

# Geometrical derivation of the boundary ground ring in 2D quantum gravity

Ivan Kostov  
*SPHT Saclay*  
*91191 Gif-sur-Yvette*  
*FRANCE*

## **Abstract**

The 2D quantum gravity with boundary, described as a matter CFT coupled to boundary Liouville theory, exhibits an integrable structure, the “boundary ground ring”. The ground ring generators are associated with degenerate conformal fields, both for the Liouville and the matter CFT’s. Therefore their OPE with generic boundary vertex operator truncates, which leads to an overdetermined system of difference equations for the boundary correlation functions, with unique solution. We show that the same set of equations appears in the microscopic formulation of 2D quantum gravity as a gas of non-intersecting loops and lines on a random planar graph. In this case the difference equations appear as combinatorial identities resulting after cutting open the sum over surfaces along a line connecting two points of the boundary.