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Average Degree in Graph Powers

The kth power of a simple graph G, denoted G^k, is the graph with vertex set $V(G)$ where two vertices are adjacent if they are within distance k in G. In this talk we are interested in finding lower bounds on the average degree of G^k, a problem that is related to both additive number theory (via Cayley graphs) and the famous Caccetta-Häggkvist Conjecture. Here we share essentially best possible lower bounds when $k = 4$ or $k \equiv 2 \pmod 3$. Joint work with M. DeVos and D. Scheide.