Abstract Submitted
for the DAMOP14 Meeting of
The American Physical Society

A one-dimensional liquid of Fermions with tunable spin CARLO SIAS, JACOPO CATANI, Istituto Nazionale di Ottica-CNR and LENS, GUIDO PAGANO, LENS and Scuola Normale Superiore, MARCO MANCINI, PIETRO LOMBARDI, LENS and Dipartimento di Fisica, Universita' di Firenze, GIACOMO CAPPELLINI, FLORIAN SCHAEFER, LENS, MASSIMO INGUSCIO, LEONARDO FALLANI, LENS, Istituto Nazionale di Ottica-CNR and Dipartimento di Fisica, Universita' di Firenze — Correlations in physical systems with spin degree of freedom are at the heart of several fundamental phenomena, ranging from magnetism to superconductivity. In general, the effects of correlations depend strongly on the dimensionality of the system. A striking example are fermions confined in one dimension, whose small-energy excitations have a collective nature. We report on the realization of multi-component one-dimensional liquids of ultracold ^{173}Yb fermions. These two-electron atoms are characterized by a large nuclear spin and highly-symmetric atom-atom interactions, which result in the possibility of performing quantum simulations of systems with intrinsic SU(N) symmetry. In one dimension, repulsive interactions between atoms in different nuclear spin states cause static and dynamic properties of the system to significantly depart from those of an ideal Fermi gas, in accordance with the Luttinger theory for a 1D liquid of spin-1/2 interacting fermions. Much stronger deviations are measured when the fermionic liquid is prepared in more than 2 internal states. This work provides the first experimental study of Luttinger physics with repulsive spinful atoms and the first realization of multi-component Luttinger liquids with tunable SU(N) symmetry.

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Date submitted: 31 Jan 2014 Electronic form version 1.4