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Pairing states of a polarized Fermi gas trapped in a one-dimensional optical lattice ADRIAN FEIGUIN, University of Maryland, College Park, and Microsoft Station Q, FABIAN HEIDRICH-MEISNER, Institut für Theoretische Physik C, RWTH Aachen, Germany — We study the properties of a one-dimensional (1D) gas of fermions trapped in a lattice by means of the density matrix renormalization group method, focusing on the case of unequal spin populations, and strong attractive interaction. In the low density regime, the system phase-separates into a well defined superconducting core and a fully polarized metallic cloud surrounding it. We argue that the superconducting phase corresponds to a 1D analogue of the Fulde-Ferrell-Larkin-Ovchinnikov (FFLO) state, with a quasi-condensate of tightly bound bosonic pairs with a finite center-of-mass momentum that scales linearly with the magnetization. In the large density limit, the system allows for four phases: in the core, we either find a Fock state of localized pairs or a metallic shell with free spin-down fermions moving in a fully filled background of spin-up fermions. As the magnetization increases, the Fock state disappears to give room for a metallic phase, with a partially polarized superconducting FFLO shell and a fully polarized metallic cloud surrounding the core.

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