Geophysical Research Abstracts
Vol. 16, EGU2014-4252, 2014
EGU General Assembly 2014

Ground based detection of the plasmapause and the density of the plasmasphere

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Although our knowledge on the plasmasphere dynamics has improved greatly thanks to some recent space missions (IMAGE, Cluster), continuous monitoring of the plasmapause position and plasma density remains unsolved. Ground based observation of geomagnetic field line resonances (FLRs) has the potential to achieve this goal. A meridional array of properly spaced magnetometers, such as EMMA (European quasi - Meridional Magnetometer Array, setup in frame of the PLASMON EU FP7 project), can provide dayside plasma density profiles. Compared to VLF whistlers, the other ground based source of plasmasphere density, FLRs have the advantage that they are often observed not only in the plasmasphere, but also outside it, in the plasmatrough, making them suitable for the detection of the plasmapause. The detection of FLRs is based on the amplitude and phase gradient observed between stations closely spaced in North-South direction. At normal conditions FLRs can be identified by a maximum in the cross phase spectra. Under special conditions, near the plasmapause the phase difference is reverted giving a minimum at the resonance frequency. This feature yields another possibility for the detection of the plasmapause. We present some events to demonstrate how the motion of the plasmapause can be monitored by means of EMMA. Results are compared to in-situ plasma density/plasmapause observations (WHISPER data onboard Cluster, EMFISIS data onboard Van Allen Probe) and some empirical models.