Speaker: Luca Trevisan  
Department of Computer Science,  
Stanford University

Title: Evolving Sets and Graph Partitioning

Abstract:
Given an undirected graph $G = (V, E)$ and a starting vertex $s$, the “evolving sets” process introduced by Diaconis and Fill is a probabilistic process that generates a sequence of sets of vertices of $G$.

Andersen, Morris and Peres show that the process can be used to find sparse cuts in $G$ with the following guarantee: if the start vertex is chosen randomly from a set $S$ of expansion at most $\phi$, then the algorithm is likely to output, in time nearly linear in $|S|$, a set of expansion at most $O(\sqrt{\phi \log |V|})$. In contrast, the spectral partitioning algorithm finds a set of expansion at most $O(\sqrt{\phi})$ in time linear in $|V|$. Thus the evolving set algorithm loses a factor of $O(\sqrt{\log |V|})$ in the quality of the cut, but is potentially faster if the cut is very unbalanced. We present a different analysis of the evolving set algorithm showing that it can find cuts of expansion at most $O(\sqrt{\phi})$, of quality comparable to the cuts found by the spectral partitioning algorithm, while maintaining a running time nearly linear in $|S|$, and hence potentially sublinear in the size of the graph. We discuss applications to the “small-set expansion” problem, which arises both in the “unique games conjecture” and as a natural clustering problem.

This is joint work with Shayan Oveis Gharan.