Clique packings in random graphs

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Let $u(n,p,k)$ be the k-clique packing number of the random graph $G(n,p)$, that is, the maximum number of edge-disjoint k-cliques in $G(n,p)$. In 1992, Alon and Spencer conjectured that for $p = 1/2$ we have $u(n,p,k) = \Omega(n^2/k^2)$ when $k = k(n,p) - 4$, where $k(n,p)$ is minimum t such that the expected number of t-cliques in $G(n,p)$ is less than 1. This conjecture was disproved a few years ago by Acan and Kahn, who showed that in fact $u(n,p,k) = O(n^2/k^3)$ with high probability, for any fixed $p \in (0,1)$ and $k = k(n,p) - O(1)$.

In this talk, we show a lower bound which matches Acan and Kahn's upper bound on $u(n,p,k)$ for all $p \in (0,1)$ and $k = k(n,p) - O(1)$. To prove this result, we follow a random greedy process and use the differential equation method. This is a joint work with Simon Griffiths.