Photonics and optoacoustics (the 1st part) and action of X-ray lasers (the 2nd part)

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1. Applications in telecommunications and nanosensing. Structured optically thick films are considered in the report. Due to their special structure, these films transmit light [1]. Although the film thickness is optically large: it is 5-7 skin layer thickness. At the same time, the film remains an effective transducer of terahertz sound generators in the film and substrate [1]. Thus our device combines the properties of photonic and optoacoustic devices. The films are created by magnetron sputtering inside few Pa Argon atmosphere.
2. Applications in material processing. A comparative analysis of ablation by femtosecond high intensity soft ($I \sim 10^{15}$ W/cm^2) 92 eV and hard ($I \sim 10^{18}$ W/cm^2) 9 keV X-ray [2] lasers has been performed. Modern XFEL produce X-ray beams with low divergence. To increase the intensity, the beam is focused into the smallest possible spot. In our work, the minimum size for soft X-rays is 3 um and 0.4 um for hard X-rays. The difference is that the attenuation length is very different for soft (few tens of nm) and hard X-rays ($\sim$ 1 mm for light elements, 7 mm in Be). This fact leads to a qualitative difference in the nature of the induced flows. In the hard X-ray case mm long empty cavity is formed not by ablation but due to radial indentation of matter along cavity.

[1] Petrov Y V, Romashevskiy S A, Dyshlyuk A V *et al.* 2025 *Zh. Eksper. Theor. Fiziki* **167**(4)
[2] Makarov S, Grigoryev S Y, Zhakhovsky V V *et al.* 2024 *arXiv:2409.03625 [physics.plasm-ph]*