

月周辺で観測される電子サイクロトロン高調波

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Generation of Electron Cyclotron Harmonic waves around the Moon

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The moon is essentially unmagnetized. However, recent spacecraft observation revealed the existence of the localized magnetic field which is the so-called magnetic anomaly. Furthermore, the body of the moon is the dielectric. The charging of its surface strongly depends on the surrounding space plasma and the sunlit conditions. In our research, we focused on plasma wave phenomena around the moon based on plasma wave data observed by using WFC (WaveForm Capture) onboard the KAGUYA spacecraft, which was launched in 2007.

We analyzed the data that KAGUYA observed when the moon was in all distinct regions in the terrestrial magnetosphere as well as in the solar wind. By using the plasma wave data we found the generation of the ECH (Electric Cyclotron Harmonics) waves. We also found ECH waves exist only over the magnetic anomaly in the night side of the moon. Lunar Prospector revealed the existence of electron loss cone over the magnetic anomaly and electron beam in the night side. Based on its observation results, we assumed that electron loss cone and electron beam cause the generation of ECH. In order to study the generation of the ECH, we also analyzed the electron velocity distribution function by using particle data obtained by PACE (Particle Angle and Composition Experiment). The velocity distribution function showed the existence of the electron loss cone distribution with the low energy electron beam whenever ECH are generated. By comparing the plasma wave data with the electron data, we found the good correlation of the ECH waves with the electron loss cone velocity distribution. We also examined the linear growth rate by solving the kinetic plasma dispersion relation. Our linear analyses showed that the electron loss cone distribution with the low energy electron destabilizes the growth rate of ECH waves. Based on the spacecraft observations and linear analyses, we succeeded in establishing the generation model of the ECH waves in the view point of the moon-plasmas interaction.