# GLOBAL SMOOTH SOLUTIONS IN $\mathbb{R}^3$ TO SHORT WAVE-LONG WAVE INTERACTIONS IN MAGNETOHYDRODYNAMICS

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Abstract. We consider a Benney-type system modeling short wave-long wave interactions in compressible viscous fluids under the influence of a magnetic field. Accordingly, this large system now consists of the compressible MHD equations coupled with a nonlinear Schrödinger equation along particle paths. We study the global existence of smooth solutions to the Cauchy problem in $\mathbb{R}^3$ when the initial data are small smooth perturbations of an equilibrium state. An important point here is that, instead of the simpler case having zero as the equilibrium state for the magnetic field, we consider an arbitrary non-zero equilibrium state $\bar{B}$ for the magnetic field. This is motivated by applications, e.g., Earth's magnetic field, and the lack of invariance of the MHD system with respect to either translations or rotations of the magnetic field. The usual time decay investigation through spectral analysis in this non-zero equilibrium case meets serious difficulties, for the eigenvalues in the frequency space are no longer spherically symmetric. Instead, we employ a recently developed technique of energy estimates involving evolution in negative Besov spaces, and combine it with the particular interplay here between Eulerian and Lagrangian coordinates. This is a joint work with Junxiong Jia and Ronghua Pan.

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