

Fractional charges and spin-charge separation in one-dimensional Wigner lattices

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We study density response $N(k, \omega)$ and one-particle spectra $A(k, \omega)$ for a Wigner lattice model at quarter filling using exact diagonalization. We show that these observables show clear signatures of charge fractionalization in addition to spin-charge separation. We investigate models with short and long-range electron-electron interaction and show that truncation of the electron repulsion can lead to very different results through affecting the interaction between domain walls. For long-range interaction, the domain-wall interaction can be attractive or repulsive and is controlled by their formal fractional charges. In striking contrast to a bound exciton in $N(k, \omega)$, we find an antibound quasi-particle in $A(k, \omega)$, which undergoes spin-charge separation. We present a case of extreme particle-hole asymmetry, where photoemission shows spin-charge separation, while inverse photoemission exhibits an uncorrelated one-particle band.