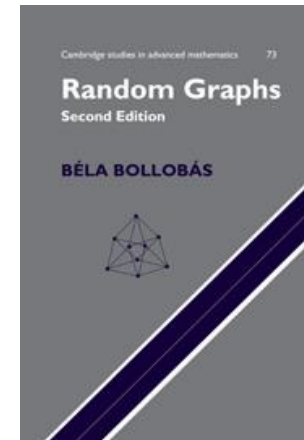


# Critical Values for a Connected Graph

- Bernoulli graph: A graph consists of  $N$  nodes where edges are chosen independently and with probability  $P$ 
  - $Pc = [\log N + c(N)]/N$
- Wireless network: A unit-disk area containing  $N$  nodes, each having the same communication radius  $R$ 
  - $Rc = [\log N + c(N)]/N$
- *A Gap between Theory and Practice*



Critical Power for Asymptotic Connectivity in Wireless Networks

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KEYWORDS: Wireless networks, connectivity, critical power, critical range, continuum percolation.

ABSTRACT: In wireless data networks each transmitter's power needs to be high enough to reach the intended receivers, while generating minimum interference on other receivers sharing the same channel. In particular, if the nodes in the network are assumed to cooperate in routing each others' packets, as is the case in *ad hoc* wireless networks, each node should transmit with just enough power to guarantee connectivity in the network. Towards this end, we derive the *critical* power a node in the network needs to transmit in order to ensure that the network is connected with probability one as the number of nodes in the network goes to infinity. It is shown that if  $n$  nodes are placed in a disc of unit area in  $\mathbb{R}^2$  and each node transmits at a power level so as to cover an area of  $\pi r^2 = (\log n + c(n))/n$ , then the resulting network is asymptotically connected with probability one if and only if  $c(n) \rightarrow +\infty$ .

# Our Results: Determinate Bounds

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- Finite radius, reliable links
  - A unit length containing  $N$  nodes, each having the same communication radius  $R$ 
    - $\ln N/N = < Rc \leq 2 \ln N/N$
- Finite radius, unreliable links
  - A unit length containing  $N$  nodes, each having the same communication radius  $R$  with link connectivity probability  $p$ 
    - $\ln N/N = < Rc \leq 2 \ln N/(pN)$