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Chiral spin condensation in a double-valley optical lattice XIAOPENG LI, Fudan University, YINGHAI WU, Max-Planck-Institut fur Quantenoptik — We study a spinor (two component) Bose gas confined in a one dimensional double-valley optical lattice which has a double-well structure in momentum space. With field theory analysis we find that the spinor bosons in the double-valley band generically form a spin-charge mixed chiral spin quasi-condensate. We further perform exact numeric calculations for a concrete π-flux triangular ladder system, where we confirm the robustness of the chiral spin order against interactions and quantum fluctuations. This exotic atomic Bose condensate exhibits spatially staggered spin loop currents without any charge dynamics despite the complete absence of spin-orbit coupling in the system, paving a novel venue to atom-spintronics. By calculating entanglement entropy scaling and conformal-field-theory central charge, we establish that the low energy effective theory for the chiral spin condensate is a two-component Luttinger liquid. Our predictions are readily detectable in atomic experiments through spin resolved time-of-flight techniques.

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