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Imbalanced fermionic superfluids and emerging bosonic phases in a 2D array of coupled tubes[1] KUEI SUN, C.J. BOLECH, University of Cincinnati — We study two-species imbalanced fermionic superfluids in an 2D array of 1D tubes that are coupled via single-particle and pair tunnelings between nearest neighbors. We build a model incorporating the interplay of Cooper pairing, spin imbalance (or magnetization) as well as intertube tunneling and obtain imbalance profiles accompanied with oscillatory pairing order parameter of the system, reminiscent of a Fulde-Ferrell-Larkin-Ovchinnikov (FFLO) state. Our model shall describe the development of signatures characteristic of the incipience of the dimensional crossover between 1D and 3D. In addition, we find that the state of unpaired majority spins in the system undergoes an incompressible-compressible transition as a function of magnetic field and tunneling strength. We show that such phase transition has a bosonic nature and can be well described by a modified Bose-Hubbard model with coupling between nearest-neighbor sites' occupation parities.

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