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A Causal, Covariant Theory of Dissipative Fluid Flow DILLON SCOFIELD, Oklahoma State Univ, PABLO HUQ, University of Delaware — The use of newtonian viscous dissipation theory in covariant fluid flow theories is known to lead to predictions that are inconsistent with the second law of thermodynamics and to predictions that are acausal. For instance, these problems effectively limit the covariant form of the Navier-Stokes theory (NST) to time-independent flow regimes. Thus the NST, the work horse of fluid dynamical theory, is limited in its ability to model time-dependent turbulent, stellar or thermonuclear flows. We show how such problems are avoided by a new geometrodynamical theory of fluids (GTF, Fluid Dynamics Research, 46, 055513,14 (2014)). This theory is based on a recent result of geometrodynamics showing current conservation implies gauge field creation, called the vortex field lemma (VFL, Phys. Lett., A 374, 3476-82 (2010)) and classification of flows by their Pfaff dimension. Experimental confirmation of the theory is reviewed.

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