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Luttinger liquids in trapped ultracold atomic Fermi gases C.J. BOLECH, PAATA KAKASHVILI, SATYAN BHONGALE, HAN PU, Rice University — Recent success in manipulating ultracold atomic systems allows to probe different strongly correlated regimes in one dimension. Experimentally, 1D tubes are defined by turning on a 2D optical lattice. Regimes such as the spin-coherent Luttinger liquid and the spin-incoherent Luttinger liquid can be realized by tuning the repulsive inter-atomic interaction strength and trap parameters. Due to the trap potential the density decreases near the edges of the tubes and the spin-incoherent regime is inevitably realized. In general, the spin-coherent Luttinger liquid regime in the center of the tube crosses over to its spin-incoherent counterpart at the edges. We identify the noise correlations of density fluctuations as a robust observable (uniquely suited in the context of trapped atomic gases) to discriminate between these two regimes. On the other hand, the inter-atomic interaction can also be made attractive in order to access Luttinger states that support paired-state ground states that are robust against population imbalance (FFLO-like states) and do not phase separate in the trap as in the case of three dimensional clouds. We explore the finite temperature properties of the attractive regime using the tools of integrability. Finally, we address the concrete prospects of realizing and probing these phenomena experimentally using optical lattices.

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