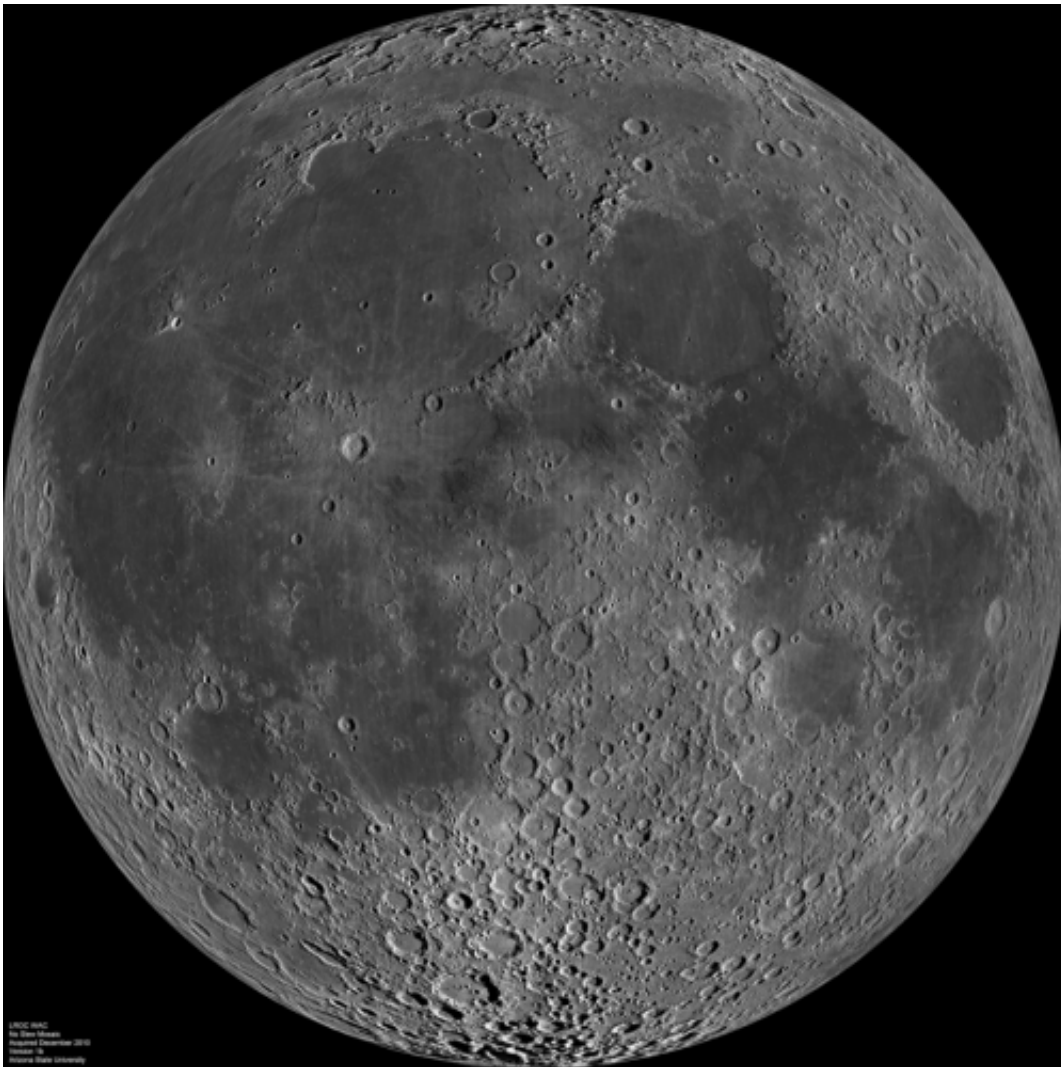


# Study shows Moon engulfed in permanent, lopsided dust cloud

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This is a composite image of the lunar nearside taken by the Lunar Reconnaissance Orbiter in June 2009, note the presence of dark areas of maria on this side of the moon. Credit: NASA

The moon is engulfed in a permanent but lopsided dust cloud that increases in density when annual events like the Geminids spew shooting stars, according to a new study led by University of Colorado Boulder.

The cloud is made up primarily of tiny [dust](#) grains kicked up from the moon's surface by the impact of high-speed, [interplanetary dust particles](#), said CU-Boulder physics Professor Mihaly Horanyi. A single [dust particle](#) from a comet striking the moon's surface lofts thousands of smaller dust specks into the airless environment, and the lunar cloud is maintained by regular impacts from such particles, said Horanyi, also a research associate at CU-Boulder's Laboratory for Atmospheric and Space Physics.

The cloud was discovered using data from NASA's Lunar Atmosphere and Dust Environment Explorer, or LADEE, which launched in September 2013 and orbited the moon for about six months. A detector on board called the Lunar Dust Experiment (LDEX) designed and built by CU-Boulder charted more than 140,000 impacts during the six-month mission.

"Identifying this permanent [dust cloud](#) engulfing the moon was a nice gift from this mission," said Horanyi, the principal investigator on LDEX and lead study author. "We can carry these findings over to studies of other airless planetary objects like the moons of other planets and asteroids."

A paper on the subject appears in the June 17 issue of *Nature*. Co-authors include Jamey Szalay, Sascha Kempf, Eberhard Grun and Zoltan Sternovsky from CU-Boulder, Juergen Schmidt from the University Oulu in Finland and Ralf Srama from the University of Stuttgart in Germany.

Horanyi said the first hints of a cloud of dust around the moon came in

the late 1960s when NASA cameras aboard unmanned moon landers captured a bright glow during lunar sunsets. Several years later, Apollo astronauts orbiting the moon reported a significant glow above the lunar surface when approaching sunrise, a phenomenon which was brighter than what the sun alone should have been able to generate at that location.

Since the new findings don't square with the Apollo reports of a thicker, higher dust cloud, conditions back then may have been somewhat different, said Horanyi. The dust on the moon—which is dark and sticky and regularly dirtied the suits of moonwalking astronauts—was created over several billion years as interplanetary dust particles incessantly pounded the rocky lunar surface.

Knowledge of the dusty environments in space has practical applications, said Horanyi. Knowing where the dust is and where it is headed in the solar system, for example, could help mitigate hazards for future human exploration, including dust particles damaging spacecraft or harming astronauts.

Many of the cometary dust particles impacting the [lunar surface](#) are traveling at thousands of miles per hour in a retrograde, or counterclockwise orbit around the sun—the opposite orbital direction of the solar system's planets. This causes high-speed, near head-on collisions with the dust particles and the moon's leading surface as the Earth-moon system travel together around the sun, said Horanyi.

The Geminid meteor showers occur each December when Earth plows through a cloud of debris from an oddball object called Phaethon, which some astronomers describe as a cross between an asteroid and a comet. "When these 'beams' we see from meteors at night hit the moon at the right time and place, we see the cloud density above the [moon](#) skyrocket for a few days," said Horanyi.

Horanyi also is the principal investigator on a CU-Boulder student dust-counting instrument on board NASA's New Horizons spacecraft that will whip by Pluto on July 14 after a journey of more than nine years.

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