Quantum-Mechanical Elaboration to the Description of Elliptical Terahertz Radiation Generation by Extended Gas Interacted with Two-Color Laser Field

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We present the results of the numerical study of the generation of the elliptical terahertz (THz) radiation by an extended argon gas media interacting with a two-color laser field. On the base of a single atom response to the action of the two-color laser field with a linear polarization of each of the components of the laser field and different angles between them, two angles ($\pi/2$ and $\pi/4$) and radiation at two frequencies (56 and 29 THz) corresponding to them and having relatively high values of ellipticities have been chosen for the calculation of the extended gas response. The results obtained for different widths and lengths (up to 20 cm) of the gas demonstrate the cone structure of the generated radiation together with a non-monotonical distribution of the ellipticity. The polarization parameters of the generated radiation depend strongly on the length of the gas and width of the laser field. The THz field strength, ellipticity, degree of ellipticity, degree of polarization distributions over the detector coordinate have been calculated for the number of gas lengths and pulse widths. The results of the numerical investigations show high ellipticity and high degree of polarization of the generated radiation. Three methods of the ellipticity value control have been presented. One of the most promising of them is to use the iris – the method enabling a significant increase in the value of ellipticity and among others giving an understanding of the regions of the laser pulse which form cones of the THz emission. The latter can be used for investigation of the influence of the laser aberration on the THz field generation [1]. The single atom investigations have been carried out with the help of the non-perturbative theory for the ionization-free regime of interaction.

References