OVERVIEW OF RECENT RESULTS ON WHISTLER-MODE CHORUS

O. Santolík

Institute of Atmospheric Physics and Faculty of Mathematics and Physics, Charles University, Prague, Czech Republic

Recent results of investigation of whistler-mode chorus by the Cluster, Double Star and CRRES spacecraft are summarized. These natural wave emissions can be important for the transfer of energy between different populations of energetic particles: whistler-mode chorus has been recently shown to play a role in the process of local acceleration of electrons in the outer Van Allen radiation belt. The reviewed results can be divided into several broader categories. (i) Substructure of chorus wave packets have been observed at time scales of 1-40 ms, with decreasing occurrence rate for longer durations. Their growth rate is between 30 and 400 s^{-1}, and amplitudes reach up to 30 mV/m or 300 nT in the disturbed times. Maximum amplitudes are inside the larger chorus wave packets which occur at time scales above 100 ms. (ii) Frequency differences have been observed for chorus wave packets which were simultaneously detected by different spacecraft. These differences have been interpreted as differential Doppler shift from rapidly moving elementary chorus sources or, alternatively, as a result of different propagation of portions chorus wave packets to different spacecraft positions. (iii) At the altitude of the perigee of Cluster satellites (≈4 Earth's radii), multipoint measurement of the Poynting flux show that the central position of the chorus source region is located close to the geomagnetic equatorial plane, fluctuating with amplitude of ≈3000 km and at speeds of the order of 100 km/s. Size of the source region along the field line, as obtained from multipoint measurement of electromagnetic planarity, is 3000-5000 km. Multipoint correlation analysis of chorus wave packets has resulted in the size of the source region of 100 km if measured perpendicular to the field line. (iv) Studies of propagation of chorus from its source region show that chorus can magnetospherically reflect and return back to the equatorial plane at a lower altitude and with a lower frequency than locally generated chorus. Chorus waves can also penetrate the plasmapause density gradient from outside and can thus represent one of the potential embryonic sources of plasmaspheric hiss.