

[Previous abstract](#)[Next abstract](#)**Session 24 - General Interstellar Medium.***Oral session, Monday, June 10**Historical Society,***[24.02] Reduced Four-Field System for Compressible Magnetohydrodynamic Turbulence in the Solar Wind and the Interstellar Medium***A. Bhattacharjee, C. S. Ng, S. Spangler (University of Iowa)*

Turbulent plasmas in the solar wind and the interstellar medium often contain a large directed magnetic field, and the plasma beta (β) is frequently of order unity. To describe the dynamics of these plasmas, we derive a system of reduced equations from the fully compressible MHD equations using the Alfvén Mach number as a small parameter [G. P. Zank and W. H. Matthaeus, *Phys. Fluids A* 5, 257 (1993)]. These reduced equations constitute a closed system to leading order and involve four field variables: the magnetic flux, vorticity, pressure and parallel flow. The reduction of the fully compressible MHD equations to a four-field system offers significant computational advantages. If $\beta \ll 1$, these equations reduce to the well-known Rosenbluth-Strauss equations (otherwise known as RMHD equations). However, for $\beta \sim 1$, if the background equilibria have non-vanishing pressure gradients, the effect of compressibility is shown to enter at leading order. In such cases, our equations differ significantly from those of Zank and Matthaeus who claim that "compressible effects ride parasitically on the back of the 2D incompressible flow field." We present numerical results involving current sheet formation, magnetic reconnection and intermittent turbulence that show clearly the dynamical differences between RMHD and four-field MHD. Implications for observations on pressure-balanced structures will be discussed. This work is supported by NSF and AFOSR.

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