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The $(1+1)$-dimensional Gross-Neveu model at non-zero μ, T and finite N

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We investigate the Gross-Neveu model for a finite number of fermions N. The solution of the Gross-Neveu model is well known in the large-N limit ($N \to \infty$) but unknown for finite N. We approach the finite-N case with a FRG method, more precisely the Wetterich equation. By using the local potential approximation the resulting flow equation for the scale dependent effective potential can be transformed into a non-linear diffusion equation. This equation is solved numerically by applying a finite volume method. No discrete chiral symmetry breaking is observed for any finite number of fermions, arbitrary chemical potentials as long as the temperature is non-zero.

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