Numerical studies of two-dimensional $k$-core percolation

ANDREA LIU, University of Pennsylvania, LINCOLN CHAYES, UCLA, JEN SCHWARZ, Syracuse University — The disconnected-connected phase transition in uncorrelated percolation has long been known to exhibit a continuous phase transition. Is this property retained when correlations between occupied sites are incorporated into percolation? An example of such a model is $k$-core percolation. In $k$-core percolation a constraint is introduced where a site can remain occupied only if it has at least $k$ occupied neighbors; otherwise it is removed from the lattice. The mean field $k$-core transition is random first-order (or hybrid). What then is the nature of the $k$-core transition in finite-dimensions? We show numerical evidence for a hybrid transition in two-dimensions for a variant of $k$-core where there is an additional constraint of pseudo-force-balance. Using finite-size scaling analysis we demonstrate that there is a jump in the usual order parameter at the transition along with, not one, but two, diverging correlation length exponents, neither of which scale as $1/2$ (or 1). This model may have some implications for the jamming transition.