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Non-linear magnetization effects within the Kosterlitz-Thouless theory LARA BENFATTO, Centro Fermi and University of Rome "La Sapienza", CLAUDIO CASTELLANI, University of Rome "La Sapienza", THIERRY GIAMARCHI, University of Geneva — Recent experiments in cuprate superconductors have attracted the attention on the role of vortex fluctuations. Measurements of the field-induced magnetization showed that the correlation length diverge exponentially, as predicted within the Kosterlitz-Thouless (KT) theory. However, it is somehow puzzling thepersistence of strong non-linear magnetization effects at low field. Here we address this issue by means of a new theoretical approach to the KT transition at finite magnetic field, based on the sine-Gordon model. This approach is particularly useful in two respects. First, it leads to a straightforward definition of the field-induced magnetization as a function of the external magnetic field H instead of the magnetic induction B, which is crucial to get a consistent description of the Meissner phase. Second, it allows us to identify the cross-over field H_{cr} from linear to non-linear magnetization both below and above the transition. Above T_{KT} H_{cr} turns out to scale as the inverse correlation length, so that it decreases as the transition is approached. As a consequence, the fact that only the non-linear regime is accessible experimentally should be interpreted as a typical signature of the fast divergence of the correlation length within the KT theory. L.Benfatto, C.Castellani and T.Giamarchi, Phys. Rev. Lett. 99, 207002 (2007)

Lara Benfatto
Centro Fermi and University of Rome "La Sapienza"

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