THz-I-6
THz gyrotrons and beyond

A. Fokin[1], *M. Glyavin*[1]
[1]*IAP RAS, Plasma physics and High power electronics, Nizhny Novgorod, Russian Federation*

This report aims to bring together information about the development and the most striking application examples of high frequency (0.3-1.5 THz) gyrotrons [1,2]. The paper describes the main features of terahertz devices. The data about pulsed and CW tubes, working at the in the specified frequency range, are given. These gyrotrons demonstrate (in some specific combinations) extremely low voltage and beam current, narrow frequency spectrum, wide frequency tuning.

The pulsed gyrotron has been used successfully for initiation of localized gas discharges [3]. Such plasma is promising for development of both a point source of multi-charged ions and a source of high-energy ultraviolet (extreme ultraviolet EUV or XUV). CW tubes widely used for the high-resolution molecular spectroscopy and diagnostic of various media. A significant improvement of spectrum quality, due to power growth in contrast with traditional BWO, was obtained and the sensitivity of the radio-acoustic detector was increased about three orders [4]. Simultaneous non-linear excitation of high harmonics during the operation at fundamental one was demonstrated. Such case radiation power at harmonics was several orders lower than in fundamental, but, any way, significantly higher than in solid state and classical vacuum electronic tubes.

Novel schemes of high frequency gyrotrons are analyzed. The electron optics and electrodynamics methods of mode selection for single mode harmonic excitation are presented. The dual electron beam gyroytron demonstrated operation at second harmonic with a frequency about 0.8 THz [5], axis-encircling CW gyrotron realized 0.4 THz operation at the third harmonic [6] and complex cavity gyrotron with phase corrector obtained pulsed 1.2 THz at the second harmonic [7].

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