

Brownian loop measure on Riemann surfaces and length spectra

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Brownian loop measure is a sigma-finite measure on Brownian-type loops on the Riemann sphere, which satisfies conformal invariance and restriction property. It was introduced by Lawler and Werner and has a tight link to random curves appearing in 2D conformally invariant systems: Schramm-Loewner evolution (SLE), Conformal loop ensemble (CLE), etc.

We consider its generalization to an arbitrary Riemann surface and show that the lengths of closed geodesics for the constant curvature metric are also encoded in the Brownian loop measure. This gives a tool to study the length spectra of Riemann surfaces. In particular, we obtain a new identity between the length spectrum of a surface and that of the same surface with an arbitrary number of additional cusps. We also express the determinant of Laplacian of a compact hyperbolic surface as the total mass of Brownian loop measure renormalized according to the length spectrum.

This is based on a joint work with Yuhao Xue (IHES).

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