Femtosecond laser installation for terahertz pulse generation, detection and applications

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Standard scheme of using femtosecond optical radiation for terahertz pulse generation and detection has been realized in the Institute of Applied Physics of Russian Academy of Sciences. Terahertz pulses are generated by nonlinear rectification of powerful optical radiation by crystal ZnTe plate and the waveform of THz pulses is registered by electrooptical sampling technique at similar ZnTe crystal; pulse repetition rate is 1 kHz. The main part of THz pulse energy is concentrated in a single field oscillation with characteristic temporal scale about 1 ps, the bandwidth of the pulse is comparable with its central frequency (~ 1 THz). According to estimates electric field intensity at the receiver crystal is about 20 kV/cm^2 and the peak power of THz pulse is about 3 kW (generation efficiency about 10^{-6}). Typical signal-to-noise ratio in the waveform measuring is 10^3.

First demonstration results are presented for measurements of absorption spectra for number of gases, solvents, protein solutions and medicine powders. Experimental scheme for Cherenkov generation of THz pulses from a laser spark produced by an axicon lens has been proposed and designed.