CHARACTERISTIC X-RAY AND BREMSSTRAHLUNG IN PLASMA WITH ENERGETIC E-VORTEX CONFINED BY MIRROR TRAP [[1]](#footnote-1)\*)

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It was previously shown [1, 2] that gyroresonant interaction in two symmetrically located regions of a long mirror trap leads to the generation of plasma with energetic e-vortex and their subsequent throw to the minimum of the trap and formation of a stable ring plasma formation with energetic (several hundred keV) electron component. X-ray diagnostics is widely used in the study of plasma with an energetic electron component and contains information on the localization of the hot plasma component and electron energy distribution function. Studies of the spatiotemporal and spectral-angular distribution of bremsstrahlung under gyroresonant interaction carried out [3, 4] the presence of anisotropy of accelerated particles and made it possible to determine the temporal dynamics of the localization of the plasma bunch at the generation stage and confinement.

The aim of this work is to study the characteristic radiation generated by energetic electrons of bunches on a gas target (heavy gases: Xe, Kr) to determine the average degree of ionization, as well as the number of particles in the bunch to determine the eigenfields.

For registration of radiation, spectrometers X-123-CdTe and Si-Pin-X-123 calibrated upon Am241 lines were used. The studies of the dynamics of changes in the intensity of the characteristic lines of the working gas (Xe Kα1 = 29.775 keV, Kr Kα1 = 12.648 keV) showed the optimal conditions for the capture of particles, which is directly related to the number of energetic electrons in the confined electron vortex. The changes in the intensities of the spectral lines of characteristic radiation from a gas target at different pressures of the plasma-forming gas are experimentally determined. The spectrum and quantum yield of X-ray radiation from the gas target showed that the electrons of the accelerated plasma bunch during confinement are localized in the minimum of the mirror trap and are concentrated in a thin cylindrical layer. The spectrum and characteristics of X-ray radiation in the longitudinal and transverse directions with respect to the direction of the magnetic field have radical differences both in intensity (*Iacross/Ilong* ~ 7) and in limiting energy (60 keV and 250 keV, respectively). The results of this work explain the previously obtained results and can be used to obtain information on the number of accelerated electrons, their energy spectrum, and the dynamics of its change within the working cycle of acceleration and confinement of generated bunches in the magnetostatic field of a long mirror trap.

Reference

1. Andreev V.V., Novitskiy A.A., Umnov A.M., Chuprov D.V. Instruments and Experimental Techniques. 2012. Т. 55. № 3. С. 301-312.
2. Andreev V. V., Chuprov D V, Ilgisonis V I, Novitsky A A and. Umnov A M 2017 Physics of Plasmas 24 093518, doi: 10.1063/1.4986009
3. V.V. Andreev, A.A. Novitsky, A.M. Umnov IOP Conf. Series: Journal of Physics: Conf. Series 1094 (2018) 012013
4. V.V. Andreev, A.A. Novitsky, A.M. Umnov IOP Conf. Series: Journal of Physics: Conf. Series 1383 (2019) 012013
1. \*) [abstracts of this report in Russian](http://www.fpl.gpi.ru/Zvenigorod/XLVIII/Lt/ru/EW-Andreev.docx) [↑](#footnote-ref-1)