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GENERATION OF THE SUPER SMALL-SCALE ARTIFICIAL IONOSPHERIC IRREGULARITIES IN THE IONOSPHERE PUMPED BY HIGH-POWER HF RADIO WAVES

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We present the results of experimental studies of generation of super small-scale plasma-density irregularities in the ionospheric F_2 region pumped by a high-power HF O-mode wave at frequencies close to the fourth gyroharmonic in the region of its interaction with the plasma. The experiments were performed using the Sura heating facility. The super small-scale irregularities were sounded by GPS satellite signals. It has been shown that super small-scale irregularities are excited with the most efficiency in the region of the magnetic zenith for the pump wave. The intensity of such irregularities and typical times of their development and decay are determined.

1. INTRODUCTION

Spectral broadening of the signals of aspect scattering of HF radio waves by decameter artificial irregularities of the plasma density was detected in 1995 in the experiments based on the Sura facility (Radiophysical Research Institute, Nizhny Novgorod) [1]. These irregularities are excited due to the thermal (resonant) parametric instability when the ionospheric F_2 region is pumped by high-power HF O-mode radio waves. The spectrum broadening was observed when the frequency f_0 of the pump wave was equal to or slightly higher than the electron gyroharmonic and the double-resonance conditions $f_0 = f_{\rm UH} = nf_{\rm He}$ ($f_{\rm UH}$ is the upper-hybrid resonance frequency, $f_{\rm He}$ is the electron gyrofrequency, and n is the harmonic number) were fulfilled [2]. In was shown in [3] that the nature of this phenomenon is due to the generation of super small-scale artificial irregularities of the plasma density inside the decameter irregularities. Since then there have been several attempts to detect these irregularities experimentally. The obtained results are given in [4-8].

This paper is aimed at discussing the Sura's new experiments on detection of super small-scale irregularities and determining their characteristics.

2. CHARACTERISTICS OF THE BROAD UP-SHIFTED MAXIMUM

Let us briefly summarize the main characteristics of the spectral broadening of the signals of aspect scattering by decameter irregularities, when the pump-wave frequency is of the order of or slightly exceeds the electron gyroharmonic, since this phenomenon, according to [3], is closely related to generation of super small-scale artificial irregularities.

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