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Recursive algorithm for generating high-temperature expansions for spin systems and the chiral non-linear susceptibility

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We show that the high-temperature expansion of the free energy and arbitrary connected correlation functions of quantum spin systems can be recursively obtained from the exact renormalization group flow equation for the generating functional of connected spin correlation functions derived by Krieg and Kopietz [Phys. Rev. B 99, 060403(R) (2019)]. Our recursive algorithm can be explicitly written down in closed form including all combinatorial factors. We use our method to estimate critical temperatures of Heisenberg magnets from low-order truncations of the inverse spin susceptibility in the static limit. We also calculate the connected correlation function involving three different spin components (chiral non-linear susceptibility) of quantum Heisenberg magnets up to second order in the exchange couplings.

Presenter: KOPIETZ, Peter

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