WIDE-BAND LASER FEMTOSECOND COMPLEX AND ITS POTENTIAL FOR SCIENTIFIC RESEARCH

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S u m m a r y

This review compiled on the basis of analysis, systematization, and generalization of literature sources is devoted to the principles of generation of ultra-short light pulses and some examples of the scientific and practical application of femtosecond pulses.

The following main questions are analyzed: a) main principles of generation of femtosecond-long ($n\times10^{-15}$ s) laser pulses; b) main properties of such a radiation; c) examples of scientific problems that can be solved with the use of femtosecond pulses; d) description of main units and methodical possibilities of the laser femtosecond complex which serves as a base for the creation of "Center for collective use of scientific equipment" at Institute of Physics of NAS of Ukraine. The review is targeted at the dissemination of information on the technical potential of the complex, causes giving birth to interest in the achievement of femtosecond-long light pulses, and gives the examples of new advanced problems that can be solved here in Ukraine with employment of this unique wide-range laser femtosecond complex. The complex is characterized by the following parameters: minimal pulse duration $\tau_i \sim 70$ fsec; maximal value of the pulsed energy $W \approx 2.5$ mJ; maximal radiated peak power $P_i \approx 3{\cdot}10^{11}$ W; maximal radiated intensity $I_0 \approx 10^{15}$ W/cm^2; possible wavelength range of radiated spectrum variation — 250 nm to 10 μm! (excluding insignificant gaps); spectra measurement range — 200 nm to 1.7 μm (with resolution of < 0.1 nm); the "pump-probe" technique with time delay of about 1 fs and the "quasi-white" continuum of a probe beam spectrum. Temperature range of the measurements — 1.8 to 300 K!

In the review, the analysis of typical experiments carried out with the use of femtosecond sources of radiation is broken into three sections, each of them being connected with three specific features of the radiation: the ultra-short duration of pulses that corresponds to several periods of a light wave; ultra-high power and intensity of the light wave close to the fields of ionization of atoms; specific features of the time coherence of spectrally wide pulses (strictly periodic "pectinated" spectrum of radiation).