The development of THz gyrotrons and their applications for plasma science and diagnostics of various media

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Abstract—Results of experimental investigations of demountable high power pulsed gyrotron are presented. This gyrotron has been successfully used for initiation of localized gas discharges in studies aimed to create a point source of extreme ultraviolet light. Design and experimental test of CW 0.26 THz gyrotrons are discussed. Some possibilities to improve mode selectivity such as multi beam electron optics and planar geometry are discussed.

Keywords—gyrotrons, THz, plasma discharge, spectroscopy

In addition to such important application of gyrotrons as electron cyclotron heating and current drive in plasma fusion installations, other device applications become now attractive (and their number increases with time). For example, gyrotrons for a spectroscopy and diagnostics of different media are of interest. In this paper, some results of testing pulsed gyrotrons are presented, same as theoretical analysis and design of novel scheme of gyrotrons.

Demountable powerful gyrotron based on pulsed coil with liquid nitrogen cooling has been developed at IAP RAS in collaboration with University of Maryland [1]. The maximum power measured by dummy load is 200 kW, efficiency about 20%, pulse duration 30 μs, operating frequency near 0.67 THz. This gyrotron has been successfully used for initiation of localized gas discharges in studies aimed to create a point source of extreme ultraviolet light. The theoretical analysis of discharge properties has been made. The estimated value of extreme ultraviolet power measured by PIN diode is in order of few kW [2].

To enhance resolution of the high-field NMR spectrometer a complex based on CW 100W/0.26THz second harmonic gyrotron with external mode converter of operating mode to narrow beam has been realized. Experiments with this gyrotron allowed 80 times increase in the sensitivity and resolution of the NMR spectrometer. The estimated value of extreme ultraviolet power measured by PIN diode is in order of few kW [2].

References