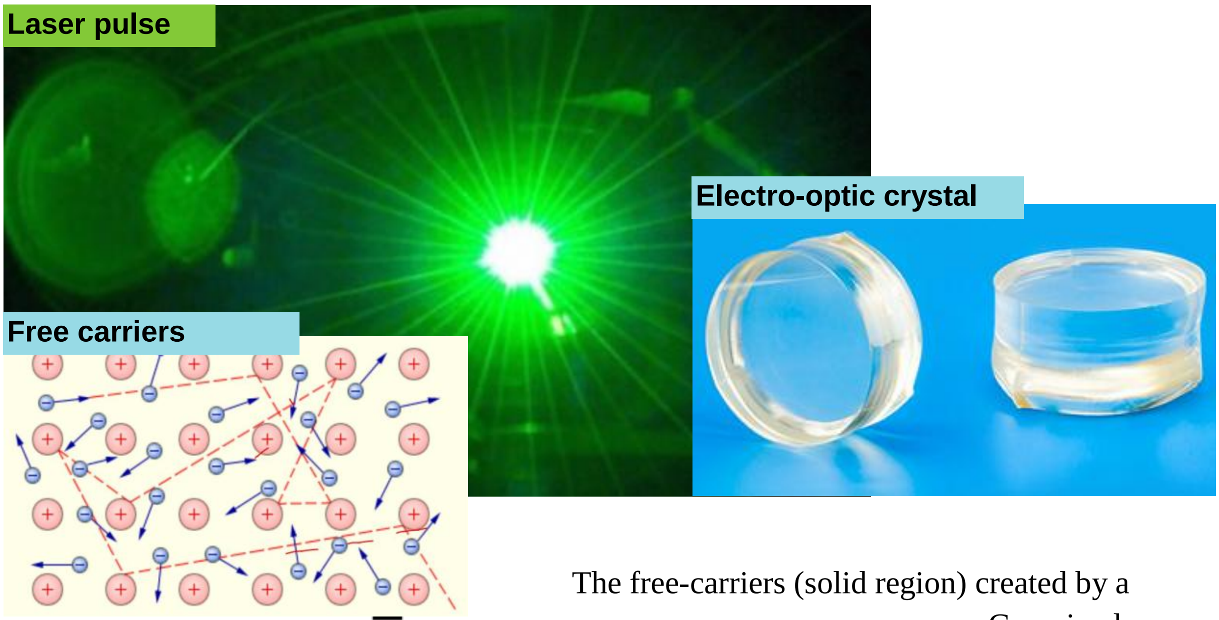
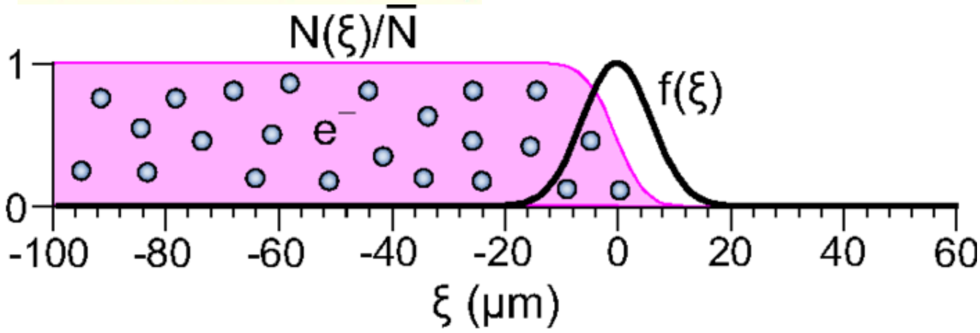
Research (What is it about?)	**Quasistatic precursors of powerful laser pulses in crystals**
UNN authors	*Bakunov M., Maslov A., Tsarev M.*
We find (The result)	It is found theoretically that an ultrashort laser pulse in an electro-optic crystal can produce a terahertz pulse with a ***quasistatic*** electromagnetic precursor propagating ***ahead*** of the pulse.
Abstract	Nowadays, extremely strong (exceeding 1 MV/cm) terahertz electric fields are of great interest. The demand for generating stronger terahertz pulses requires increasing the optical pump intensity. At high intensity, two-photon, or more generally multiphoton, absorption becomes an essential factor that can limit the optical-to-terahertz conversion efficiency. Multiphoton absorption leads not only to the depletion of the pump beam but also to the generation of free carriers that absorb terahertz waves. Thus, free-carrier generation is commonly considered as a detrimental effect for terahertz generation. We show that free-carrier generation can give rise to a much less trivial physical effect, compared to the free-carrier terahertz absorption, namely, to the generation of strong quasistatic electric and magnetic precursors ahead of the laser pulse. This effect cannot be accounted for by simply including the free-carrier contribution to the complex dielectric permittivity of the crystal. The mechanism of the effect is rather related to the nonstationarity of the free carriers. In particular, the newly born ***carriers are accelerated*** by the electric field that copropagates nonlinear polarization. The acceleration produces a burst of an electric current, which in turn generates quasistatic precursors ahead of the laser pulse. The nature of quasistatic precursors is different from the canonical Sommerfeld and Brillouin precursors, which are a linear propagation effect. They result from disintegration of an electromagnetic pulse in a dispersive medium and appear as oscillations propagating ahead of the main part of the pulse. Quasistatic precursors have a ***nonoscillating*** character and originate from the ionization of a nonlinear (electro-optic) medium by a strong optical pulse.

