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Two- and Three-Particle Complexes with Logarithmic Interaction: Compact Wave Functions for Two-Dimensional Excitons and Trions

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In the framework of the effective mass approximation and assuming a logarithmic interaction between constituent charged particles, compact and locally accurate wave functions that describe bound states of the two-particle neutral and three-particle charged complexes in two dimensions are designed. Prime examples of these complexes are excitons and trions that appear in monolayers of Transition-Metal DichalCogenides (TMDCs). In the case of excitons, these wave functions led to 5-6 correct decimal digits in the energy and the diamagnetic shifts. In addition, it is demonstrated that they can be used as zero-order approximations to study magnetoexcitons via perturbation theory in powers of the magnetic field strength. For the trion, making a comparison with experimental data for concrete TMDCs, we established that the logarithmic potential leads to binding energies <= 25% greater than experimental ones. Finally, the structure of the wave function at small distances is established for excitons whose carriers interact via the Rytova-Keldysh potential.

This talk will be based on the forthcoming paper arXiv:2302.11928

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