Powerful THz generation from thin crystal at multiTW laser pulses

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For pump-probe experiments in strong fields and with femtosecond resolution, a simple method is required to obtain high-power, short THz pulses from 0.8 μm multiTW laser systems. Lithium niobate crystal has advantages in this situation, despite strong THz absorption and the absence of phase matching. We identify the physical factors that limit the THz yield in this case. Several nonlinear processes (spatiotemporal phase modulation, multiphoton absorption, ablation) should be taken into account and avoided to get a high-energy THz pulse. Generation in a 10 μm layer provides significantly broadband and short THz pulses in comparison with other methods. Such single-cycle pulses allows an experimental study of the matter manipulation of a superstrong, quasi-stationary electric field with an amplitude above 5 MV/cm, and a duration of only 0.1 ps, which does not lead to the destruction of the material. The high-frequency part of obtained powerful THz pulse allows modifying doped Si slab in an unusual way, we observe induced THz absorption. For THz-pump–X-ray-probe experiments we tested Bragg diffraction measurements from laser-plasma X-ray. This work is supported by RFBR grant (18-02-40032, 20-21-00140).