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Analysis of low-frequency plasma wave observed by Waveform Capture (WFC) onboard KAGUYA

Takafumi Shiraishi[1*], Taketoshi Miyake[1], Keigo Ishisaka[1], Toshimi Okada[1], Yoshiya Kasahara[2], Yoshitaka Goto[2], Kozo Hashimoto[3], Atsushi Kumamoto[4], Takayuki Ono[4], Hideo Tsunakawa[5], SELENE MAP-LMAG Team[5], Masaki N Nishino[6], Yoshifumi Saito[6], Shoichiro Yokota[6], SELENE MAP-PACE Team[6]

[1]Toyama Pref.Univ., [2]Kanazawa Univ., [3]RISH,Kyoto Univ., [4]Tohoku Univ., [5]Tokyo Institute of Technology, [6]ISAS/JAXA

KAGUYA was launched on September 14, 2007. KAGUYA consists of three satellites in lunar polar orbit, main satellite at about 100km altitude and other two small satellites. The WaveForm Capture (WFC) is one of the subsystems of Lunar Radar Sounder (LRS) onboard KAGUYA. The WFC measures two components of electric wave signals detected by two orthogonal 30m tip-to-tip antennas. WFC consists of WFC-L and WFC-H. WFC-L measures waveforms with the frequencies less than 100Hz. WFC-H is a fast sweep frequency analyzer covering the frequency range from 1kHz to 1MHz. The scientific objectives of the WFC are lunar science and extra-lunar science. The former is the science of the plasma physics related to the moon itself. One of the most specific phenomena is the plasma dynamics in the lunar wake region. As for the extra-lunar science, various kinds of local plasma waves and radio waves from the Earth, the Sun and Jupiter are expected to be observed.
In this study, we are making analysis of low-frequency plasma waves less than 1 kHz using data observed by WFC-L from April to June 2008, and found 91 examples of characteristic plasma waves with narrowband spectra less than electron cyclotron frequency. 17 examples of these continue in several minutes. When these low-frequency plasma waves are observed, the magnetic fields were stable and small, and were not correlated with the frequencies of these plasma waves. This suggests that these plasma waves do not correlate to particle cyclotron motions. These plasma waves are considered to be correspond with ion-plasma oscillation, e.g. ion acoustic wave, since all of these low-frequency plasma waves have several tens of frequencies, which are local ion plasma frequencies. In this study, we will make analysis of the relation between these intruded ions and the low-frequency plasma waves with narrowband spectra.

Keywords: Wave Form Capture, low-frequency plasma waves, narrow band spectrum, ion plasma oscillation