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String Topology and the Based Loop Space.

The Chas-Sullivan product, a multiplication operation on the homology of the free loop space of a manifold, is one of the fundamental features of string topology. Geometrically, this product arises from the intersection product of the manifold and the Pontryagin product on its based loop space. Continuing an extensive series of relations between free loop spaces and Hochschild homology and cohomology, we use Poincare duality with local coefficients to show that the homology of the free loop space is isomorphic to the Hochschild cohomology of the algebra of singular chains of the based loop space. This isomorphism takes the Chas-Sullivan product to the Hochschild cup product and induces a Batalin-Vilkovisky structure on Hochschild cohomology compatible with the standard Gerstenhaber bracket. (Received September 14, 2009)