Abstract Submitted
for the MAR17 Meeting of
The American Physical Society

One Body Density Matrix for Strongly Interacting Spinor Gases in 1D LI YANG, HAN PU, Rice University — We study one dimensional spinor quantum gases from the strong coupling perspective. A family of strong coupling ansatz wavefunctions (physically similar to spin-incoherent Luttinger liquid wavefunctions) can be used to describe the states in this regime. From those wavefunctions, we can interpret the system as a direct product of spin and charge Hilbert spaces, coupled by an effective p-wave interaction. At zero temperature, when the interaction strength approaches infinity, the system fermionizes and the charge degree of freedom is frozen, and the spin degree of freedom is governed by a spin chain Hamiltonian. We found that the one body density matrix of such a strongly interacting 1D spinor gas can be written into a summation of products of charge parts and spin parts. And remarkably, we discover that the charge part is related to the one body density matrix of spinless anyon system via a discrete Fourier transformation. This allows us to obtain a closed form for the one body density matrix of the spinor system. This result allows us to calculate many other important quantities related to the 1D spinor system in a very efficient way, such as the momentum distribution, the Tan relation, and the coupling constants in the spin-chain model.

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Date submitted: 09 Nov 2016 Electronic form version 1.4