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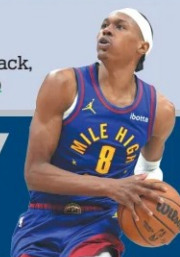
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Negative ions found on moon solve old mystery

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In a first for space exploration, a Chinese-led research team has detected negative hydrogen ions on the moon's surface, solving a long-standing mystery on how the solar wind interacts with airless celestial bodies.

The discovery was made by a specialized instrument aboard China's Chang'e 6 lander. It reveals that these rare particles are created when the solar wind — a constant stream of charged particles from the sun — slams into the lunar soil.

Negative ions are atoms or molecules that have "stolen" an extra electron. While they are a vital component of the plasma that fills the universe, they are notoriously difficult to study. Because they are fragile, sunlight quickly strips away that extra electron, making them nearly impossible to detect from a distance or by orbiting spacecraft.

The researchers used the Negative Ions at the Lunar Surface, or NLS, detector, a first-of-its-kind instrument developed by the Swedish Institute of Space Physics and the Chinese Academy of Sciences. During its mission, the device recorded six energy signatures of these hydrogen ions over two days. This marks the first time such particles have been measured directly on the surface of another world.

To confirm where these ions came from, the team compared their findings with data from the European Space Agency's Artemis satellites, which monitor the sun's activity. They found a direct link: as the solar wind intensified, so did the production of negative

ions. The process works through "scattering", where solar wind particles hit the lunar surface and bounce back, picking up electrons from the soil in the process.

The team's simulations showed two very different environments on the moon. On the day side, sunlight destroys the ions almost instantly, keeping them trapped in a very thin layer just above the ground. However, on the night side, in the absence of sunlight, the ions can survive much longer. They are swept up by electromagnetic fields, forming a massive tail that stretches thousands of kilometers behind the moon.

Understanding these ions helps scientists explain "space weathering", the process by which the harsh environment of space physically and chemically changes the lunar surface over millions of years. Plasma is often called the fourth state of matter, and it is essentially a gas-like soup of electrically charged particles. In this case, the negative ions can trigger plasma waves — ripples of energy — that disturb the environment around the moon.

The researchers believe these ions may play a role in how water forms on the moon and how the moon's incredibly thin atmosphere, known as an exosphere, is maintained. During periods of intense solar activity, the density of these ions can jump by more than 1,000 percent, creating measurable disturbances in the lunar environment.

The findings provide a new blueprint for studying other airless bodies in our solar system, such as asteroids or the moons of other planets.