

Abstract Submitted  
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**Excitonic condensation in an electron-hole bilayer with density imbalance**<sup>1</sup> B. TANATAR, A.L. SUBASI, Bilkent University, P. PIERI, University of Camerino, G. SENATORE, University of Trieste — There is a growing interest in the BCS-BEC crossover phenomenon because of experimental advances in ultracold atomic gases. In particular, the possibility of exotic phases such as gapless superfluid (Sarma phase) and Fulde-Ferrell-Larkin-Ovchinnikov (FFLO) phase in imbalanced two-species Fermi systems attracted considerable attention. In this work, we study the excitonic condensation in an electron-hole bilayer with unequal layer densities at zero temperature. Coulomb repulsion within each layer suppresses the phase separation and different electron and hole band masses and nonlocal nature of the electron-hole attraction both favor the exotic phases. We solve the mean-field BCS gap equations and investigate the effects of intra- and inter-layer interactions and analyze the stability of the Sarma phase by calculating the superfluid mass density. We find that with bare Coulomb interactions the Sarma phase is always locally stable. Introducing a simple model for screening we find that in the intermediate density a region of the phase diagram becomes unstable which we identify as the FFLO phase.

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