

ARTEMIS observations of lunar dayside plasma in the terrestrial magnetotail lobe

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We report observations by the dual-probe ARTEMIS mission of Moon-related electron and ion signatures obtained above the dayside lunar surface in the terrestrial magnetotail lobes. While the Moon is often thought of as a passive absorber, recent observations from Kaguya, Chandrayaan, Chang'E, and ARTEMIS indicate that plasma of lunar origin can have significant effects on the near-lunar environment. We now present new observations from ARTEMIS showing that lunar plasma can play a dominant role in the low-density environment of the terrestrial magnetotail. Two-point observations reveal that the density of plasma of lunar origin is higher than that of the ambient lobe plasma even several hundreds of kilometers above the Moon's dayside. Meanwhile, the distributions of incoming electrons exhibit modifications correlated with Moon-related populations, suggesting direct or indirect interactions of the lobe electrons with plasma of lunar origin. We also observe high-energy photoelectron emission from the dayside lunar surface, supporting the existence of large positive potentials on the lunar surface. Pickup ions with nonzero parallel-velocity components provide further evidence for positive surface potentials of tens of volts or more. ARTEMIS data reveal not only the existence of the large surface potentials first inferred from Apollo CPLEE measurements, but also their significant implications for the dynamics of both the dominant Moon-originating ions and the tenuous ambient plasma populations in the tail lobe.

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