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Spectroscopy of the soliton lattice formation in quasi-one-dimensional fermionic superfluids with population imbalance[1] ROMAN LUTCHYN, Microsoft Station Q, MAXIM DZERO, Kent State University, VICTOR YAKOVENKO, University of Maryland — Motivated by recent experiments in low-dimensional trapped fermionic superfluids we study quasi-1D superfluid with imbalanced populations between two hyperfine states and analyze its properties using the exact mean field solution for the order parameter. When population imbalance exceeds some critical value the superfluid order parameter develops spatial inhomogeneities and can be described by a soliton lattice formation. Emergence of the soliton lattice is accompanied by the formation of the spin density wave with the majority fermions residing at the points in space where Fulde-Ferrell-Larkin-Ovchinnikov (FFLO) order parameter vanishes. We show that the presence of the spin density wave leads to the formation of the band of the "subgap states," which serves as a hallmark of the quasi-1D FFLO state. We employ the soliton lattice description to discuss the possibilities for the experimental detection of the quasi-1D FFLO phase: elastic and inelastic optical Bragg scattering experiments and radio-frequency spectroscopy. We demonstrate that these measurements allow one to extract necessary information about the inhomogeneous superfluid phase to unambiguously identify quasi-1D FFLO state.

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