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Elasticity of tangled magnetic fields DAVID HOSKING, ALEXANDER SCHEKOCHIHIN, STEVEN BALBUS, University of Oxford — The fundamental difference between incompressible ideal magnetohydrodynamics and the dynamics of a non-conducting fluid is that magnetic fields exert a tension force that opposes their bending; magnetic fields behave like elastic strings threading the fluid. It is natural, therefore, to expect that a magnetic field tangled at small length scales should resist a large-scale shear in an elastic way, much as a ball of tangled elastic strings responds elastically to an impulse. In this talk, I will describe a treatment of magnetoelasticity motivated by the need to understand the large-scale dynamics of the hot, rarified plasma of the intra-cluster medium (ICM). In contrast to previous work, the treatment I present explicitly accounts for intermittency of the Maxwell stress. I will show, via analytical theory and supporting numerical work, that this intermittency necessarily decreases the frequency of 'magnetoelastic waves' propagating through a tangled-magnetic-field equilibrium, and results in anomalous viscous damping. I will also present numerical simulations of sporadically-driven MHD turbulence, elucidating the possible role of magnetoelastic waves in facilitating energy transport in the turbulent ICM.

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