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Shock Waves in Hall-MHD[1] GEORGE HAGSTROM, ELIEZER HAMEIRI, Courant Institute of Mathematical Sciences — Hall-MHD is a partial differential equation of degenerate parabolic type that describes the dynamics of an ideal two fluid plasma with massless electrons. We study shock waves and discontinuities in this system. We characterize planar travelling wave solutions and find solutions with discontinuities in the hydrodynamic variables. These solutions, which correspond to the ion-acoustic wave, arise due to the presence of hydrodynamic real characteristics in Hall-MHD. We demonstrate finite-time discontinuity formation for certain types of initial data with discontinuous derivatives and study the shock structure under different regularizations. We also explore the possible existence of solutions with discontinuous magnetic field. A non-algebraic, non-local set of jump conditions is derived under the assumption of $[B] \neq 0$. These conditions are used to study the contact discontinuity and it is shown that massless electrons crossing the surface of discontinuity may enter and leave at different locations. These conditions suggest the possible existence of mathematically novel shocks in Hall-MHD.

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George Hagstrom
Courant Institute of Mathematical Sciences

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