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The Case for Enhanced Transport Coefficients in Astrophysical Plasmas[1] STEVEN SPANGLER, University of Iowa — Theoretical descriptions of astrophysical plasmas such as the solar corona, the interstellar medium, and extragalactic radio sources typically employ single fluid magnetohydrodynamics (MHD). The lack of detail in astronomical observations often disqualifies more sophisticated theories. Solutions of the MHD equations can possess agreement with observations, but only if transport coefficients such as resistivity, viscosity, and thermal conductivity are many orders of magnitude larger than independent estimates based on binary electron collisions with ions and electrons. Illustrations of this concept are Joule heating of the solar corona by observed currents and the structure of the magnetic field in the Milky Way and similar galaxies. This situation can be understood in one of two ways. (1) The MHD equations may indeed be a correct description of the dynamics of these plasmas, and the true transport coefficients are greatly enhanced over collisional values. (2) Alternatively, more complex sets of primitive equations may be needed to describe astrophysical plasmas. This paper explores possibility (1), and discusses possible mechanisms for transport coefficient enhancement, and observational tests of those mechanisms.

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