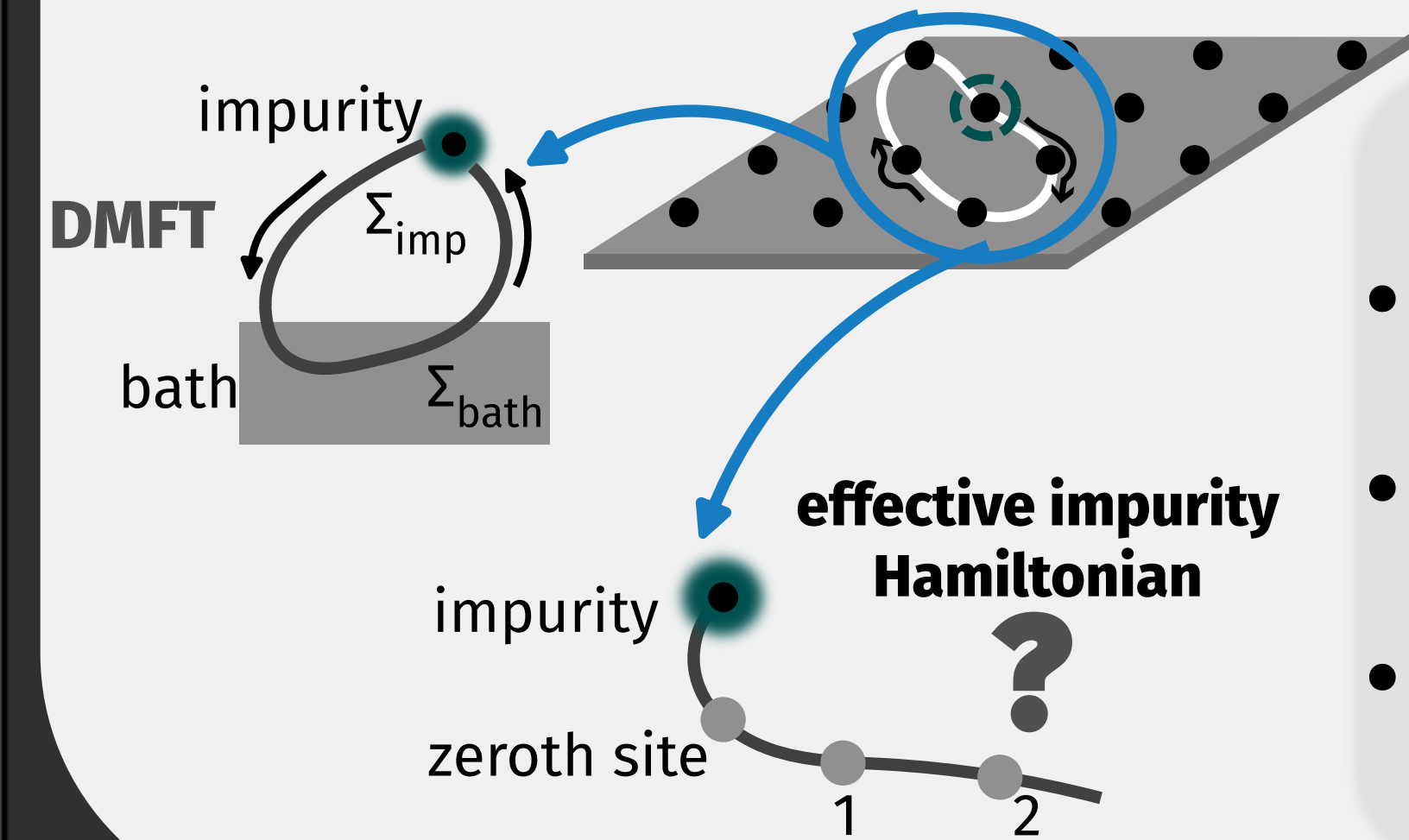


## DMFT on the Bethe lattice in $d = \infty$

- Dynamical mean-field theory: exact in  $d = \infty$
- Solves the bulk model by obtaining a self-consistent Anderson impurity model
- Displays Mott MIT on the Bethe lattice
- Standard Anderson model is always metallic - bath must get correlated during self-consistency



