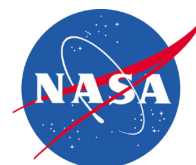


National Aeronautics and Space Administration



Guide Lites

Exploring Craters

www.youtube.com/nasaclips

www.nasa.gov/nasaclips

www.nasa.gov



Exploring Craters

NASA's Lunar Reconnaissance Orbiter (LRO) has forever changed our view of the moon, literally bringing it into sharper focus and showing us the whole globe in unprecedented detail. This rich new portrait has been rendered by LRO's seven onboard instruments, which together have delivered more than 192 terabytes of data, images and maps – the equivalent of nearly 41,000 typical DVDs.

On June 18, 2009, LRO began exploring our nearest neighbor, the moon. Its multi-year mission focuses on mapping the moon's surface to create a comprehensive atlas of the moon's features and resources.

LRO's Lunar Orbiter Laser Altimeter (LOLA) has taken more than 4 billion measurements, which have allowed scientists to create the most precise topographic maps of the moon to date. These maps are opening up a world of possibilities for future exploration and for science.

To further explore the polar regions, LRO's Lyman Alpha Mapping Project (LAMP) provides images of permanently shadowed regions, searching for surface ice and frost. LAMP can literally "see" in the dark by using ultraviolet light generated by stars as well as the hydrogen atoms that are thinly spread throughout the solar system.

Objective:

In this activity students will use ultraviolet light to observe materials that cannot be seen with the naked eye.

Materials:

- newspapers or large plastic sheet
- shallow flat pan or storage bin (pan should not be made of glass)
- sand or cat litter
- flour
- powdered whitening agent for laundry
- baking cocoa or chocolate cake mix
- marbles or other small objects that could be dropped to make craters
- hand-held ultraviolet light
- safety goggles
- digital cameras (optional)

Engage:

Preparation:

1. During this activity, the powdered materials may fall onto the floor or be disbursed into the air. Spread newspaper or plastic under the pan to cover the floor. Students should wear safety goggles while doing the activity.
2. Cover the bottom of a shallow, flat pan such as a brownie pan or storage bin with a layer of sand or cat litter about 4 cm deep.
3. Cover the sand layer with white flour, about 2 cm thick.
4. In isolated sections of the pan, sprinkle powdered whitening agent over the flour. Do not cover the entire surface.
5. Add a layer of baking cocoa or chocolate cake mix so the top layer is brown and the layers beneath are hidden.



From a standing position, ask students to drop marbles or other small impactors into the pan. Carefully remove the impactors. Make careful observations of the disturbed surface. Students may take digital images of the surface. Now shine a hand-held ultraviolet (UV) light on the surface. What new observations are revealed with the UV light? Take a digital image under the UV light. Compare the two images.

Explore:

Ask students to carefully measure their impact craters. Calculate the area and volume of the craters. Using graph paper, draw the craters to scale. Problems specifically designed for LRO data can also be found at SpaceMath@NASA: <http://spacemath.gsfc.nasa.gov/>.

Additional activities to learn more about lunar craters can be found in the NASA eClips™ Educator Guide, *NASA's Our World: Crater Maps and Earth Landforms*, which can be downloaded at: http://www.nasa.gov/pdf/484631main_OW8-CraterMaps_508.pdf

Explain:

As students compare their observations, they should note that one material (the whitening agent) is only revealed in the presence of the UV light. In the same way, NASA is using instruments on LRO and UV light from the stars to help identify materials on the moon's surface.

To learn more about the Lunar Reconnaissance Orbiter, watch the NASA eClips™ video segment, *Real World: NASA's Lunar Reconnaissance Orbiter Mission*, which can be viewed or downloaded at:

<http://www.nasa.gov/audience/foreducators/nasaclips/search.html?terms=%22NASA's%20Lunar%20Reconnaissance%20Orbiter%20Mission%22&category=0000&disp=grid>. This segment can be viewed in high definition using the following direct link to YouTube/NASA eClips™: <http://www.youtube.com/nasaclips#p/c/887C1C3BAAD53F17/33/UDrJFRr-KHo>

Extend:

NASA uses UV and other wavelengths of light to explore remote locations in our solar system. To find out more about NASA's newest planetary explorations, watch the NASA eClips™ video segments:

Our World: Moons in Our Solar System, which can be viewed or downloaded at:

<http://www.nasa.gov/audience/foreducators/nasaclips/search.html?terms=%22Moons%22&category=1000&disp=grid>. This segment can be viewed in high definition using the following direct link to YouTube/NASA eClips™: http://www.youtube.com/nasaclips#p/c/31002AD70975DC1B/2/vU5_aYlaXa8.

Launchpad: Curiosity Goes to Mars, which can be viewed or downloaded at:

<http://www.nasa.gov/audience/foreducators/nasaclips/search.html?terms=%22Curiosity%20Goes%20to%20Mars%22&category=0010&disp=grid>. This segment can be viewed in high definition using the following direct link to YouTube/NASA eClips™: <http://www.youtube.com/nasaclips#p/c/D7BEC5371B22BDD9/3/0VgmyPUC7bl>

Additional relevant NASA eClips™ segments may be found at www.nasa.gov/nasaclips.