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SPECTROSCOPIC METHODS FOR STUDYING PLASMA OBJECTS *)

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Numerous studies conducted over several decades have shown that X-ray spectroscopy can be a very useful tool for studying high-temperature plasma. At the same time, it is necessary to take into account the expected parameters of the object under study in order to choose the type of crystal used, its geometry, the geometry of the experiment, as well as the geometry of the source and the time of its existence. The results obtained largely depend on the use of correctly selected equipment and a program for calculating the obtained spectra. For example, when using spectrographs without spatial and temporal resolution, the parameters of a plasma object will be averaged over time and space and, therefore, significantly lower than the real ones. A cycle of studies of the parameters of laser plasma with an Al target and plasma of hybrid X-pinches with an Al wire has been carried out [1]. Experiments with X-pinches were carried out on a high-current BIN generator (270 kA, 100 ns, 350 ns). The laser plasma was created by focusing the radiation of a PICO neodymium laser with a pulse duration of 3 ns /FWHM/ and an energy of 10-30 J on a copper target with a flux density of 10^{14} W/cm^2. The experiments used spectrographs with a convex CsAp crystal and with a spherical mica crystal R =100 cm. A distinctive feature of the experiments was the use of the same spectrographs with the same setup and the same spectrum modeling program. The spectra were recorded on FUJI BAIT image plates. The PrismSPECT program was used to model the K-spectra of Al [2]. The calculated spectra approximately coincided with the experimental ones for very similar plasma parameters of X-pinch bright points and laser plasma: Te = 350-400 eV, Ne = (3-5) 10^{19} cm^{-3} and R=25 microns.

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