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Depinning in the integer-valued Gaussian field and the BKT phase of the 2D Villain model

Abstract:

It is shown that the Villain model of two-component spins over two dimensional lattices exhibits slow, non-summable, decay of correlations at any temperature at which the dual integer-valued Gaussian field exhibits depinning. For the latter, we extend the recent proof by Lammers of the existence of a depinning transition in the integer-valued Gaussian field in two-dimensional cubic graphs to all doubly periodic graphs, in particular to $\mathbb{Z}^2$. Taken together these two statements yield a new perspective on the Berezinskii Kosterlitz Thouless phase transition in the Villain model, and complete a new proof of depinning in two-dimensional integer-valued height functions. Based on joint work with: Michael Aizenman, Matan Harel and Ron Peled.