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Exact ground state properties of the t-J model with U(1) symmetry breaking

In this paper, we investigate the ground state energy of the one-dimensional supersymmetric t–J model with U(1) symmetry breaking. We study the distribution of the zero roots of the corresponding nested transfer matrix. We find that in the ground state, the zero roots form two string pairs, finite pure real roots, and pure imaginary roots. Based on the distribution of the zero roots, we obtain the ground state energy of the system in the thermodynamic limit.

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