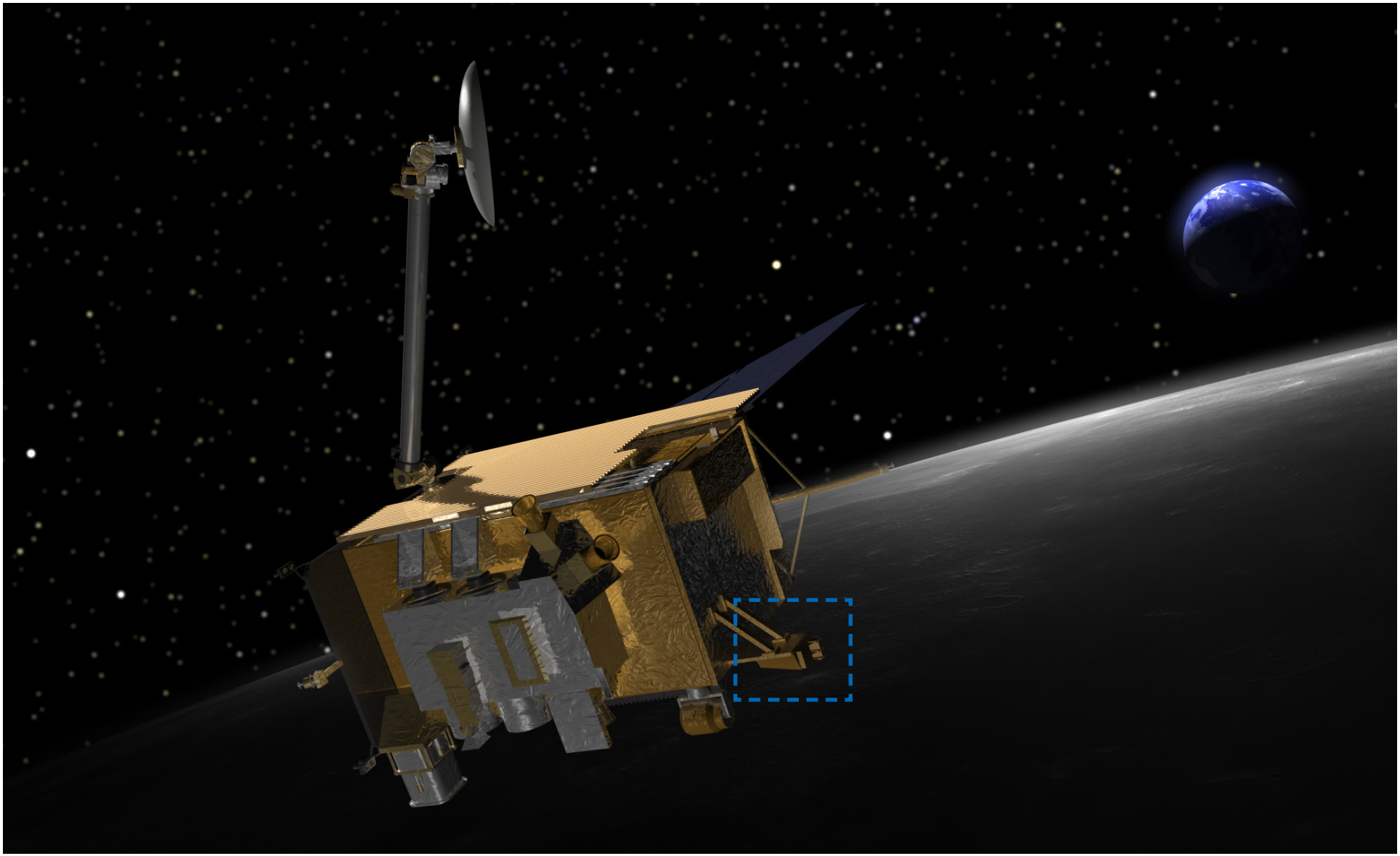
National Aeronautics and Space Administration



Cosmic Ray Telescope for the Effects of Radiation: CRaTER

Credit: NASA/GSFC/Conceptual Image Lab

Lunar Reconnaissance Orbiter's CRaTER Instrument

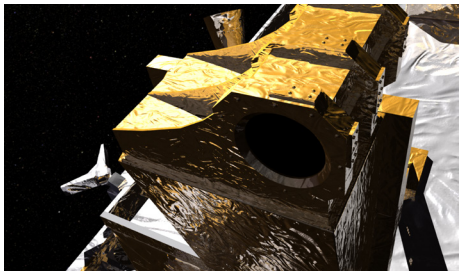
CRaTER: Exploring Space Radiation at the Moon

NASA's Lunar Reconnaissance Orbiter (LRO) was launched on June 18, 2009. With a suite of seven instruments, LRO has collected a treasure trove of data, making an invaluable contribution to our knowledge about the Moon.

