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Self-Similar Decay of Enstrophy in an Electron Plasma DOUGLAS RODGERS, SERGIO SERVIDIO, WILLIAM MATTHAEUS, TRAVIS MITCHELL, Department of Physics and Astronomy, University of Delaware, Newark, DE 19716 — The similarity solution for energy decay in 3D hydrodynamic turbulence, due to Taylor and von Karman [1], based on the self preservation hypothesis for the shape of the two point correlation, implies that the energy E decays as dE/dt = - a Z^3/L, where a is a constant, Z is the turbulence amplitude and L is a similarity length scale. Extensions of this idea to MHD [2] have been of great utility in solar wind and coronal heating studies. While the hydrodynamic case is well studied experimentally, we are not aware that similarity decay has been examined in a laboratory plasma. Here we conduct an experimental study of this idea in the context of two dimensional electron plasma turbulence. Specifically, we propose an expression for the decay of enstrophy of a single-signed-vorticity fluid which is analogous to the von Karman decay of energy in 3D turbulence, and compare this to the dynamical relaxation of a pure electron plasma in a Malmberg-Penning (MP) trap [3]. Results show good agreement between the proposed decay law and the MP experiments. [1] G. I. Taylor, Proc. Roy. Soc. Lon. A, 151:421, 1935; T. de Karman and L. Howarth, Proc. Roy. Soc. Lon. A, 164:192, 1938. [2] W. H. Matthaeus, G. P. Zank and S. Oughton. J. Plas. Phys., 56:659, 1996. [3] D. J. Rodgers et al, Phys. Rev. Lett., 102(24):244501, 2009.

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