A MINIMAL MODEL OF PARALLEL ELECTRIC FIELD GENERATION IN TRANSVERSELY INHOMOGENEOUS SOLAR CORONAL PLASMAS

David Tsiklauri

Institute for Materials Research, Newton Building, University of Salford, Manchester, M5 4WT, United Kingdom

Particle acceleration during solar flares and acceleration of fast solar wind are likely to be related to the parallel electric fields in solar corona. The generation these parallel electric fields by the propagation of ion cyclotron waves in the plasma with a transverse density inhomogeneity was studied. Using two-fluid, cold plasma linearised equations, it was shown for the first time that, in this particular context, $E_{\parallel}$ generation can be understood by an analytic equation that couples $E_{\parallel}$ to the transverse electric field of the driving ion cyclotron wave. It was proven that the minimal model required to reproduce the previous kinetic simulation results of $E_{\parallel}$ generation (Tsiklauri et al 2005, Génot et al 2004) is the two-fluid, cold plasma approximation in the linear regime. By considering numerical solutions it was also shown that the cause of $E_{\parallel}$ generation is the charge separation induced by the transverse density inhomogeneity. In this simplified model, the generated $E_{\parallel}$ amplitude e.g. for plausible solar coronal parameters attains values of 10^4 Vm^{-1}. Interestingly, because of the oscillatory nature of obtained $E_{\parallel}$, it can possibly act as yet another mechanism for interpreting the peculiar hard x-ray (> 25 keV) solar flare, which is believed to be produced by a non-thermal electron beam (Ofman and Sui, 2006, Nakariakov et al.,2006).