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**Exact sign structure and variational wave function of t-J chain and ladder** QING-RUI WANG, ZHENG ZHU, Tsinghua Univ, YANG QI, Perimeter Institute, D. N. SHENG, California State University, Northridge, ZHENG-YU WENG, Tsinghua Univ — The motion of a doped hole in the anti-ferromagnetic spin background generally induces a many-body phase shift, which is identified by an exact sign structure of the t-J model known as the phase string. We find that the characteristic momentum structure, the one dimensional (1D) Luttinger liquid behavior, the quantum phase interference of the hole under a periodic boundary condition, and the breakdown of Landau's quasiparticle description can all be attributed to it. Based on the exact sign structure, we introduce a variational wave function for the t-J model and calculate physical properties such as the momentum distribution, quasiparticle weight, and hole distribution of the single-hole 1D and ladder system in detail using Monte Carlo (MC) method. An excellent agreement is found between the MC and Density Matrix Renormalization Group results.

Qing-Rui Wang  
Tsinghua Univ

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