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Perturbative non-Fermi liquids from dimensional regularization

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A dimensional regularization scheme for
quantum field theories with Fermi surface is proposed
to study scaling behaviour of non-Fermi liquid states
in a controlled approximation.
Starting from a Fermi surface in two space dimensions,
the co-dimension of Fermi surface is extended to
a general value while the dimension of Fermi surface is fixed.
When Fermi surface is coupled with a critical boson centred at zero momentum,
the interaction becomes marginal at a critical space dimension $d_c = 5/2$. A deviation from the critical dimension is used as a small parameter for a systematic expansion.
This method is applied to the theory where two patches of Fermi surface
are coupled with a critical boson, and it is shown that the Ising-nematic
critical point is described by a stable non-Fermi liquid state
slightly below the critical dimension.
Critical exponents are computed up to the two-loop order.

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