Dihao Sun (Columbia University, USA)

Dihao Sun (Columbia University), Xiaomeng Liu (Princeton University), Jia Li (Brown University), Kenji Watanabe (National Institute for Materials Science), Takashi Taniguchi (National Institute for Materials Science), James Hone (Columbia University), Cory R Dean (Columbia University), Bertrand Halperin (Harvard University), Phillip Kim (Harvard University)

ds3917@columbia.edu

Crossover between Strongly-coupled and Weakly-coupled Exciton Superfluid

In fermionic systems, superconductivity and superfluidity occur through the condensation of fermion pairs. The nature of this condensate can be tuned by varying the pairing strength, which is challenging in electronic systems. We studied graphene double layers separated by an atomically thin insulator. Under applied magnetic field, electrons and holes couple across the barrier to form bound magneto-excitons whose pairing strength can be continuously tuned by varying the effective layer separation. Using temperature-dependent Coulomb drag and counterflow current measurements, we were able to tune the magneto-exciton condensate through the entire
phase diagram from weak to strong coupling. Our results establish magneto-exciton condensates in graphene as a model platform to study the crossover between two bosonic quantum condensate phases in a solid-state system.