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Magnetic field turbulence and regular oscillations in terrestrial cusp and its vicinities

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ULF magnetic turbulence in the external terrestrial cusp and adjacent regions at southward IMF conditions is studied on the base of the Cluster measurements with applying the advanced phase difference method for the data analysis. The contribution of the coherent oscillations in the turbulence energy has been estimated, and wave energy distributions (WED) over the wave vectors and the frequency in a plasma frame are found, as well as the polarization parameters of waves. It is shown that most of magnetic turbulence energy (from 65% up to 95%) is determined by the regular magnetic field oscillations. The estimations of WED have shown that the coherent emissions in these regions very often consist of two types: of the propagating waves with non zero both the phase and group velocities relative to the plasma, and of the 'frozen' wave structures having zero group velocities in a plasma frame. Their properties are changing very fast but they retain the next remarkable features. The 'frozen' structures are predominantly observed at the ion-cyclotron frequencies and their harmonics. Significant part of propagating waves (presumably non linear) have phase velocities coincident with those of the modes, postulated by the linear MHD theory, such as Alfven, sound, fast and slow magneto-sonic. It is shown that the wave structure spatial scales are determined mostly by the ion gyro radii, doubled gyro radii, and in some cases by the ion inertial lengths. Similar structures are observed in the cusp, and also in the magnetosheath turbulent layer above the magnetopause and in the high latitude magnetosphere layer border with cusp as well. Simultaneous appearance of two waves sheds light on wave generation processes and is an evidence of nonlinear wave coupling taking place in the cusp and its vicinity. The difference between the cases observed in various regions is mainly consists in a compressibility of the waves, taking part in these processes, which are directly dependent on the plasma beta irrelative to the wave amplitudes. The wave generation mechanisms and the cascade processes from the low to the higher wave numbers are discussed.