

Continuum Percolation and Duality with Hard-Particle Systems Across Dimensions

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I describe a new set of bounds on the percolation threshold of a class of continuum percolation models consisting of overlapping convex hyperparticles in d -dimensional Euclidean space. The bounds converge to one another as the space dimension increases, but the tightest bound still provides an excellent estimate of the threshold, even for relatively low dimensions. It is shown that low-dimensional percolation behavior encodes high-dimensional information. Our analysis is aided by a certain remarkable duality between the equilibrium hard-hyperparticle fluid system and the continuum percolation model of overlapping hyperparticles. Correspondences between these two seemingly different problems are described.