太陽風中の月周辺でかぐや衛星によって観測された広帯域ノイズと電子加熱について
Broadband noise and associated electron heating observed by Kaguya around the Moon in the solar wind

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Broadband electromagnetic noise in the frequency range up to ~10 Hz has been detected around the Moon at ~100 km altitude [Halekas et al., 2008; Nakagawa et al., 2011; Tsugawa et al., 2012]. Halekas et al. [2008] suggested that the waves are associated with electron energizations and are basically generated through the interaction between the solar wind plasma and crustal magnetic field. Nakagawa et al. [2011] studied the characteristics of the broadband waves by considering properties of whistler-mode waves propagating in the solar wind frame of reference. Tsugawa et al. [2012] showed that the statistical distributions of the intense noise are clearly located at the magnetic anomalies. While they discussed the possible generation process of the waves through resonant or non-resonant instability by ions reflected from the lunar surface, details of the generation process of the waves have not been clarified yet.
We analyzed the broadband noise observed by Kaguya statistically, and suggest that the absolute condition to observe the noise at altitudes ~100 km are 1) the spacecraft is connected to the Moon through the magnetic field, and 2) the solar wind ions are reflected considerably in the connected region on the Moon. The fluxes of reflected ions depend on the solar wind parameters and the magnetisms of the lunar crusts. In a usual solar wind condition (roughly the dynamic pressure < 2 nPa), the second condition is mostly satisfied above the magnetic anomalies. In the solar wind with larger density and faster speed than usual (roughly the dynamic pressure > 2 nPa), the second condition can be satisfied above not only magnetic anomalies but also unmagnetized surface.
Electrons are often energized perpendicular to the ambient magnetic field or isotropically in association with the noise and reflected ions. The electron heating above the lunar magnetic anomalies are also associated with the broadband electrostatic noise in the frequency range up to ~10 kHz [Kasahara et al., 2011]. Their correlation is suggested in analogous to the transverse ion acceleration due to broadband extremely low frequency noise in the Earth's auroral region [e.g., Andre et al., 1998].

