Unitary Renormalization Group Approach to the Single-Impurity Anderson model

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Outline

- The model
- Motivation
- URG formalism
- Results

The Single-Impurity Anderson Model

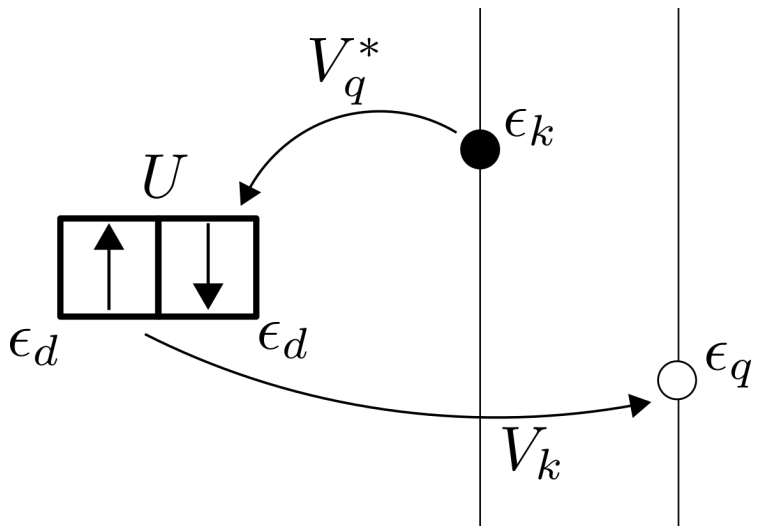
kinetic energy

hopping between impurity and bath

single-impurity energy

impurity-impurity repulsion

$$\mathcal{H} = \sum_{k\sigma} \epsilon_k \hat{n}_{k\sigma} + \sum_{k\sigma} \left[V(k) c^\dagger_{k\sigma} c_{d\sigma} + \text{h.c.} \right] + \epsilon_d \sum_\sigma \hat{n}_{d\sigma} + U \hat{n}_{d\uparrow} \hat{n}_{d\downarrow}$$



Motivation

- "Poor man's" scaling[1] is *perturbative* and fails at large values - cannot show strong-coupling (SC) fixed point.
- Instead, one needs to flow to large value of U, do a Schrieffer -Wolff transformation and then flow to the SC fixed point.
- **It would be nice to get a single set of equations that show the crossover to the strong-coupling fixed point.**

[1] Haldane 1978, Jefferson 1977

Motivation

- Numerical Renormalization Group (NRG) does not provide any scaling equations - hard to figure out what is really happening.
- NRG cannot show *how the Hamiltonians and many-body wavefunctions vary along the flow* - projective in nature.
- **It would be enlightening to see the flow into SC regime by tracking the change in entanglement** - hence we need wavefunctions.