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Investigation of electron acceleration in vacuum by a radially polarized laser pulse in the presence of helical wiggler field and axial magnetic field guiding

M Asri

Department of physics, Gonbad Kavous university, Gonbad Kavous, Iran

E-mail: mehdi.asri@gonbad.ac.ir

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Abstract

In this paper, electron acceleration by a radially polarized laser pulse in the presence of helical wiggler magnetic field and axial magnetic field has been studied. The governing equations on electron dynamics in the presence of these electric and magnetic fields were solved by the fourth order Runge-Kuta method. The effect of axial magnetic field and electron injection angle on energy gained by the electron was investigated. Numerical studies have shown that the final energy of an electron depends on the value of the magnetic field and the injection angle. It was seen that by applying a magnetic field of about 0.2 and the injection angle of about 11 degrees, the electron can gain final energy of about 3.8 GeV, which is 40 percent more than the case of zero degrees injection angle and the absence of external magnetic field.

Keywords: electron acceleration, radially polarized laser pulse, helical wiggler, magnetic field

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