Abstract Submitted
for the MAR16 Meeting of
The American Physical Society

The effectiveness of mean-field theory for avalanche distributions

EDWARD LEE, ARCHISHMAN RAJU, JAMES SETHNA, Cornell University —

We explore the mean-field theory of the pseudogap found in avalanche systems with long-range anisotropic interactions using analytical and numerical tools. The pseudogap in the density of low-stability states emerges from the competition between stabilizing interactions between spins in an avalanche and the destabilizing random movement towards the threshold caused by anisotropic couplings. Pazmandi et al. have shown that for the Sherrington-Kirkpatrick model, the pseudogap scales linearly and produces a distribution of avalanche sizes with exponent t=1 in contrast with that predicted from RFIM t=3/2. Lin et al. have argued that the scaling exponent ? of the pseudogap depends on the tail of the distribution of couplings and on non-universal values like the strain rate and the magnitude of the coupling strength. Yet others have argued that the relationship between the pseudogap scaling and the distribution of avalanche sizes is dependent on dynamical details. Despite the theoretical arguments, the class of RFIM mean-field models is surprisingly good at predicting the distribution of avalanche sizes in a variety of different magnetic systems. We investigate these differences with a combination of theory and simulation.

Edward Lee
Cornell University

Date submitted: 06 Nov 2015

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