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Avalanches in crack front propagation¹

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We study avalanches in a model for a planar crack propagating in a disordered medium. Due to long-range interactions, avalanches are formed by a set of spatially disconnected local clusters, the sizes of which are distributed according to a power law. We derive a scaling relation between the local cluster and the global avalanche distributions. For length scales above a crossover length proportional to the Larkin length, the aspect ratio of the local clusters scales with the roughness exponent of the line model. For smaller lengthscales we observe multiscaling in the crack line correlations. Our analysis provides an explanation for experimental results on planar crack avalanches in Plexiglas plates, but the results are applicable also to other systems with long-range interactions such as Barkhausen avalanches in ferromagnetic thin films.

¹in collaboration with L. Laurson, S. Santucci and G. Durin