Representative articles 2017-2018, quartiles	1. *Bakunov M.I., Maslov A.V., Tsarev M.V.* Optically generated terahertz pulses with strong quasistatic precursors. Phys. Rev. A. **95**: 063817 (2017).	Q1, Q2
	Q-index (Qi) for the result	**3.5**
	medial blue	

In collaboration	–



The free-carriers (solid region) created by a Gaussian laser pulse (solid line) in *ZnTe* crystal.

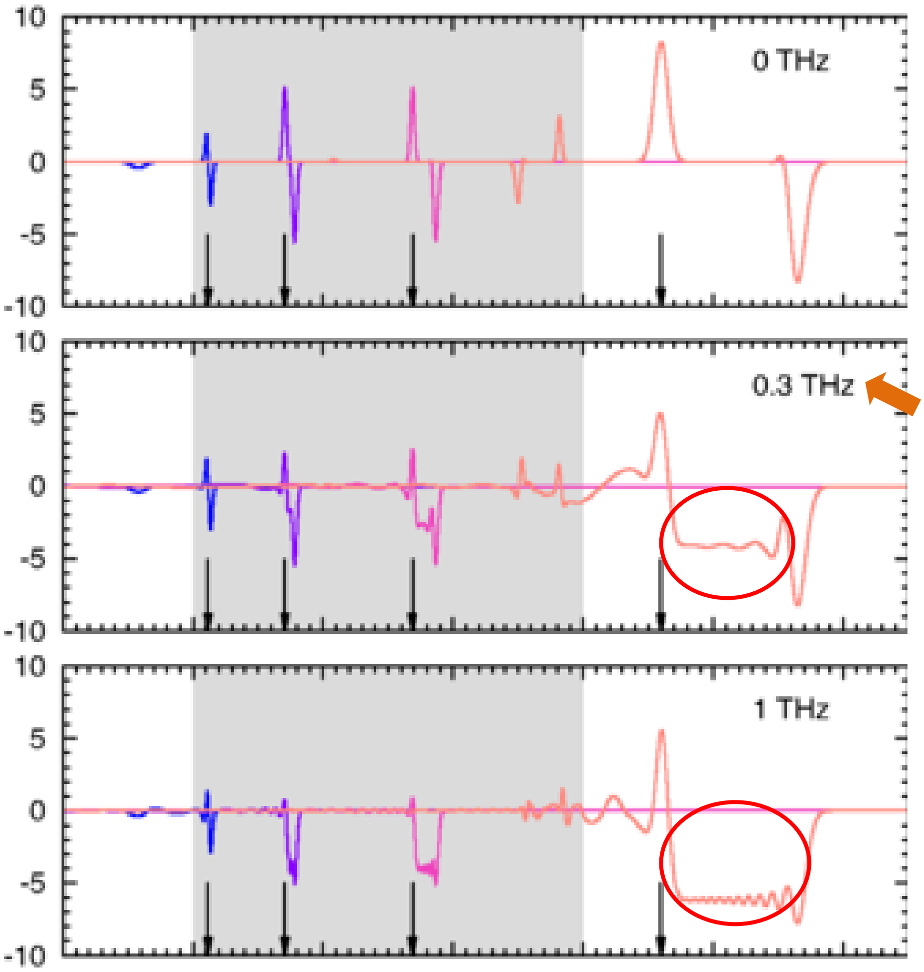


Transmission of a pulse (250 fs) through *ZnTe* layer:

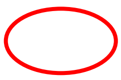
without carrier creation…

and

…with carrier creation of different concentration (corresponding plasma frequency is shown).



The *ZnTe* layer (shaded region) is 3 mm thick. The arrows indicate the center of the laser pulse.

 – ***precursor.***