

低电离层舒曼谐振观测

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Observations on Schumann Resonance in Low Ionosphere

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摘要

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摘要 舒曼谐振与大气温度变化及地震电磁前兆密切相关,该文针对地面直接观测受环境制约严重的问题,提出了一种新的舒曼谐振监测方法,即人工向电离层发射高频(HF)电磁波,与舒曼谐振产生电离层交叉调制,通过解调HF波获得舒曼谐振。基于大气晴天电场作用下HF电磁波与舒曼谐振在低电离层的非线性调制模型,论证了该方法的可行性;利用我国首个舒曼谐振观测台站,接收短波授时信号BPM,并在其解调谱图上得到了分别位于7 Hz, 14 Hz, 20 Hz, 26 Hz的舒曼谐振前4阶谐振峰。理论及实验表明在HF的解调谱上获取低电离层舒曼谐振,是一种可行的舒曼谐振观测方式。

关键词: 舒曼谐振 地-电离层波导 极低频 电离层非线性

Abstract: Schumann Resonance (SR) is closely related with atmospheric temperature changes and electromagnetic precursors of earthquakes. In this paper, a new method to monitor SR is proposed as the heavy environment constraints in the ground-based observing. That is to transmit High Frequency (HF) electromagnetic waves into the ionosphere, where the HF signals will be cross-modulated with SR. So it can be obtained by de-modulating the HF waves. The feasibility of the experiment is verified based on the nonlinear modulation model of HF waves and SR in the lower ionosphere, in which the fair weather electric field is taken into account. The first 4 peaks of Schumann resonance respectively at 7 Hz, 14 Hz, 20 Hz, 26 Hz are obtained in demodulation spectra of short wave timing signal BPM at the first Schumann Resonance observatory of China. The theoretical and experimental results show that it is feasible to get SR signals in the lower ionosphere from the HF demodulation spectra.

Keywords: Schumann Resonance (SR) Earth-ionosphere wave guide Extra-low frequency Ionosphere nonlinearity

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