

Fermionic Renormalization Group

An approach often used in the study of critical field theories is provided by the functional Renormalization Group [1], which implements at functional level Renormalization Group techniques and ideas. It has been used in a variety of cases ranging from low-dimensional systems [2] to spin systems with long-range interactions [3]. The so-called derivative expansion is an efficient tool to calculate universal (and in some cases non-universal) quantities in spin and bosonic systems. However, the application to fermionic systems is not straightforward: different strategies have been proposed, including the introduction of a partial bosonization, but active work is currently in progress to make them simple and efficient as the ones used in ϕ^4 theories. In this proposal it is planned to study fermionic systems using an approach which parallels the derivative approximation and its various levels of approximation. The method developed is foreseen to be applied to non-relativistic and relativistic fermionic theories.

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References:

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- [2] N. Dupuis *et al.*, *The nonperturbative functional renormalization group and its applications*, Physics Reports (2021)
- [3] N. Defenu, A. Codello, S. Ruffo, and A. Trombettoni, *Criticality of Spin Systems with Weak Long-Range Interactions*, Journal of Physics A (2020)