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LASER INDUCED SPIN-1/2 DYNAMICS BEYOUND THE DIPOLE APPROXIMATION IN THE SEMI-RELATIVISTIC REGIME

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I. Introduction

With this article we aim to discuss quantum effects in charged spin-1/2 particle dynamics caused by a
A charged particle's dynamics in the electromagnetic background, classical as well as quantum strongly dep

In the present work, having in mind the necessity of the dipole approximation scheme modification, we will discuss the dynamics in an "intermediate regime", when the values of a laser field strength lead to the post non-relativistic type of dynamics. We address the question what is the effect of complete treatment of the Heaviside-Lorentz force (non ignoring its magnetic part) on the particle's spin evolution. Concentrating on a charged spin-1/2 particle motion in a strong monochromatic plane wave and the induced evolution of particle's spin, the deviation from the standard spin precession will be demonstrated. The claimed results developed out of our studies of a charged particle's classical dynamics beyond the dipole approximation [4] and the semi-classical analysis of the spin-1/2 evolution in a strong laser field [5,6].

II Deviations from the dipole approximation results

Within the semi-classical approach, one can point several examples of deviations of particle's spin evolut

• A spin-flipping process in a strong monochromatic plane with the resonant form of the spin-flipping transition probability with respect to a laser intensity;
• Effect of non-linear dependence of a spin precession frequency on a laser intensity and polarization;
• Appearance of a non-trivial, intensity depended phase of a particle's wave function in a strong circularly polarized laser field background.

III Concluding remarks

Analytical and numeric studies of the modified Pauli equation for a charged spin-1/2 particle' s in

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