

## Combinatorics and Probability Seminar

### *Homomorphisms from the torus*

Matthew Jenssen (Oxford)

**Abstract:** We present a detailed probabilistic and structural analysis of the set of weighted homomorphisms from the discrete torus  $\mathbb{Z}_m^n$ , where  $m$  is even, to any fixed graph. We show that the corresponding probability distribution on such homomorphisms is close to a distribution defined constructively as a certain random perturbation of some "dominant phase". This has several consequences, including solutions (in a strong form) to conjectures of Engbers and Galvin and a conjecture of Kahn and Park. Special cases include sharp asymptotics for the number of independent sets and the number of proper  $q$ -colourings of  $\mathbb{Z}_m^n$  (so in particular, the discrete hypercube). The proof combines tools from statistical physics, namely polymer models and the cluster expansion, with entropy and graph containers. This is joint work with Peter Keevash.

Monday, November 11 at 3:00 PM in 612 SEO