ELECTRON ACCELERATION AND ABSORPTION OF RELATIVISTIC LASER PULSE IN DENSE PLASMA

Gimaletdinova D.I., * ***Sedov M.V.***

JIHT RAS, Moscow, Russia

**diashka01@mail.ru*

Among the mechanisms that have been studied for laser acceleration of electrons, wake acceleration is the primary one. Acceleration gradients achieved using laser-plasma methods are of the order of 100 GeV/m and significantly exceed those that can be obtained in traditional accelerators [1], which allows them to be used to build alternative, compact accelerators of charged particles with practical applications in science, medicine and industry. Until now, it has been demonstrated experimentally that electrons with an energy of around 8 GeV can be obtained [2], and theory predicts that energies of the TeV order can be achieved.

At the same time, there are a large number of significant applications that require accelerated electrons of lower energies (in the range from 50 MeV to 1 GeV), but in significantly greater quantities.

In this work, a three-dimensional numerical simulation of the interaction of femtosecond laser radiation (intensity of 10^{22} W/cm^2) with gas jets (gas density of $10^{19} - 10^{22}$ cm^{-3}) was performed using the particle-in-cell (PIC) method. Fully ionized argon was used as the target. The calculations for this task were carried out with the PIC code EPOCH [3].

In the work, the dependencies of the laser pulse absorption and the electron cutoff energy on the plasma density were investigated. Electronic spectra and angular distributions were determined. The conversion efficiency of laser radiation into hot electrons was also measured in the calculations. It was measured separately for 3 energetic regions: for electrons with an energy of $0.1 - 1$ MeV, $1 - 50$ MeV and > 50 MeV.

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