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X-PINCH AS A SOURCE OF SPATIALLY COHERENT SOFT X-RAY RADIATION *)

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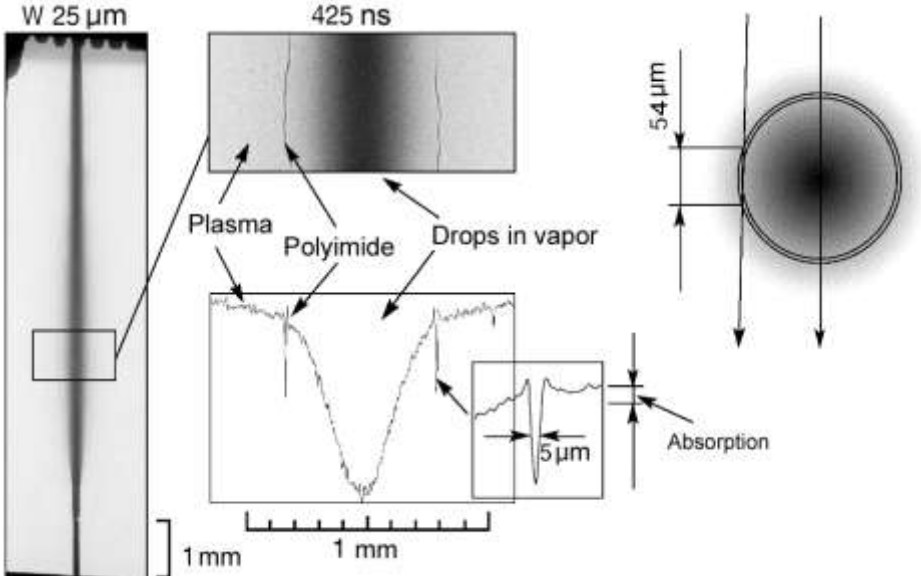
As part of the work on ICF in the Laboratory of Problems of New Accelerators of the Lebedev Physical Institute, an original Z-pinch scheme was proposed, which makes it possible to effectively transfer the energy of an electric storage device into plasma at a given point in space and obtain matter with extreme parameters at a given point in time [1,2]. The original configuration consisted of two thin conductors crossed in an X-shape in a vacuum diode, to which a high-voltage pulse was supplied from a low-impedance, high-current generator. From the results of experiments with the X-pinch, it became clear that the size of the plasma region emitting soft X-rays with photon energies greater than 1 keV can reach very small sizes. It was shown that the so-called X-pinch "Hot spot" can have dimensions in the micron range [2], which determined interest in it as a radiation source for projection radiography of fast-occurring phenomena in matter with a high energy density [3]. In particular, unique studies of the nanosecond explosion of wires and wire assemblies were carried out, which made it possible to obtain reliable information about the processes during and after the explosion, which was previously unavailable. In a number of cases, the contrast of images in the zone of sharp changes in density was significantly higher than expected under the assumption of geometric optics. This indicates that factors related to the coherent properties of the probing radiation begin to play in image formation. The figure, as an example, shows an image of an exploded 25 μm tungsten wire, which in the initial state was covered with a thin layer (5 μm) of polyimide insulation. Calculation of radiation absorption in the substance of the expanded shell gives a change in the optical density of the photographic film that is significantly less than observed in experiment, that is, there is a so-called phase contrast associated with the interference of probing radiation.



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References

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*) abstracts of this report in Russian