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On the kinetic nature of dipolarization fronts

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A non-ideal two-dimensional MHD simulation including Hall and finite Larmor radius (FLR) effects were performed to study the mesoscale property of dipolarization fronts (DFs) produced by the interchange instability in the magnetotail. Numerical simulations indicate that Hall effect on the scale of inertial length determines the distributions of electric field and its components at DFs. The electric field is mainly contributed by Hall electric field and small by the electron pressure gradient. However, inclusion of FLR effect would cause an asymmetry and dawnward drifting of the DF structure, which is more distinct than that resulted from Hall effect. On the DFs, FLR effect arises approximately due to the ion magnetization velocity, which is mainly contributed by the ion diamagnetic velocity. In addition, it also causes to alter the direction of the high-speed flow near the DF. Therefore, the ion diamagnetic velocity associated with FLR effect on the scale of the Larmor radius would alter the plasma property on the DF and the large-scale geometry of the DFs.