THE UNIVERSITY OF CHICAGO

Department of Statistics

DISSERTATION PROPOSAL

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Weighted Graphs and Complex Gaussian Free Fields

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ABSTRACT

Discrete Gaussian free field (DGFF) is a Gaussian random field, whose covariance structure can be determined by the random walk Laplacian, and which is commonly used in probability and statistical physics to study random surfaces. The square DGFF known to relate to the continuous occupation field of the random walk loop soup via an isomorphism theorem. Traditionally, the correlations in DGFF are assumed to be positive, and the loop soup is treated as probability measure. However, both notions can be generalized by interpreting events and their probabilities as path configurations and associated weights, respectively. We introduce this extended framework, complex DGFF and complex loop soup, and show an isomorphism theorem for them. We also discuss possible extensions and applications of this framework.

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