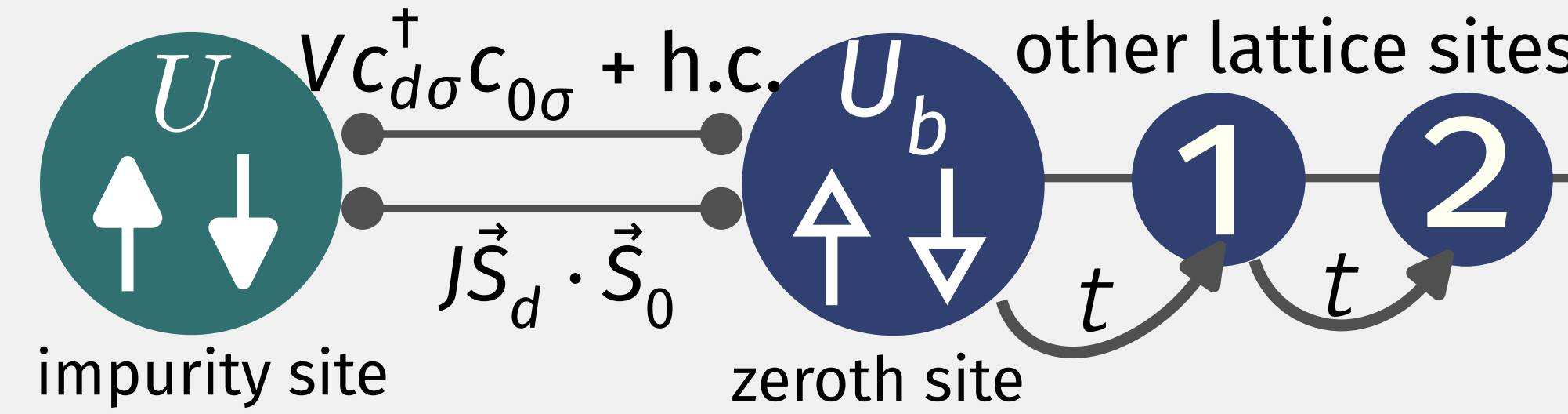
## Outstanding Questions

- Can we replace the  $\Sigma$ -based description of correlations with an effective impurity model Hamiltonian?
- What fluctuations destabilise the Kondo screening? Is there a minimal universal theory near the transition?
- How does the local Fermi liquid die at the critical point, and what low-energy excitations replace it there?

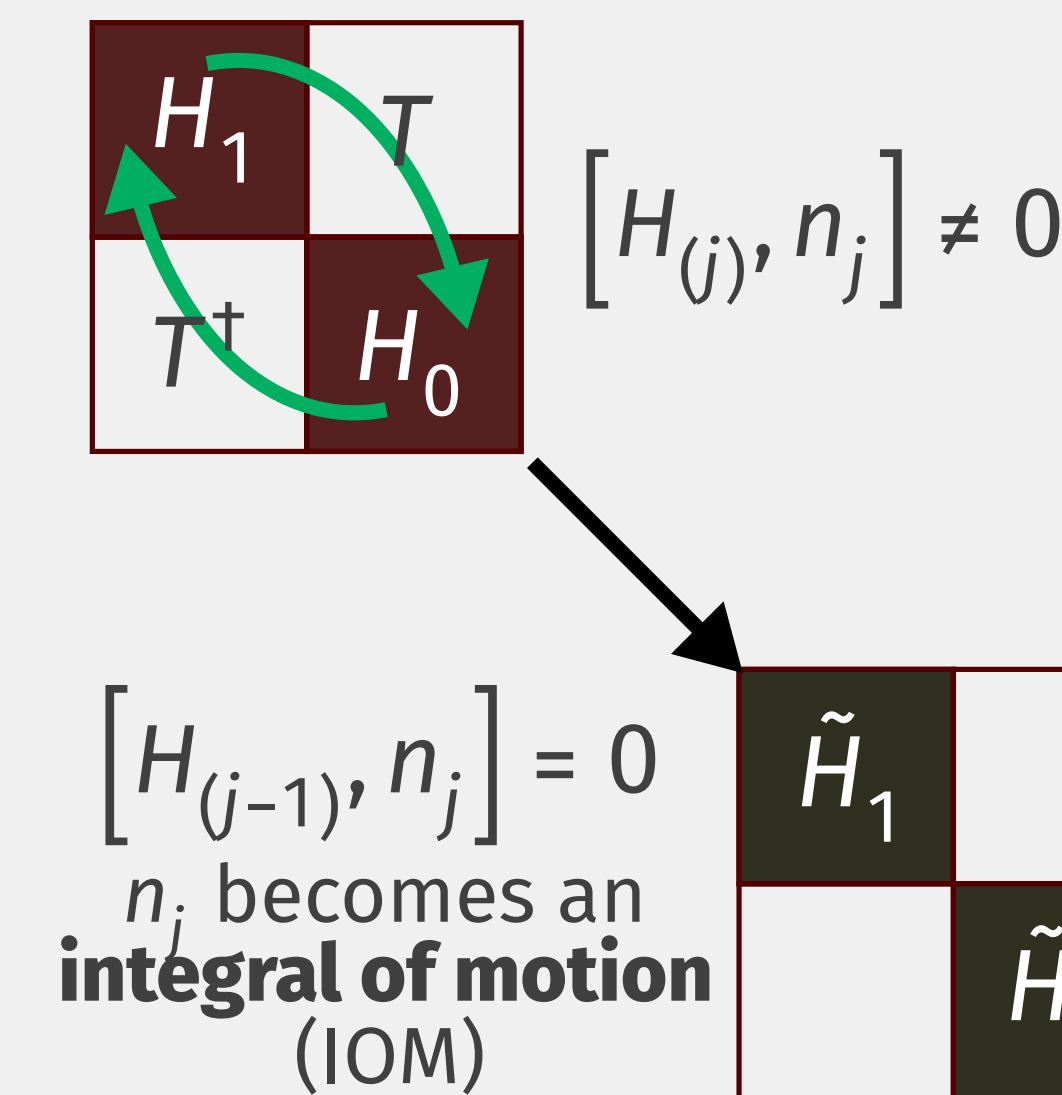
## An Extended Anderson Impurity Model

Insert two additional interaction terms to the SIAM:

