DOI: 10.34854/ICPAF.51.2024.1.1.111

INVESTIGATION OF SOFT X-RAY AND EXTREME ULTRAVIOLET RADIATION OF LASER PLASMA PRODUCED ON SOLID COPPER TARGETS AT THE "KANAL-2" FACILITY *)

[1]Vergunova G.A., [1]Gus'kov S.Yu., [1]Kologrivov A.A., [1]Puzyrev V.N., [1]Sahakyan A.T., [1]Starodub A.N., [1]Bezverkhnyaya D.M., [2]Vichev I.Yu., [2]Grushin A.S., [2]Kim D.A., [2]Solomyannaya A.D.

[1]*Lebedev Physical Institute, Moscow, Russia*
[2]*Keldysh Institute of Applied Mathematics, Moscow, Russia*

The studies were carried out at the Kanal-2 facility [1], the main parameters of which had the following values: wavelength – 1.06 microns; pulse duration – 2.5 ns; spectral width – 26 Å; number of transverse modes in the resonator ≈ 1000; radiation divergence – $1.4 \cdot 10^{-3}$ rad; beam diameter at the output – 60 mm. The radiation energy of the laser pulse varied in the range of 12-30 J, and with a focusing spot diameter of 170 microns, the power density on the target was $2.1 \cdot 10^{13}$ – $4.2 \cdot 10^{13}$ W/cm^2. The emission spectra of the resulting plasma were recorded in the wavelength range from 25 to 450 Å in the time-integral mode using the GIS-S grazing incidence spectrograph. Calculations of the effect of laser radiation on a flat copper layer were performed using the one-dimensional RADIAN software [2]. The physics-mathematical model on which the RADIAN code is based contains the equations of two temperature radiation gas dynamics. Electron-ion exchange and classical or reduced electron thermal conductivity are taken into account. The laser radiation is absorbed by the inverse-bremsstrahlung method. The equations of gas dynamics are solved together with the multigroup equation of the plasma intrinsic radiation transfer. Optical spectral absorption and radiation coefficients from the THERMOS database [3] were used.

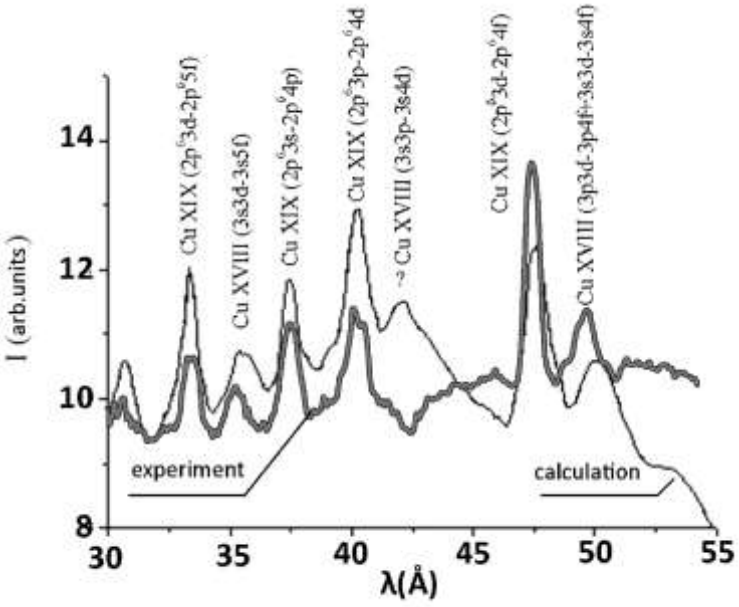

Fig. 1. Experimental and calculated spectra

In Fig. 1, the time-integral calculated spectrum in the range of 30-55 Å is compared with the experimental one obtained at the Kanal-2 facility when irradiating a flat copper target. It can be seen that the position of the spectral lines is the same.

References

[1]. Fedotov S. I., Feoktistov L. P., Osipov M. V. and Starodub A. N.// J. Rus. Las. Res., 2004, 25, 79-92.
[2]. Vergunova G.A. and Rozanov V.B. // Laser Part. Beams, 1999, 17, 579.
[3]. Kim D.A., Vichev I.Yu., Solomyannaya A.D., Grushin A.S., Preprint IAM, 58, Moscow, 2020 [in Russian].

*) abstracts of this report in Russian