

## Small Lifts of Expander Graphs are Expanding

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In this talk, we will examine the spectrum of random  $k$ -lifts of  $d$ -regular graphs. We show that, for random shift  $k$ -lifts (which includes 2-lifts), if all the nontrivial eigenvalues of the base graph  $G$  are at most  $\lambda$  in absolute value, then with high probability depending only on the number  $n$  of nodes of  $G$  (and not on  $k$ ), the absolute value of every nontrivial eigenvalue of the lift is at most  $O(\lambda)$ . While previous results on random lifts were asymptotically true with high probability in the degree of the lift  $k$ , our result is the first upperbound on spectra of lifts for bounded  $k$ . In particular, it implies that a typical small lift of a Ramanujan graph is almost Ramanujan, which might prove crucial in constructing large Ramanujan expanders of all degrees.

Joint work with Naman Agarwal and Vivek Madan