Changes in polarization and spectrum of short elliptically polarized pulses due to self-action in medium with the frequency dispersion and the spatial dispersion of cubic nonlinearity.

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Diploma thesis abstract.

In this diploma thesis we have made the computation modeling of propagation of elliptically polarized laser pulses in nonlinear medium. We have proposed the model of nonlinear medium with frequency dispersion and spatial dispersion that allows formulate material equations without the requirement of smallness for characteristic dimension scale of the nonlocality. In the case of short (containing about 10 or less oscillations of the electric field vector) pulses the results of our numerical simulation significantly differ from those predicted by the SVEA, particularly, from the analytic expressions for the intensity-dependent ellipticity degree and the angle of rotation of the polarization ellipse in the case of monochromatic radiation. We have made the analysis of impact of polarization state of pulse on entry to the nonlinear medium on dynamics of polarization (change with the propagation) and intensity for polarization state of propagated pulse. Also, we have made a research for efficiency of signal generation near third harmonic of short laser pulse, which propagates in nonlinear medium, depending from characteristic dimension scale of the nonlocality for linear optical response.

In this diploma the numerical simulation was made using the modification of the finite-difference time-domain method (FDTD method) with the auxiliary differential equation (ADE).