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The Berezinskii-Kosterlitz-Thouless (BKT) phase transition

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One of the main goals of statistical physics is to study how spins displayed along the lattice $\mathbb{Z}^d$ interact together and fluctuate as the temperature changes. When the spins belong to a discrete set (which is the case for example in the celebrated Ising model, where spins δ_x take values in {-1, +1} the nature of the phase transitions which arise as one varies the temperature is now rather well understood. When the spins belong instead to a continuous space (for example the unit circle S^1 for the so-called XY model, the unit sphere S^2 for the classical Heisenberg model etc.), the nature of the phase transitions differs drastically from the discrete symmetry setting. The case where the (continuous) symmetry is non-Abelian is even more mysterious (especially when $d = 2$) than the Abelian case. In the latter case, Berezinskii, Kosterlitz and Thouless have predicted in the 70's that these spins systems undergo a new type of phase transition in $d = 2$ - now called the BKT phase transition - which is caused by a change of behaviour of certain monodromies called "vortices".

In this course, I will introduce the intriguing BKT phase transition, explain the key ideas behind recent proofs of its existence, and discuss some of the latest results.

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