Interference Percolation

Paul Balister
University of Memphis, TN

Suppose we have a communication network consisting of transceivers (vertices) and communication links (edges) forming a graph G. Suppose at some time each transceiver is active independently with probability p. We suppose that a message can be relayed through active transceivers, but with the restriction that if a transceiver has more than k active neighbors, then interference between the signals means that this transceiver cannot effectively relay a message. We wish to know whether a message can be propagated effectively.

We show that if $k = 3$, $\delta \geq 6$ and Δ/δ is not too large then almost surely there is no long range communication. Moreover, this result is essentially best possible since there are examples of graphs giving long range communication with any single one of these three conditions removed. In particular, we show that there is long range communication in the lattice $\mathbb{Z}^d$ for large d and $k \geq 4$, and in the Gilbert model in $\mathbb{R}^2$ for large k and sufficiently large communication range.

Joint work with Béla Bollobás.