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Field Aligned potentials associated with Alfvenic Double Layers at Non-Maxwellian Effective Temperature Scales in multicomponent Space Plasmas

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Abstract: Observations conducted by FAST, THEMIS, Magnetospheric Multi-Scale (MMS), and other satellite missions have validated the existence of double layers with substantial parallel electric fields. These field aligned structures play an important role not only in the dynamics of near Earth plasmas but also at the boundary of other planets. These findings prompted our investigation into double layers and the accompanying electric fields in low-β, plasmas consisting of positive ions and two non-Maxwellian electron populations (hot and cold) modeled using the (r, q) distribution function.

We utilized fluid theory to model our system and employed a fully nonlinear Sagdeev potential approach to obtain arbitrary amplitude double layer solution. Specifically, we examined the parallel electric fields associated with Alfvenic double layers at non-Maxwellian temperature scale analyzed our results in the light of observed data. Our results indicate that compressive and rarefactive potential structures exist for specific range of Alfvénic Mach number $M_A$linked to kinetic Alfvén waves are sensitive to nonthermal parameters r and q, propagation angle θ.