Abstract

By numerically solving the relativistic equations of a single electron in a laser modeled by those of a Gaussian beam and in a combined laser beam and a DC electric field, we demonstrate electron capture by reflection from, and transmission through the beam. With the appropriate focusing technology, a laser system is capable of making available to a charged particle, say an electron, huge amounts of energy to absorb from and get accelerated. However, it is now believed that the fields of such a laser system need to be made asymmetric over the space-time points of interaction with the particle, if the latter is to come out with any appreciable energy gain. This asymmetry may be brought about by an appropriately applied extra DC electric field, among other methods. We investigate the problem of acceleration of a single particle, an electron, in such an environment using laser and DC fields currently available to laboratory experiments. In modeling the laser fields, term of order up to ε^5, where ε is the diffraction angle, are retained. All cases of capture are accompanied by energy gain that reaches a few GeV, from fields of present-day intensities [1]. Reflection and transmission, on the other hand, result sometimes in no gain or captures electron, a process

that sometimes results in even more energy gain. It is shown that more energy gain up to a few GeV may be obtained, by adding a DC electric field to the say x or z components of the laser electric fields. Electron dynamics is investigated by numerical computation using Runga-Kutta adaptive method RK4, to obtain the trajectory and velocity of the electron.