Experimental study of the dynamics of femtosecond and nanosecond plasma ablation flows in an external magnetic field

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Experimental studies of high-speed (more than 100 km/s) plasma flows propagating into vacuum across a strong uniform magnetic field with an induction of more than 13 T are presented. The experiments were carried out on a PEARL petawatt laser facility where two types of high-power laser pulses (femtosecond—10 J, 60 fs and nanosecond—10 J, 1 ns) irradiated a solid target hence creating two types of plasma flows. Comparative studies of the dynamics and 3D morphology of these two types of plasma flows were performed using femtosecond optical diagnostics. It has been shown that the efficiency of energy transfer into plasma is significantly lower for the femtosecond ablation than for nanosecond one. A significant difference in the dynamics and morphology of femtosecond and nanosecond plasma flows, both in vacuum and in the external magnetic field, has been observed. The work is supported by The Ministry of Science and Higher Education of the Russian Federation (Agreement No. 075-15-2022-316, Center of Excellence "Center of Photonics").