EXCITONS IN THE UPPER HUBBARD BAND

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9.7 cm

Motivated by recent Raman and resonant inelastic X-ray scattering experiments performed for Mott insulators, which suggest existence of excitons in these systems, we present a theory of exciton formation in the upper Hubbard band. These objects are built of a hole and a single occupancy. We demonstrate that the effective Hamiltonian representing propagation and interaction of these particles has a dual from which reflects the particle-hole symmetry. The analytical analysis of that Hamiltonian is based on the spin polaron approach. Results confirm existence of excitons and show resemblance with experimental data despite the crudeness of the approach. The driving mechanism of exciton formation is the kinetic energy saving achieved by formation of spin bipolaron consisting of a hole and a double occupancy connected by a line formed by spin defects in the antiferromagnetic background which moves freely by expanding at one end of the line and shrinking at the other. Our results also demonstrate that even if the Coulomb attraction between the hole and the double occupancy is screened, bound states will form and that the underlying mechanism of exciton formation is similar to that of pairing in weakly doped antiferromagnets.

13.4 cm

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