Abstract Submitted
for the MAR11 Meeting of
The American Physical Society

Magnetism and Cooper pairing in one-dimensional large spin fermions with repulsive interactions HSIANG-HSUAN HUNG, The department of Physics, Univeristy of California, San Diego, YUPENG WANG, Institute of Physics, Chinese Academy of Sciences, Beijing, China, CONGJUN WU, The department of Physics, Univeristy of California, San Diego — The recent experimental realization of ultracold large-spin fermionic systems provides a new opportunity to investigate exotic magnetism and Cooper pairing physics. By means of exact diagonalizaton and the density matrix renormalization group, we systematically study the magnetic properties of the Mott-insulating state of the simplest large-spin systems with hyperfine spin $F = 3/2$ in one-dimension and at quarter filling. Such a system is characterized by an exact $SO(5)$ symmetry. The ground state shows various profiles at various $\theta = \tan^{-1} J_0/J_2$, where J_0/J_2 is the ratio of exchange strengths of the singlet ($S_T = 0$) and quintet ($S_T = 2$) channels. As $\theta > 45^\circ$ the ground state is a gapped state with dimerization patterns whereas as $\theta \leq 45^\circ$ it is a gapless Luttinger liquid state. Furthermore, we found that in the Luttinger liquid phase the static correlation functions show power-law decays with a four-site periodicity, which is similar to an SU(4) chain. We also study the spin-3/2 model with doping. In the regime of $\theta > 45^\circ$ and at moderate doping, the singlet pairing correlations indicate power-law decays whereas the quintet pairing correlations have exponential decays. On the other hand, in the regime of $\theta \leq 45^\circ$ the quintet pairing correlations are more robust than the singlet pairing correlations.

Congjun Wu
The department of Physics, Univeristy of California, San Diego

Date submitted: 18 Nov 2010 Electronic form version 1.4