1138-05-235 **Samantha N Petti*** (spetti@gatech.edu) and **Santosh S Vempala**. *Approximating Sparse Graphs: The Random Overlapping Communities Model.*

How can we approximate sparse graphs and sequences of sparse graphs (with average degree unbounded and $o(n)$)? We consider convergence in the first k moments of the graph spectrum (equivalent to the numbers of closed k-walks) appropriately normalized. We introduce a simple random graph model that captures the limiting spectra of many sequences of interest, including the sequence of hypercube graphs. The Random Overlapping Communities (ROC) model is specified by a distribution on pairs (s, q), $s \in \mathbb{Z}_+, q \in (0, 1]$. A graph on n vertices with average degree d is generated by repeatedly picking pairs (s, q) from the distribution, adding an Erdős-Rényi random graph of edge density q on a subset of vertices chosen by including each vertex with probability s/n, and repeating this process so that the expected degree is d. Our proof of convergence to a ROC random graph is based on the Stieltjes moment condition. The model is an effective approximation for individual graphs. For almost all possible triangle-to-edge and four-cycle-to-edge ratios, there exists a pair (s, q) such that the ROC model with this single community type produces graphs with both desired ratios, a property that cannot be achieved by block models of bounded size. (Received February 10, 2018)