Japan Geoscience Union Meeting 2010
(May 23-28 2010 at Makuhari, Chiba, Japan)

PPS003-P25 会場:コンベンションホール 時間: 5月24日17:15-18:45

かぐやLRS/WFCで観測された非対称型バイポーラパルス

Asymmetric bipolar-pulses observed by the LRS/WFC-L onboard KAGUYA

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The waveform capture (WFC) is one of the subsystems of the Lunar Radar Sounder (LRS) on board the KAGUYA spacecraft. The main purpose of the WFC is to observe plasma waves and radio emissions around the moon and it measures two components of electric wave signals detected by the two orthogonal 30 m tip-to-tip antennas from 100Hz to 1MHz. The WFC-L is one of subsyetems of WFC and it measures electric waveform from 100Hz to 100kHz. The WFC-L has two operation modes: DIFF and MONO. In DIFF mode, signals from two pairs of 30m tip-to-tip dipole antennas are obtained. MONO mode is namely an interferometry mode and we separately measure the signals from a pair of monopole antennas. This mode is dedicated to measure the phase velocities and wave numbers of plasma waves.

Bipolar-pulses with their time scales of a few ms upto several tens ms were often observed by the WFC-L. Some of them are classified into electrostatic solitary waves (ESW), which are caused by electron-holes in the nonlinear evolution of electron beam instability. On the other hand, another type of bipolar pulses characterized by their asymmetric waveforms are also observed. It is also noted that detection probability of such asymmetric bipolar pulses in MONO mode is much higher than that in DIFF mode. This is because bipolar pulses detected by a pair of monopole antennas in MONO mode are almost identical (pulses are simultaneously detected with both monopole antennas and the polarities of these pulses are also same) and thus most of bipolar-pulses which can be detected in MONO mode are cancelled in DIFF mode. This fact suggests that these bipolar pulses are not a kind of natural wave but these are caused by instantaneous potential changes of the KAGUYA spacecraft. Similar type of bipolar-pulses has been observed by the monopole antenna measurements using Radio and Plasma Wave Science (RPWS) instruments on-board Cassini around Saturn. They demonstrated that these bipolar pulses are caused by impacts of dusts floating around the Saturn. It is well-known that lunar dusts are widely distributed in higher altitude range around the moon and it is plausible that these bipolar pulses are caused by the lunar dust impacts.

In the presentation, we show the detailed characteristics of bipolar pulses detected by the WFC-L onboard KAGUYA.

キーワード:かぐや,波形捕捉器,バイポーラ型パルス,月ダスト
Keywords: KAGUYA, Waveform capture, Bipolar-pulse, Lunar Dust