The effectiveness of mean-field theory for avalanche distributions
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We explore the mean-field theory of the pseudogap found in avalanche systems with
long-range anisotropic interactions using analytical and numerical tools. The pseu-
dogap 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 lin-
early 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 expo-
nent $\gamma$ 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 sys-
tems. We investigate these differences with a combination of theory and simulation.

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