One of LRO's instruments is the Cosmic Ray Telescope for the Effects of Radiation, or CRaTER, which measures two sources of space radiation: galactic cosmic rays (which come from supernovae outside the solar system) and solar energetic particles (which come from solar "storms" such as flares and coronal mass ejections).

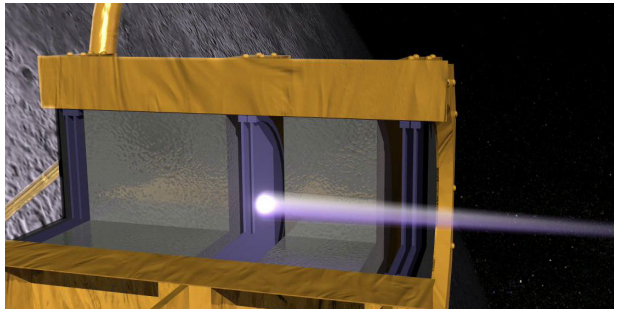
Space Radiation and Humans

CRaTER data helps us understand how space radiation will affect the bodies of astronauts going to the Moon. Inside the instrument is material that has the same chemical makeup as human tissue, so radiation interacts with it as it would with a human body.



A close-up of the Cosmic Ray Telescope for the Effects of Radiation (CRaTER) instrument. Credit: NASA/GSFC/Conceptual Image Lab

Because CRaTER measures the amount of radiation behind different thicknesses of material, it can show how much radiation would be received by different parts of the body, such as the skin, eyes, and internal organs. This information helps to predict how long astronauts can safely be in space before accumulating a high dosage of radiation.



An illustration of a cosmic ray passing through a cutaway of CRaTER and setting off the middle pair of detectors. Credit: NASA/GSFC/Conceptual Image Lab

The Moon and Space Radiation

Data gathered by CRaTER informs us about how space radiation affects the Moon. We are learning how solar energetic particles charge the lunar soil as well as the effects that space radiation has on water ice.

Lunar Sparking

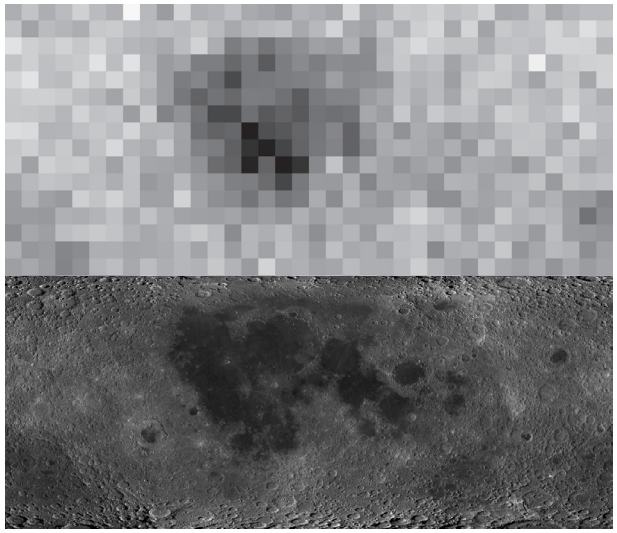
During a solar energetic particle event, large numbers of electrically charged particles (e.g. protons and electrons) can bombard the Moon and charge up its soil. The soil is very cold on much of the Moon's nightside and in permanently shadowed regions (areas that never receive any direct sunlight), so the charge dissipates slowly. This can create strong electric fields in the top millimeter of soil, possibly producing "sparking" which can melt and vaporize small amounts of soil. Over time, repeated sparking events may cause the lunar soil to darken.

Water Ice

Some of the permanently shadowed regions on the Moon contain water ice that has been exposed to space radiation for over a billion years, enabling the ice to gain energy from the radiation. This increase in energy alters the ice, creating more complex molecules. With CRaTER, we are able to better understand the history of water ice on the Moon.

More Information

nasa.gov/lro



Top: A radiation map of the Moon. Darker grey corresponds to more radiation. Bottom: A Lunar Reconnaissance Orbiter Camera image of part of the Moon, centered at the near side. Credits: NASA/UNH (top); NASA/ASU/Applied Coherent Technology Corp (bottom)