

1107-58-385

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A metric on a compact manifold  $M$  gives rise to a length function on the free loop space  $\Lambda M$  whose critical points are the closed geodesics on  $M$  in the given metric. Morse theory gives a link between Hamiltonian dynamics and the topology of loop spaces, between iteration of closed geodesics and the algebraic structure given by the Chas-Sullivan product on the homology of  $\Lambda M$ . Poincaré Duality reveals the existence of a related product on the cohomology of  $\Lambda M$ .

A number of known results on the existence of closed geodesics are naturally expressed in terms of nilpotence of products. We use products to prove a resonance result for the loop homology of spheres. There are interesting consequences for the length spectrum, and related results in Floer and contact theory.

Mark Goresky, Alexandru Oancea, and Hans-Bert Rademacher are collaborators. (Received January 19, 2015)