

A functional renormalization group approach to systems with long-range correlated disorder

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We studied the statics and dynamics of elastic manifolds in disordered media with long-range correlated disorder using functional renormalization group (FRG) [1]. We identified different universality classes and computed the critical exponents and universal amplitudes describing geometric and velocity-force characteristics. In contrast to uncorrelated disorder, the statistical tilt symmetry is broken resulting in a nontrivial response to a transverse tilting force. For instance, the vortex lattice in disordered superconductors shows a new glass phase whose properties interpolate between those of the Bragg and Bose glasses formed by point-like and columnar disorder, respectively. Whereas there is no response in the Bose glass phase (transverse Meissner effect), the standard linear response expected in the Bragg glass gets modified to a power law response in the presence of disorder correlations. We also studied the long distance properties of the $O(N)$ spin system with random fields and random anisotropies correlated as $1/x^{d-\sigma}$ [2]. Using FRG we obtained the phase diagram in (d, σ, N) -parameter space and computed the corresponding critical exponents. We found that below the lower critical dimension $4+\sigma$, there can exist two different types of quasi-long-range-order with zero order-parameter but infinite correlation length.

[1] A.A. Fedorenko, P. Le Doussal, and K.J. Wiese, Phys. Rev. E **74**, 061109 (2006).

[2] A.A. Fedorenko and F. Kühnel, Phys. Rev. B **75**, 174206 (2007).