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Semiclassical Theory of Laser-Assisted Radiative Recombination[1]

ILYA FABRIKANT, University of Nebraska - Lincoln, HARINDRANATH AMBALAMPITIYA, University of Nebraska-Lincoln — We study the process of laser-assisted radiative recombination of low-energy electrons with positive ions by using a semiclassical approach involving calculation of classical trajectories in combined laser and Coulomb fields. We assume the initial velocity vector to be parallel to the laser polarization. Due to chaotic scattering in the combined fields [1], the radiation probability as a function of the impact parameter and the constant phase of the linearly-polarized laser field exhibits fractal structures similar to those observed in bremsstrahlung [2]. We obtain a strong enhancement of the recombination cross section as compared to the laser-free case due to the Coulomb focusing effect. For sufficiently low incident electron velocities, in the range 0.1-0.2 a.u., the cross section becomes infinite, and we limit it by assuming a finite laser pulse duration of about 5-10 ps. With this assumption we obtain the gain factor for capture into the ground state of the hydrogen atom of about 220 for infrared fields ranging in intensity between 2 GW/cm^2 and 1 TW/cm^2. [1] L. Wiesenfeld, Phys. Lett. A **144**, 467 (1990). [2] H. B. Ambalampitiya and I. I. Fabrikant, Phys. Rev. A **99**, 063404 (2019).

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