Abstract Submitted
for the MAR10 Meeting of
The American Physical Society

Scaling crossover for the average avalanche shape STEFANOS PAPANIKOLAOU, Cornell University, FELIPE BOHN, Universidade Federal do Rio Grande do Norte, Brazil, RUBEM L. SOMMER, Centro Brasileiro de Pesquisas Fisicas, Brazil, GIANFRANCO DURIN, INRIM and ISI Foundation, Italy, STEFANO ZAPPERI, CNR-INFM, Universita di Modena e Reggio Emilia, Modena and ISI Foundation, Italy, JAMES P. SETHNA, Cornell University — Universality and the renormalization group claim to predict all behavior on long length and time scales asymptotically close to critical points. In practice, large simulations and heroic experiments have been needed to unambiguously test and measure the critical exponents and scaling functions. We announce here the measurement and prediction of universal corrections to scaling, applied to the temporal average shape of Barkhausen noise avalanches. We bypass the confounding factors of time-retarded interactions (eddy currents) by measuring thin permalloy films, and bypass thresholding effects and amplifier distortions by applying Wiener deconvolution. We show experimental shapes that are approximately symmetric, and measure the leading corrections to scaling. We solve a mean-field theory for the magnetization dynamics and calculate the relevant demagnetizing-field correction to scaling, showing qualitative agreement with the experiment. In this way, we move toward a quantitative theory useful at smaller time and length scales and farther from the critical point.

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Date submitted: 05 Jan 2010 Electronic form version 1.4