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# Further Acceleration of MeV Electrons by a Relativistic Laser Pulse

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Abstract: With the development of photocathode rf electron gun, electrons with high-brightness and mono-energy can be obtained easily. By numerically solving the relativistic equations of motion of an electron generated from this facility in laser fields modelled by a circular polarized Gaussian laser pulse, we find the electron can obtain high energy gain from the laser pulse. The corresponding acceleration distance for this electron driven by the ascending part of the laser pulse is much longer than the Rayleigh length, and the light amplitude experienced on the electron is very weak when the laser pulse overtakes the electron. The electron is accelerated effectively and the deceleration can be neglected. For intensities around $10^{19}$ W•μm$^2$/cm$^2$, an electron's energy gain near 0.1 GeV can be realized when its initial energy is 4.5 MeV, and the final velocity of the energetic electron is parallel with the propagation axis. The energy gain can be up to 1 GeV if the intensity is about $10^{21}$ W•μm$^2$/cm$^2$. The final energy gain of the electron as a function of its initial conditions and the parameters of the laser beam has also been discussed.

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Key words: electron acceleration, energy gain, laser, femtosecond

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