Representations of fundamental groups of nonorientable 2-manifolds

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Abstract

If Σ is a Riemann surface, let $M(\Sigma, G)$ be the moduli space of conjugacy classes of representations of the fundamental group of Σ in a compact Lie group G. In his paper "Quantum gauge theories in two dimensions" (Commun. Math. Phys. **141** (1991) 153-209) Witten defined a volume on this space using Reidemeister-Ray-Singer torsion, and proved this volume is equal to the symplectic volume.

Witten also defined a volume on the corresponding moduli space $M(\Sigma', G)$ when Σ' is a non-orientable 2-manifold. The latter space does not admit a symplectic structure. We show that in this case Witten's volume can be obtained from the Riemannian volume associated to a choice of Riemannian metric on Σ'.

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