ELF oscillations associated with electron beam injections from the space shuttle - DTU Orbit (28/12/2018)

**ELF oscillations associated with electron beam injections from the space shuttle**

ELF oscillations (f < 500 Hz) were observed during the electron beam emissions of the space experiments with particle accelerators (SEPAC) flown on the Spacelab 1 shuttle mission. The beams had energies up to 5 keV and currents up to 300 mA, and the oscillations were present in the data from a Langmuir probe, a floating probe, an electron energy analyzer, and a photometer. The VLF (1 kHz < f < 10 kHz) wave stimulation monitored by a wave receiver during one particular beam sequence has already been reported by Neubert et al. (1986). The amplitudes of the ELF and VLF oscillations observed during this sequence have almost identical variations with beam pitch angle, the strongest emissions being observed for parallel beams; the ELF power spectra for the strongest emissions have peaks about 10 dB above the broadband ELF noise at frequencies around 50-60 Hz. In another beam sequence the power spectra had a harmonic structure with the fundamental frequency around 200 Hz. The power density and frequency of the fundamental increased with the shuttle charge-up potential. The emission level observed during the beam sequences increased with the charge-up potential of the orbiter, which largely depended on the wake structure. We find it most likely that the ELF oscillations are expressions of fluctuations in the return current and the shuttle potential and that these fluctuations are caused by processes involving charge imbalances in the near environment of the shuttle, possibly in a comoving plasma cloud. The observations suggest that the plasma cloud has a particle lifetime at least of the order of 100 ms.

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