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New Exact Solutions of the Dirac Equation of a Charged Particle Propagating in a Strong Laser Field in an Underdense Plasma

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In the present contibution we show that there are closed–form exact solutions of the Dirac equation of a charged particle moving in a strong classical laser field in a medium (which may be an underdense plasma of index of permittivity em (w) = 1 −wp2/w2). These solutions form a doubly infinite discrete set, labeled by two integer quantum numbers, representing a quantized spectrum of momentum components along the propagation direction and along the polarization of the laser field. Various properties of these new states will be discussed, and numerical illustrations of their wave functions will bw presented. Their relevance concerning possible quantum features of mechanisms of laser acceleration of electrons by high-intensity fields in an underdense plasma will also be discussed.

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