Abstract Submitted
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Spontaneous Exciton Condensate in Transition Metal Dichalcogenides electron-hole bilayer System[1] BISHWAJIT DEBNATH, YAFIS BARLAS, DARSHANA WICKRAMARATNE, MAHESH NEUPANE, ROGER LAKE, University of California Riverside — Spontaneous Bose-Einstein Exciton condensation (BEC) in spatially separated graphene layers has received intense theoretical and experimental attention, due to its promise for low-dissipation electronic devices. We have investigated BN-separated monolayers of transition metal dichalcogenides (TMDs) to explore the possibility of achieving exciton superfluidity in this class of 2D materials. The top and bottom monolayers can consist of either same TMD (homo-bilayer) or a combination of different TMDs (hetero-bilayer). The particle density in each monolayer is tuned by independent gate biasing. In TMDs, the almost equivalent particle-hole symmetry is an assisting factor towards achieving condensation. The calculated exciton binding energies are found to be as large as 50 – 250 meV, which is a result of the large effective masses in the TMDs. For BN thicknesses of around 3nm, the interaction strength is large and no longer in the weak coupling regime. Therefore, to calculate the excitonic gap, we use a modified Eliashberg formalism in which the phonon-mediated interaction is replaced with the inter-layer screened coulomb interaction between TMD bilayers.

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