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Exceptional sets of Gaussian Free Fields in Dimension $d > 2$

Originated from quantum mechanics and statistical physics, the log-correlated Gaussian free field (GFF) in 2D has been extensively studied in recent years. In particular, as a natural model of "random surface", the study of GFF has lead to rich developments in the realm of 2D random geometry. However, much less is known in higher dimensions. As an attempt to explore higher-dimensional random geometry, we turn to a class of GFF models in dimensions $d > 2$. In this talk, we will introduce GFFs in any dimension from the viewpoint of abstract Wiener space and discuss some problems arising from the study of the geometry of GFFs, such as the exceptional sets and the multifractal property. In dim $d > 2$, the GFFs will be polynomially correlated and hence more singular compared with the 2D log-correlated model. We will explain the techniques on how to handle the GFFs with worse singularity, and to extend some of the results from 2D random geometry to higher dimensions.