

Measurement of electron temperatures via plasma wave observations

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The present paper introduces the measurement of electron temperatures via plasma wave observations. The most popular technique to measure the electron temperature is the measurement of electron velocity distributions obtained by plasma detectors. However, we need the careful calibration for calculating electron temperatures from the data observed by plasma instruments, since the data is influenced by the spacecraft potential and they are likely to be contaminated from photoelectrons. Further, since in order to increase the counts of detected particles, we need to accumulate the data for a few spin periods. This data accumulation leads to the worse time resolution. Another technique to measure the electron temperature has been attempted in Europe and US spacecraft. This is based on the observation of electric field spectra, which are induced by plasma thermal motions. Such electric field waves with the frequency around local electron plasma frequencies are called the electron thermal noise. The frequency spectral structure of the electron thermal noise depends on the antenna impedance. The antenna impedance is theoretically calculated by the plasma dispersion relation and current distributions on electric field antennas. In the present paper, we introduce the technique to measure the electron temperature using the plasma wave data and apply it to the Geotail plasma wave data.