

## A statistical study of type-3 solar wind proton entry into the lunar wake

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Entry processes of solar wind plasma into the lunar wake are fundamental phenomena of the lunar plasma sciences. Recently we have found a new entry mechanism of shock-reflected solar wind protons into the deepest lunar wake (i.e. type-3 entry) that takes place when the Moon is located in the ion foreshock in front of the Earth's magnetosphere. Here we show a statistical study of type-3 entry into the deepest lunar wake at 100 km altitude using Kaguya data. We have confirmed that the type-3 proton entry is almost continuously observed in the upstream solar wind near the quasi-parallel bow shock, and that the type-3 protons can access the lunar dayside region as well owing to their gyro radius comparable to the lunar diameter. Low energy electron beams from the lunar night side surface are often not obvious in the continuous type-3 events. On the other hand, an intermittent type-3 proton entry (for a few min) is found even far upstream of the bow shock. In the intermittent type-3 events, one can recognize that the kinetic energy of upward-going field-aligned electron beams decreases to be a few tens eV. These observations show that incident ion current into the lunar nightside surface drastically changes the electrostatic potential in the wake. We will present a comprehensive understanding of the lunar plasma environment for the type-3 entry.