IONIZATION OF ATOMS IN A STRONG LASER RADIATION FIELD AND THE IMAGINARY TIME METHOD

V.M. Rylyuk[1], *V.A. Nastasyuk*[2]

[1]Odessa State Academy of Civil Engineering and Architecture (*4, Didrikhson Str., Odessa 65029, Ukraine; e-mail: rvmcom@onu.edu.ua*),
[2]K.D. Ushynskyi South-Ukrainian National Pedagogical University (*26, Staroportofrankivska Str., Odessa 65020, Ukraine*)

S u m m a r y

The phenomenon of nonlinear relativistic ionization induced by a strong electromagnetic wave has been considered. The relativistic version of the imaginary time method is used to calculate the probability for an electron with an energy of the order of its rest energy to tunnel through a potential barrier under the action of a strong electromagnetic wave. Besides the exponential factor, the Coulomb and pre-exponential ones are also obtained with regard for the electron spin and the ionization probability. Simple analytical formulas for the momentum distributions of relativistic photo-electrons are derived. The relativistic effects are shown to result in a nonzero drift velocity of an electron, when it quits the barrier. In the nonrelativistic limit, the well-known Keldysh exponent and the Landau–Lifshitz formula for the ionization probability of a hydrogen atom in the ground state are obtained.