Indirect excitons in heterostructures

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An indirect exciton (IX), also known as an interlayer exciton, is a bound pair of an electron and a hole confined in spatially separated layers.

Due to their long lifetimes, IXs can cool below the temperature of quantum degeneracy. This gives an opportunity to realize and study cold excitons. We will present direct measurements of spontaneous coherence and Bose-Einstein condensation of IXs. We will present phenomena observed in the IX condensate, including the commensurability effect of exciton density wave, spin textures, Pancharatnam-Berry phase and long-range coherent spin transport, and interference dislocations.

IXs are dipoles and their energy can be controlled by voltage. This gives an opportunity to build devices, which operate with excitons in place of electrons. We will present excitonic devices, including excitonic transistor, trap, lattice, conveyer, ramp, and split-gate devices.

We will present van der Waals heterostructures where IX condensation can be realized at high temperatures. We will present IXs at room temperature and indirect charged excitons, i.e. indirect trions, in van der Waals heterostructures.