Same-same but different: Polyakov formulas via microlocal analysis and mathematical physics

Julie Rowlett
Chalmers University of Technology

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The zeta-regularized determinant of the Laplacian connects analysis, geometry, number theory, and physics. It is simultaneously beautiful and elusive, because in general it is impossible to compute in closed form, due to its global nature. To glean information, many have considered the variation of the determinant, because in contrast, this is a local quantity. Here, we shall investigate the variation of the determinant in singular geometric contexts. We will discuss so-called variational Polyakov formulas for surfaces and domains with singularities and boundaries. For the special cases of finite circular sectors and finite cones, we will show two different methods for obtaining the variation of the determinant. At first glance, the formulas obtained via microlocal analysis versus mathematical physics look quite different. It is an utter joy that although they appear different, we can prove that the expressions are indeed the same. This talk is based on joint work with Clara Aldana and Klaus Kirsten.