Analysis of DC electric fields and photo emission pulses observed by SS-520-2 sounding rocket

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SS-520-2 sounding rocket was launched from Norway on Dec. 4, 2000 to observe plasma acceleration and heating processes in the low altitude noon cusp region. It is natural that DC electric fields accelerate ions and electron in this region. We developed EFD(Electric Field Detector) onboard SS-520-2 rocket and obserred DC electric fields with EFD. EFD is a subsystem of PWA(Plasma Wave Analyser), and is designed to observe DC electric fields and ELF plasma waves with frequencies of 0-50Hz. Through all this rocket experiment, EFD worked properly and succeeded to obtain clear electric field data. We have been analyzing these EFD data to identify natural DC electric fields. In the rocket experiments in the polar region, observed DC electric fields always contain a strong inductive electric field component. We removed this inductive E field component and extract natural DC electric fields. With using some assumpitions, the existence of natural DC electric fields are confirmed about the apogee of the rocket orbit. The amplitudes of these DC electric fields are up to 50mV/m, and their directions are almost southwest-ward. Corresponding E cross B drift velocities are almost about 1500m/s, and their directions are southeast-ward. By comparing these DC electric fields and ESA/ISA particle observations, we are going to investigate relations between DC electric fields and accelerated ions.

According to the waveform analysis, on the other hand, spiky pulses are confirmed in all the observation time. Thses spiky pulses are observed in synchronizing with the rocket spin frequency 1.5Hz. These spiky pulses are generated due to the photo electron emission. Judging from the trajectory of SS-520-2 rocket, the rocket was irradiated by the sun and the influence of the photo electron emission exist during all the observation time of EFD. The amplitudes of the photo electron pulses are expected to be related to the local plasma environment, e.g. electron density and temperatures. Though their amplitudes are in inverse proportion to the altitudes of the rocket, however, we cannot find a clear relation between the distribution of the amplitudes of the photo electron pulses and those of the electron densities, especially in the F region of the ionosphere (500-300km in the altitude) where the electron density is a little large. the statistics, which are more detailed with the photo electron emission. We are going to take statistics of the amplitudes of the photo electron pulses in detail, and make farther analysis about their generation mechanism.