THEORY OF COULOMB COMPLEXES IN 2D SEMICONDUCTORS

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Atomically thin semiconductors and Van der Waals structures with them attract a lot of attention both theoreticians and experimentalists. Due to very small thickness and characteristics of dielectric environment, Coulomb correlations are especially pronounced in two-dimensional semiconductors based on transition metal dichalcogenides, for example, in MoS2 or WSe2, where the binding energies of excitons – electron-hole pairs – are hundreds of meV, and trions or charged excitons – three-particle complexes of an electron and two holes or two electrons and a hole - tens of meV [1,2]. Extremely small thickness of 2D semiconductors leads to modification of effective interaction potential.

In my talk I will speak about excitons and trions in Van der Waals heterostructures with one or two layers of 2D semiconductors. The main focus will be on one or bilayer transition metal dichalcogenides including excitons and trions with one electron from high high-lying conduction band with negative effective mass [3,4]. Also, excitons and trions in bilayer CrSBr will be spoken about. The main feature of this layered magnetic material relevant to this study is extremely high anisotropy of effective masses of charge carriers in the layer plane. Presented results are obtained by variational method with trial function with small number physically reasonable trial parameters and various numerical methods.

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References

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