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Excitation and breaking of relativistic longitudinal electron-ion modes in a cold plasma RATAN KUMAR BERA, ARGHYA MUKHERJEE, SUDIP SENGUPTA, Institute for Plasma Research, AMITA DAS, Indian Institute of Technology Delhi — The excitation and breaking of relativistically intense electron-ion modes in a cold plasma is studied using 1D-fluid simulation techniques. To excite the mode, we have used a relativistic rigid homogeneous electron beam propagating inside a plasma with a velocity close to the speed of light. It is observed that the wake wave excited by the electron beam is identical to the corresponding Khachatryan mode [*Phys. Rev. E, 58, 6(1998)*], a relativistic electron-ion mode in a cold plasma. It is also seen that the numerical profile of the excited electron-ion mode gradually modifies with time and eventually breaks after several plasma periods exhibiting explosive behavior in the density profile. We have found that the numerical wave breaking limit of these modes lies much below than their corresponding analytical limit. The discrepancy between the numerical and analytical limit has been understood in terms of phase-mixing process of the mode. The phase mixing time (or wave breaking time) obtained from the simulations has also been scaled as a function of beam parameters and found to follow the existing analytical scaling.

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