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Zoom meeting B ：11/2 PM2 (15:45-18:15)
17:30～17:45

An event study on electrostatic solitary wave excitation and electron distributions in the lunar wake boundary

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Electrostatic solitary wave (ESW) is a plasma wave commonly seen in space, and it is observed as broadband electrostatic noises (BENs) in frequency-time spectrograms due to its nature of the solitary waveforms. In the plasma environment around the Moon, spacecraft observations in recent decades have shown the existence of ESWs, but their excitation mechanism is not fully understood. Here we revisit an ESW event in the wake boundary previously reported by Hashimoto et al. (2010), focusing on the relation between BENs and electron pitch-angle distribution functions. We show that upward electron beams from the nightside lunar surface are effective for the excitation of ESWs, in contrast to the original interpretation by Hashimoto et al. (2010) that high-energy electrons accelerated by strong ambipolar electric fields generate ESWs in the region far from the Moon. When the BENs were observed by the Kaguya spacecraft in the wake boundary, the spacecraft's location was magnetically connected to the nightside lunar surface, and bi-streaming electron distributions of downward-going solar wind strahl component and upward-going field-aligned beams (at ~124 eV) were detected. The interplanetary magnetic field was dominated by a positive B_Z (i.e. the northward component), and strahl electrons travelled in the anti-parallel direction to the interplanetary magnetic field (i.e. southward), which enabled the strahl electrons to precipitate onto the nightside lunar surface directly. The incident solar wind electrons cause negative charging of the nightside lunar surface, which generates downward electric fields that accelerate electrons from the nightside surface toward higher altitudes along the magnetic field. The bidirectional electron distribution is not a sufficient condition for the ESW excitation, and the distribution of upward electron beams seems to be correlated with the ESW excitation. Ambipolar electric fields in the wake boundary should also contribute to the electron acceleration toward higher altitudes and the further intrusion of the solar wind ions into the deeper wake. We suggest that solar wind ion intrusion into the wake boundary is also an important factor that controls the excitation of ESWs by facilitating the influx of solar wind electrons there.