# Influence of intense terahertz pulses on the optical properties of silicon

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We report the results of numerical simulation of the dynamics of the electron-hole pairs formation in silicon under the action of an intense terahertz pulse with a maximum electric field strength of up to 20 MV/cm. The novelty of the results obtained lies in the refinement of previous calculations carried out without taking into account such factors as hole impact ionization, Auger recombination, pulse reflection at the interface between air and silicon, and the band structure of silicon, which will expand knowledge about the dynamics of charge carriers on picosecond time scales [1]. The calculations took into account the propagation of the pulse into the sample over time. Temporal dependences of charge carriers concentration at different values of the initial concentration and maximum electric field intensity of terahertz pulse were obtained. Also this study represents the calculation of dependeces of integral transmittance on number of parameters (maximum electric field intensity of terahertz pulse and initial carriers concentration). The most interesting results are concentration behavior (the lower initial charge carrirers concentration leads to the higher final concncentration) and nonlinear dependence of integral transmittance of probing optical pulse on initial charge carriers concentration due to the dynamic role of the surface layer. The relevance of the proposed study is due to the significant interest in studying the process of impact ionization in strong electric fields for applications in the field of semiconductor physics and in applied problems of creating ultrafast electronic and optoelectronic devices [2].

[1] Ovchinnikov A V, Chefonov O V, Agranat M B, Kudryavtsev A V, Mishina E D and Yurkevich A A 2021 *Opt. Express* **29** 26093–26102

[2] Tarekegne A, Hirori H, Tanaka K, Iwaszczuk K and Jepsen P 2017 *New J. Phys.* **19** 123018