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Chasing the k -SAT threshold

Let F be a random Boolean formula in conjunctive normal form over n Boolean variables with m clauses of length k . The existence of a (non-uniform) sharp threshold for the satisfiability of such formulas is well known [Friedgut 1999]. However, despite considerable effort the precise location of this phase transition remains unknown for any $k > 2$. The best previous upper and lower bounds differ by an additive $k \ln 2/2$ [Achlioptas, Peres 2003]. In this talk I present an improved lower bound, which reduces the gap to 0.19 . The proof is inspired by the cavity method of statistical mechanics.