RIGIDITY OF 3-COLORINGS OF THE D-DIMENSIONAL DISCRETE TORUS

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We prove that a uniformly chosen proper coloring of $\mathbb{Z}_{2n}^d$ with 3 colors has a very rigid structure when the dimension d is sufficiently high. The coloring almost surely takes one color on almost all of either the even or the odd sub-lattice. In particular, one color appears on nearly half of the lattice sites. This model is the zero temperature case of the 3-states anti-ferromagnetic Potts model, which has been studied extensively in statistical mechanics. The proof involves results about graph homomorphisms and various combinatorial methods, and follows a topological intuition. Joint work with Ron Peled.