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Exponential Volumes in Geometry and Representation Theory

lundi 16 septembre 2024 14:00 (1 heure)

Let S be a topological surface with holes. The moduli space parametrising hyperbolic structures on S with geodesic boundary, and a given set L of lengths of boundary circles carries the Weil-Peterson volume form. Its volume is finite. Maryam Mirzakhani proved remarkable recursion formulas for these volumes, related to several areas of Mathematics. In particular the volumes are polynomials in L. Their leading coefficients are the volumes studied by Maxim Kontsevich in his proof of Witten's conjecture.

However for a surface P with polygonal boundary, e.g. just a polygon, similar volumes are infinite. We consider a variant of these moduli spaces, and show that they carry a canonical exponential volume form. We prove that exponential volumes are finite, and satisfies unfolding formulas generalizing Mirzakhani's recursions.

There is a generalization of these moduli spaces for any split simple real Lie group G, with canonical exponential volume forms. When the modular group of the surface P is finite, the exponential volumes are finite for any G. We show that when P are polygons, they can be used to define a commutative algebra of positive Whittaker functions for the group G.

We define the tropical limits of the exponential volumes.
The tropical limits for surfaces S with holes and SL(2) lead to the volumes studied by Kontsevich in his proof of Witten's conjecture.
The tropical limits of the algebra of positive Whittaker functions for any group G give the algebra of spherical functions for the group G(C).

A part of the talk is based on the joint work with Zhe Sun.

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