Particle Heating due to an Obliquely Propagating Wave in a Magnetized Plasma

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We study the dynamics of a relativistic charged particle in the presence of a uniform magnetic field and a stationary electrostatic wave that propagates at an arbitrary angle. The wave is considered as a series of periodic pulses [1] which allows us to derive an exact map for the system. In particular, we investigate the heating process of an initially low-energy particle. It is found that abrupt changes in the maximum energy attained by the particle may occur as the angle between the wave propagation and the magnetic field varies. To determine what is the mechanism behind this phenomenon a reduced Hamiltonian that retains the important dynamical features is obtained. Using both Poincaré plots and perturbation theory, we identify that a separatrix reconnection is the key mechanism for the abrupt change in particle response [2].

[1] M. C. de Sousa, F. M. Steffens, R. Pakter, and F. B. Rizzato, Phys. Rev. E **82**, 026402 (2010).

[2] T. M. Corrêa da Silva, R. Pakter, F. B. Rizzato, M. C. de Sousa, I. L. Caldas, and F. M. Steffens, Phys. Rev. E **88**, 013101 (2013).