

Abstract Submitted  
for the DFD19 Meeting of  
The American Physical Society

**A 3-D Poor Man's Boltzmann Equation**<sup>1</sup> J. M. MCDONOUGH, University of Kentucky (Retired), H. W. YU, Indiana University Purdue University at Indianapolis — A 1-D “synthetic” distribution function for the poor mans Boltzmann equation (PMBE) has been studied previously; but real applications must be in three space dimensions. In this presentation we outline derivation of the 3-D PMBE and study bifurcations of the corresponding discrete dynamical system (DDS) for this case. In particular, we first provide a brief single-mode Galerkin derivation of the PMBE, and then present time series, power spectra and regime maps to demonstrate its consistency with expected fluid flow behaviors in particular, existence of Ruelle & Takens, Feigenbaum, and Pomeau & Manneville bifurcation sequences, as well as combinations of these. We also suggest how such a DDS can be used to produce very efficient sub-grid scale synthetic distribution function models for turbulence simulations within a lattice-Boltzmann/large-eddy simulation framework.

<sup>1</sup>The authors wish to acknowledge support of this work by the U. S. National Science Foundation through grant #NSF-CBET 1803845.

James McDonough  
University of Kentucky (Retired)

Date submitted: 24 Jul 2019

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