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Multi-component integrable models in cold atoms YUZHU JIANG, Beijing Computational Science Research Center, Beijing 100084, China, JUNPENG CAO, YUPENG WANG, Beijing National Laboratory for Condensed Matter Physics, Institute of Physics, Chinese Academy of Sciences, Beijing 100190, PR China, HAIQING LIN, Beijing Computational Science Research Center, Beijing 100084, China — The quantum gases are intensively studied for the inspiring advances in ultra-cold atomic physics. Various kinds of lattice and gas systems are created in different dimensions. The multi-component cold atomic systems have rich phase diagrams. Our works focus on the one-dimensional integrable quantum systems. We find a series of integrable models of $Sp(2s+1)$ fermions and $SO(2s+1)$ bosons and solve them via Bethe ansatz techniques, where s the hyperfine spin of the atoms. We find the paired bosons exist in both repulsive and attractive $SO(3)$ integrable bosonic gases with hyperfine spin-1. For the $Sp(2s+1)$ repulsive fermions, there are no bound states in the ground state, while 2-string bound solutions appear in the spin sector. We also calculate the spin-wave velocities and low temperature specific heat of the repulsive fermions. These systems have spin-charge separation property of Luttinger liquid. Different from the $SU(2s+1)$ repulsive models, the spin-wave velocities of the $Sp(2s+1)$ models are no longer the same. The holes of 1-strings (real rapidities) of different branches in the spin sector have a same spin-wave velocity v_1 and the ones of 2-strings share a same spin-wave velocity v_2. The two velocities are different.

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