SPECTRA OF RANDOM GRAPHS WITH GIVEN EXPECTED DEGREES

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Abstract. In the study of the spectra of power law graphs, there are basically two competing approaches. One is to prove analogues of Wigner's semi-circle law while the other predicts that the eigenvalues follow a power law distributions. Although the semi-circle law and the power law have nothing in common, we will show that both approaches are essentially correct if one considers the appropriate matrices. We will prove that (under certain mild conditions) the eigenvalues of the (normalized) Laplacian of a random power law graph follow the semi-circle law while the spectrum of the adjacency matrix of a power law graph obeys the power law. Our results are based on the analysis of random graphs with given expected degrees and their relations to several key invariants. Of interest are a number of (new) values for the exponent β where phase transitions for eigenvalue distributions occur. The spectrum distributions have direct implications to numerous graph algorithms such as randomized algorithms that involve rapidly mixing Markov chains, for example.

This is a joint work with Lincoln Lu and Van Vu.

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