Polarization and frequency-controlled THz amplification in nonequilibrium magnetized plasma

Bogatskaya A V[1,3], Volkova E A[2] and Popov A M[1,3,@]

[1] Department of Physics, Lomonosov Moscow State University, Leninskiye Gory 1 Bldg 2, Moscow 119991, Russia
[2] Skobeltsyn Institute for Nuclear Physics, Lomonosov Moscow State University, Leninskiye Gory 1, Moscow 119899, Russia
[3] Lebedev Physical Institute of the Russian Academy of Sciences, Leninsky Avenue 53, Moscow 119991, Russia

[@] alexander.m.popov@gmail.com

Here we present a new way to implement polarization-controlled amplification of the linearly polarized THz pulse in the nonequilibrium xenon plasma channel formed by the intense UV laser pulse [1] in the presence of external magnetic field. The physical mechanism involves the well-known cyclotron resonance, which has been demonstrated to strongly influence the amplifying and focusing abilities of nonequilibrium plasma [2]. Similar to [1], the plasma channel serves as the controllable amplifier for the THz radiation while the seed pulse is produced by the one of well-known (for ex., two-color) schemes. We provide the results of the self-consistent modelling of THz pulse propagation in the nonequilibrium magnetized plasma based on the second-order 3D wave equation and kinetic Boltzmann equation in the two-term expansion for the electron velocity distribution function (EVDF) evolution. The results show the possibility to tune the pulse central frequency in a wide range and to control its polarization degree, thereby providing intense THz pulses with both circular and elliptical polarization. In the frames of 3D modelling we also analyse the focusing features of such nonequilibrium magnetized plasma channel that become more pronounced in the presence of cyclotron resonance.
This work is supported by RSF grant No. 22-22-00225.

[1] Bogatskaya A and Popov A 2013 *JETP Lett.* **97** 388–392
[2] Bogatskaya A, Gnezdovskaia N and Popov A 2020 *Phys. Rev. E* **102** 043202