. Because there is no atmosphere on the Moon, there is nothing to hold in the heat of the sun, like the Earth's atmosphere does at night.	
So where on the Moon might there be craters that get no sunshine inside them?	Don't know.
To Do: Point to the pan full of flour (or the play dough moonscape). *To Say:* This represents a small area of the surface of the Moon.	

Leader's Role	Participants' Role (Anticipated)
(If using the "Pan with Flour") ***<u>To Say</u>:*** What's missing from our moonscape? What do we see a lot of on the Moon? Right – let's make some! *<u>To Do:</u>* Show rocks (or wrapped bite-size candies). *<u>To Say:</u>* We'll take these rocks, representing meteoroids that bombarded the Moon early on, and drop them to create craters, like this. *<u>To Do:</u>* Hold hand up high above the pan and drop one rock. Pass out rocks to participants. *<u>To Say:</u>* Don't throw them. Just drop them. *<u>To Say:</u>* NOW we have craters!	Craters! Drop rocks into flour.
<u>Presentation Tip:</u> Encourage people to just drop their object into the flour. Your participants may want to THROW their objects into the flour. Discourage this. If they miss the pan, they might hit and hurt someone. To reduce the likelihood of injury have all the participants group themselves on one side of the pan. That way, if someone does throw his or her object at the pan, it will not hit anyone.	

Leader's Role	Participants' Role (Anticipated)
(If using the "Play Dough Moonscape") ***<u>To Say</u>:*** We have a moonscape here. What do you see? 	Mountains. Craters

Leader's Role	Participants' Role (Anticipated)
 *To Do:* Hand the flashlight covered with a paper towel to a visitor. Hold the polystyrene ball by the stick straight up and down and slowly turn the ball in the light (see photo at left). *To Say:* The Moon orbits the Earth and turns as it orbits. Let's say this is the side that faces Earth *(pointing to the side with the square).* Let's put this model moon next to the moonscape. The pan represents the small area inside this square. *To Do:* Place the moon ball on the pan so that the side square is facing up. Using the flashlight covered with a paper towel – as shown in photo below – to represent the Sun, have visitors move the Sun over the moonscape, starting with the Sun high above the moonscape (as in photo at right). 	
To Say: When the Sun is shining on the Moon, how much of the moon ball is lit up? Can you find any craters in our moonscape that are in shadow – where the bottom of the crater gets no light?	This whole side. No.

Leader's Role	Participants' Role (Anticipated)
To Say: Now, let's have this pan represent a small area of the Moon at the pole. *To Do:* Move the polystyrene ball so it is sticking straight out of the pan. Point to the top of the ball. *To Say:* Right here – inside this square at the top of the Moon. Move the Sun down to the edge of the pan *(as in photo below).* Let's rotate the pan like the Moon rotates as it orbits Earth.	
Now are there any craters that never see the light of day? So the bottoms of craters at the poles of the Moon stay cold enough for any water vapor that might have come from comets to stay frozen.	Yes!
So where should the LCROSS mission choose a crater that could have water ice in it – on the front or at the poles?	At the poles.

Presentation Tip:

It's a common misunderstanding that comets and meteoroids hitting the Moon survive intact, like the rocks that were dropped into the flour. The impact actually blasts them to bits, spraying rock and water vapor in all directions.

If some of this ejected water vapor falls into the bottom of one of the always-dark craters, it will freeze and remain there as water ice. This could have happened over and over again since the Moon formed, building up a good reservoir of ice.

Leader's Role	Participants' Role (Anticipated)
To Say: Now, we got some pretty big craters on our moonscape, don't we? Do you think the LCROSS craft that crashes into the Moon will make such a big impact? *To Do:* Take a small grain of sand (or salt) and throw it into the moonscape. *To Say:* On this scale, the LCROSS impactor will be smaller than a grain of sand. Will it make a really big crater? You're right. Some of the Moon's craters are as big as a city. The crater LCROSS will make is about the size and depth of an Olympic-sized swimming pool. It will blast a little bit of the target crater above the Moon's surface and the spacecraft will fly down into the debris, checking for any signs of water ice.	Yeah! Don't know. No!
Presentation Tip: At the end of the presentation, if you used the Pan with Flour and used wrapped candies instead of rocks, you can either: • (Least messy option) pass out a candy from the original bag to each participant or • Retrieve the candy from the flour using a potato masher or slotted spoon, Allowing participants to reach into the flour to retrieve their candy will result in flour-covered hands – not a good combination with telescope viewing.	

Where do I get materials?

1. 5cm (2") dylite/polystyrene balls: Order in quantity from http://plasteelcorp.com/. You might also find polystyrene balls at arts and craft stores, but be sure you are using polystyrene, NOT Styrofoam. The material is also called "dylite".
2. Skewer sticks: grocery store
3. Aluminum or plastic pan: grocery store
4. "Meteoroids": rocks: your yard or a garden supply store (alternatively you can purchase bite-size wrapped candy)
5. Powdered hot cocoa mix: grocery store
6. Flashlight: Hardware store
7. Flour: Grocery store
8. Play Dough ingredients can be found at a grocery store: flour, cream of tartar, salt, salad oil