1084-00-157 **Mikhail Belkin***, Computer Science and Engineering, 2015 Neil Ave, DL 395, Columbus, OH 43210, and **Qichao Que**, **Yusu Wang** and **Xueyuan Zhou**. *Toward understanding complex spaces: graph Laplacians on manifolds with singularities and boundaries.*

Algorithms based on graph Laplacian have received considerable attention both in practical applications and theoretical analysis. Much of the existing work has been done under the assumption that the data is sampled from a manifold without boundaries. However, singularities and boundaries are an important aspect of the geometry of realistic data. Boundaries occur whenever the data has a constraint; while singularities appear when two different manifolds intersect or if a process undergoes a "phase transition", changing non-smoothly as a function of a parameter. We consider the behavior of graph Laplacians at points at or near boundaries and two main types of singularities: intersections, wheremanifolds come together and sharp "edges". We show that the behavior of graph Laplacian near these singularities is different from that in the interior of the manifolds. Unlike in the interior of the domain, where graph Laplacian converges to the Laplace-Beltrami operator, near singularities graph Laplacian tends to a first-order differential operator, with different scaling behavior. One implication is that while points near the singularities occupy only a small part of the total volume, the difference in scaling results in a large contribution to the total behavior. (Received August 30, 2012)