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Analytical results for locally interacting systems: How strong fluctuations of emergent gauge fields affect charge-blocking physics[1]
NOBUHIKO TANIGUCHI, Univ of Tsukuba — We present an analytical treatment that captures non-perturbative effect of strong local correlation for the multi-level dot in the environment. Through the DMFT idea, this gives a universal mechanism of how dynamical fluctuations induce the metal-insulator transition without symmetry breaking. Using a Keldysh functional of the quantum $U(1)$-rotor plus fermion model, we re-examine the effect of emergent $U(1)$-gauge fields, whose strong quantum dynamical fluctuations invalidate the standard quadratic approximation around the saddle-point. Our analysis originates from the analysis of how to evaluate exactly the atomic correlation for the multi-level dot in terms of Keldysh functionals, which is nontrivial because of its quartic nature though one can readily achieve it by the operator method. It helps us identify a strong-coupling effective action that describes charge-blocking physics, and learn how to treat correctly large gauge fluctuations, particularly its compactness. We then investigate the effect of connecting the interacting dot with the environment (= the leads) and see gauge fluctuations have the self-energy acutely diverge and reduce near the Fermi level, which brings a new quasiparticle peak at low temperature.

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