月周辺で観測される広帯域磁場擾乱の観測条件と生成過程について

津川 靖基 [1]; 加藤 雄人 [1]; 寺田 直樹 [2]; 綱川 秀夫 [3]; 高橋 太 [4]; 渋谷 秀敏 [5]; 清水 久芳 [6]; 松島 政貴 [7]; 斎藤 義文 [8]; 横田 勝一郎 [8]; 西野 真木 [9]
[1] 東北大・理・地球物理; [2] 東北大・理・地物; [3] 東工大・理・地惑; [4] 九大・理・地惑; [5] 熊大・自然・地球; [6] 東大・地震研; [7] 東工大・地惑; [8] 宇宙研; [9] 名大 STE 研

Conditions to observe broadband magnetic fluctuations near the Moon and their generation processes

Yasunori Tsugawa[1]; Yuto Katoh[1]; Naoki Terada[2]; Hideo Tsunakawa[3]; Futoshi Takahashi[4]; Hidetoshi Shibuya[5]; Hisayoshi Shimizu[6]; Masaki Matsushima[7]; Yoshifumi Saito[8]; Shoichiro Yokota[8]; Masaki N Nishino[9]
[1] Dept. Geophys., Grad. Sch. Sci., Tohoku Univ.; [2] Dept. Geophys., Grad. Sch. Sci., Tohoku Univ.; [3] Dept. Earth Planet. Sci., Tokyo TECH; [4] Kyushu Univ.; [5] Dep't Earth & Env., Kumamoto Univ.; [6] ERI, University of Tokyo; [7] Dept Earth & Planetary Sciences, Tokyo Tech; [8] ISAS; [9] STEL, Nagoya University

Broadband magnetic fluctuations in the frequency range up to ~10 Hz have been reported near the Moon. Halekas et al. [2008] pointed out a close association of the waves with electron energization near the Moon. Nakagawa et al. [2011] suggested that they are whistler-mode waves associated with scattered protons in various directions from the lunar surface. Tsugawa et al. [2012] performed statistical analyses, which indicate a clear correlation between the intense waves and the lunar crustal magnetic anomalies. However, their generation processes have not been clarified yet.

In the present study, we investigate the conditions to observe the waves, such as the solar wind parameters, ambient magnetic field direction, and velocity distributions of particles reflected from the Moon, using dataset of MAP-Kaguya in order to reveal the generation processes. The results indicate that the essential conditions to observe the waves are the connection between the Kaguya and the lunar surface by the magnetic field as well as the presence of ions considerably reflected from the Moon. The latter condition is satisfied mostly above the magnetic anomalies in a typical solar wind condition and also above unmagnetized surface under the fast and dense solar wind condition. Since the ions have no preferred direction to the magnetic field at Kaguya's position and the electrons are isotropically energized, the waves possibly propagate from altitudes lower than Kaguya's position along the magnetic field and energize the electrons. We suggest that the perpendicular component of the relative velocity between reflected ions and electrons with respect to the ambient magnetic field line drives an instability generating whistler-mode waves in the frequency range around the lower hybrid resonance frequency, which is relevant to the regime of the modified two stream instability.