1024-53-182 **Jeff Cheeger*** (cheeger@cims.nyu.edu), Jeff Cheeger, Courant Institute, 251 Mercer St., New York, NY 10012. *Gerneralized Differentiation and BiLipschitz Nonembedding.*

We discuss the interplay between differentiation theory for Lipschitz maps, $X \to V$, and bi-Lipschitz nonembeddability, where X is a metric measure space and V is a Banach space. We assume the the measure, μ satisfies a doubling condition and that a $(1,1)$-Poincaré inequality holds in the sense of upper gradients. When $V = \mathbf{R}^k$, we give a generalization of Rademacher's theorem on the almost everywhere differentiability of Lipschitz function on $\mathbf{R}^n$. This is used to show that a large class of such X, including the Heisenberg group, H, with its Carnot-Caratheodory metric, d^H, do not bi-Lipschitz embed in any finite dimensional Euclidean space. In joint work with B. Kleiner, the theory is extended to a class of infinite dimensional targets including separable dual spaces, but not L^1. The possible existence of bi-Lipschitz embeddings, $f : X \to L^1$, is of interest in theoretical computer science. Jointly with Kleiner, we establish a new connection between Lipschitz maps, $f : X \to L^1$, and families of functions of bounded variation on X. We use this to show that Lipschtiz maps, $f : H \to L^1$, are differentiable in a generalized sense. From this we find that f cannot be bi-Lipschitz. (Received January 08, 2007)