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2007年3月3日长时间持续Pc5 ULF波的多点联合观测分析

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Multi-point joint observations of long-time continual Pc5 ULF waves on 3 March 2007

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摘要

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摘要 2007年3月3日位于磁层昏侧THEMIS的5颗卫星、同步轨道晨侧和午前的GOES 3颗卫星和地面地磁台站同时观测到了持续近4 h的Pc5 ULF波. 我们用交叉小波相关分析计算脉动的传播速度, 用MVA分析求解脉动的传播方向, 然后结合两者的计算结果获得了Pc5相速度矢量信息. THEMIS卫星观测到Pc5具有压缩特性, 且向阳传播, 速度约在6~20 km/s左右, 相比于磁层中阿尔芬速度(1000 km/s)较低. 这些Pc5 ULF波动可能产生于磁尾或磁层内部不稳定性. GOES 3颗卫星观测到不同情况的Pc5 ULF波, 极向模占主要成分, 且具有波包结构, 具有阿尔芬驻波特性, 可能产生于K-H(Kelvin-Helmholtz)不稳定性. 地面台站观测到ULF波扰动幅度随纬度升高而增强, Pc5脉动在地理纬度60°附近达到最大值, Dumont durville台站观测到的脉动与THEMIS观测到波形有很好的相似性.

关键词 Pc5 ULF 波, 剪切Alfven波, 压缩波, 磁层

Abstract: On 3 March 3 2007, five THEMIS satellites on the dusk side of the magnetic layer, three geosynchronous GOES satellites on the downside and morning and ground geomagnetic stations all observed Pc5 ULF waves for almost four hours. We use cross wavelet correlation analysis to calculate the pulse's propagation speed and MVA to determine the propagation direction. Then we combine the speed and the direction to obtain the information of the Pc5 phase velocity vectors. THEMIS satellite observed that Pc5 waves were of compression, propagating sunward at a speed about 6~20 km/s. Compared to the magnetic layer Alfven speed (1000 km/s), this velocity is relatively low. They may come from the magnetotail or innermagnetosphere instability. Three GOES satellites observed different Pc5 ULF pulsations dominated by the poloidal mode and have the wave packet structure which means that Pc5 waves have the Alfven wave feature, likely originated from K-H instability. The ULF disturbance amplitude observed by ground stations strengthened with increasing latitudes. Pc5 waves reached the highest level at 60 degree latitude. There is good similarity in waveforms between the pulses observed by the Dumont Durville station and the waves observed by THEMIS.

Keywords Pc5 ULF waves, Shear Alfven wave, Compressional wave, Magnetosphere

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