Berezinskii-Kosterlitz-Thouless transition and Sine-Gordon theory: from superconductors to cold atomic gases

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The Berezinskii-Kosterlitz-Thouless transition provides a remarkable example of a transition controlled by topological effects. In addition to its consequences for classical two-dimensional systems, the BKT transition also directly applies to one-dimensional quantum problems as well. I will show how, using a formalism initially developed by Haldane, one can relate the BKT problem to another paradigmatic quantum problem, namely the so-called sine-Gordon theory. This mapping allows deriving several interesting consequences both for clean (in periodic or quasi-periodic lattices) and dirty bosons. I will examine such problems, in particular in the context of cold atomic gases. I will also show how using this mapping one can go back to the case of two dimensional systems, namely disordered superconducting films.