I Congresso Brasileiro de
Jovens Pesquisadores em
Matemática Pura e Aplicada

Critical line for a Potts model coupled to causal dynamical triangulations

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Abstract

We introduce the (annealed) Potts model coupled to two-dimensional causal dynamical triangulations. Using duality on a torus (periodic boundary condition) we provide a relation between the free energy of the Potts model coupled to CDTs and its dual. This duality relation comes from the FK representation for the Potts model. We use the duality relation, the FK representation and the high-temperature expansion for determine a region in the quadrant of parameters where the critical curve for the Potts model coupled to CDTs and Potts model coupled to dual CDTs can be located. This is done by outlining a region where the infinite-volume Gibbs measure exists and is unique and a region where the finite-volume Gibbs measure has no weak limit (in fact, does not exist if the volume is large enough).