LRO takes extreme close-up of eclipse

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(PhysOrg.com) -- Orbiting about 31 miles above the lunar surface, NASA's Lunar Reconnaissance Orbiter (LRO) spacecraft will get a "front-row seat" to the total lunar eclipse on June 15, says Noah Petro, Associate Project Scientist for LRO at NASA's Goddard Space Flight Center in Greenbelt, Md.

A lunar eclipse happens when the moon passes into Earth's shadow, and a total lunar eclipse occurs when Earth completely blocks the sun, causing the moon to darken and appear to change color. However, the moon doesn't go completely dark because Earth's atmosphere bends (refracts) indirect sunlight toward the moon, giving it dim illumination. Since indirect sunlight must travel through Earth's atmosphere before reaching the moon, any clouds or dust in the atmosphere will block certain colors in the sunlight, causing the moon to seem to change color, frequently turning it yellow, orange, or red. The exact color varies from eclipse to eclipse, depending on the weather at the time.

The June 15 lunar eclipse will be visible, at least in part, from around the world except North and Central America. "However, LRO will be observing, so eventually everyone will get to see a close-up of it," says Petro. The eclipse begins at about 17:24 Universal Time (UT), will be darkest from around 19:22 UT to 21:02 UT, and ends a bit after 23:00 UT. During this eclipse, the moon's orbital path will take it close to the center of the darkest part of Earth's shadow, called the umbra, so the deepest part of the eclipse will last a long time -- just over an hour and 40 minutes. Unlike a solar eclipse, a lunar eclipse is safe to view without special equipment.

LRO's Diviner Lunar Radiometer instrument will record how quickly different areas on the moon's day side cool off during the eclipse. Since large boulders cool more slowly than a fine-grained or dusty surface, Diviner will be able to see what areas are covered with boulders and what regions are blanketed by dust.

"This is an unprecedented opportunity to learn more about the uppermost few millimeters of the moon," says Diviner Principal Investigator David Paige of the University of California, Los Angeles. "Diviner plans to operate continuously during the entire eclipse period, targeting ten specific regions. The ten sites represent a diverse selection of lunar terrains. Some consist of fine dust, others are rocky, and there are a variety of compositions including dark, iron-rich lunar maria and light, iron-poor lunar highlands. Diviner will target these features before, during, and after the eclipse, which will allow us to observe how these different surfaces respond to the sudden drop in temperature."

"The moon turns slowly -- a complete day-night cycle lasts more than 29 Earth days," says Petro. "So lunar dusk and dawn last a long time, and normally the lunar surface cools down and heats up slowly. This eclipse is a special opportunity to see what happens if you 'switch off' the sun relatively quickly. It's like taking a pie out of the oven and throwing it into the freezer without letting it cool down first. We want to see how the moon's surface responds to this abrupt temperature change," said Petro.

The Diviner observations will complement surface roughness measurements from LRO's other instruments because Diviner can get hints at what lies just beneath the surface, according to Petro. "LRO's camera and laser altimeter might see a flat, dusty region, but if Diviner sees that it is cooling unusually slowly, that tells us large blocks of material are hidden beneath a thin layer of dust," said Petro.

The eclipse presents unusual conditions for LRO, according to Petro. LRO runs on solar energy, with battery back-up for power during its approximately hour-long journey over the moon's night side each orbit. LRO's other instruments will be turned off to conserve energy during the long night imposed by the eclipse, and the spacecraft will have to endure a longer period of deep cold.

"It will be like taking my car off-road. It's not really built for that, but it can handle limited excursions," said Petro. This will be the first time LRO operates an instrument during a total lunar eclipse, according to Petro, and it will be the longest eclipse during the mission's expected lifetime.

Paige and his Diviner team will lead the observations, with funding from NASA's Science Mission Directorate, NASA Headquarters, Washington. NASA Goddard assembled and manages LRO.

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