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INFLUENCE OF AZIMUTHAL PLASMA CONCENTRATION INHOMOGENEITY ON PLASMA MASER EMISSION SPECTRA ^{*)}

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Plasma masers are microwave pulse sources with a power of $10^8 \dots 10^9$ W with the central frequency of emission and spectrum width controlled within wide limits [1]. The presented results are obtained during the experimental research of axially symmetric plasma maser operating in epy noise amplifier mode in the frequency band 3...16 GHz at power from 10 MW to 100 MW. The plasma was created by a plasma source based on a ring thermocathode; its concentration, which determines the frequency of emission, was measured by a Langmuir probe [2].

It is shown that the width of the emission spectrum depends to a large extent on the azimuthal homogeneity of the plasma concentration. When the plasma is homogeneous in azimuth, changing its concentration allowed us to change the central frequency of radiation in the range from 4 to 13 GHz while maintaining the spectrum width of 3...4 GHz, see Fig. 1.

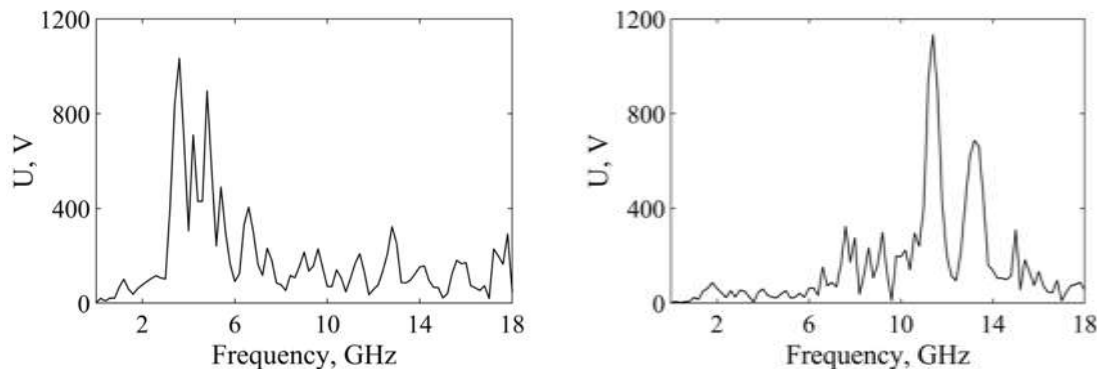


Fig. 1 Emission spectrum of a plasma maser for different plasma concentrations: left – $n_e = 1 \cdot 10^{13} \text{ cm}^{-3}$; right – $n_e = 3 \cdot 10^{13} \text{ cm}^{-3}$ (plasma concentration is homogeneous in azimuth)

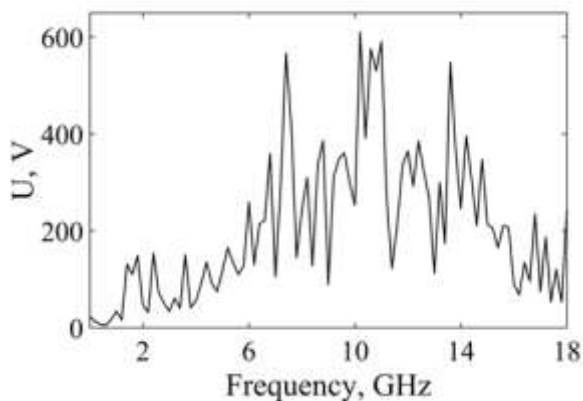


Fig. 2 Emission spectrum of a plasma maser (plasma concentration is inhomogeneous in azimuth)

Violation of the azimuthal homogeneity of the plasma concentration to a factor ~ 2 resulted in broadening of the spectrum of emitted frequencies up to 100% of the center frequency, Fig.2.

A method of electronic control of the emission spectrum width based on the use of a sectionalized direct incandescence thermocathode is proposed. The azimuthal distribution of the plasma concentration and the width of the maser emission spectrum change depending on the degree of shunting of the incandescence of one of the sections.

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References

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^{*)} [abstracts of this report in Russian](#)