Vortex fluctuations in continuous spin systems and lattice gauge theory

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Abstract

Topological phase transitions were discovered by Berezinskii-Kosterlitz-Thouless (BKT) in the 70's. They describe intriguing phase transitions for classical statistical physics models such as

- the 2d XY model (spins on $\mathbb{Z}^2$ with values in the unit circle)
- the 2d Coulomb gas
- the integer-valued Gaussian Free Field (or $\mathbb{Z}$-ferromagnet)
- Abelian lattice gauge theory on $\mathbb{Z}^4$

In this talk, I will explain a new technique to obtain quantitative lower bounds on the fluctuations induced by the topological defects (vortices) on such systems at low temperature. We will see in particular that the fluctuations generated by the vortices are at least of the same order of magnitude as the ones produced by the so-called "spin-wave". Our approach is non-perturbative but it gives matching lower bounds with the fluctuations predicted from RG analysis. I will start the talk by giving an overview of the above models. The talk is based on joint works with Avelio Sepúlveda.