A relativistic Vlasov Maxwell code for the numerical simulation of the excitation of trapped electron acoustic waves in a moderately overdense plasma

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The excitation of trapped electron acoustic scattering and its interconnection with the usual self-induced transparency mechanism of a moderately overdense layer is investigated using a semi-lagrangian relativistic Vlasov-Maxwell code. Although the propagation of a low intensity electromagnetic wave in plasma is known to be impossible if its frequency ω_0 is below the plasma frequency ω_p, relativistic effects however allow the wave propagation in homogeneous plasmas with electron density up to γn_{crit} where n_{crit} denotes the critical density and γ the Lorentz factor. As a result a relativistic Doppler effect takes place and gives rise to a back-reflected wave (ω_r, k_r) which beats with the incoming pump wave (ω_0, k_0) leading to the generation of a low-frequency plasma wave of frequency $\omega = (k_0 + k_r)\, v_F$, v_F being the front wave velocity. This low-frequency mode acts as a perturbation source and excites then a trapped electron acoustic wave which plays a major role in the plasma heating and can give rise to the formation of a soliton-like structure.