- a spin-exchange term  $J\vec{S}_d \cdot \vec{S}_0$  between impurity site and bath site that is coupled to the impurity site
- a local particle-hole symmetric correlation term  $-U_b(\hat{n}_{0\uparrow} - \hat{n}_{0\downarrow})^2$  on the same bath site



## Our Impurity Solver - Unitary Renormalisation Group



- Proceeds by **applying unitary transformations**  $U_j$  on the Hamiltonian to generate RG flow  $H_j$

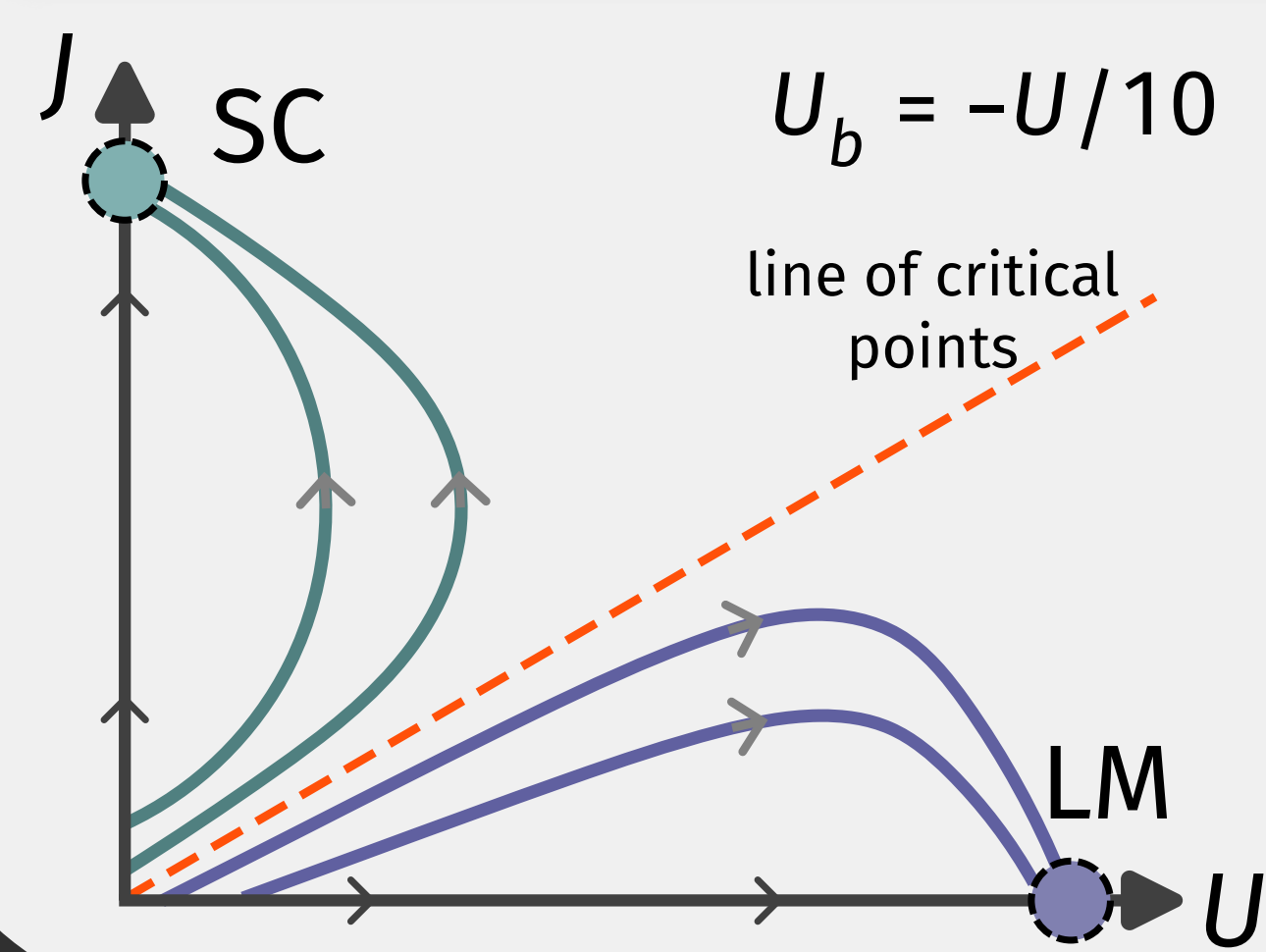
$$H_{j-1} = U_j H_j U_j^\dagger$$

- $U_j$  are defined so as to **remove quantum fluctuations** of high energy  $k$ -states
- Continues until denominator of RG equation vanishes: fixed point
- Fixed point Hamiltonian describes **emergent theory** at low energy

## Nature of RG Flows

- RG equations for  $J, V$  have critical points at  $r = -U_b/J = 1/4$
- Beyond critical point,  $V, J$  turn irrelevant
- $U_b$  always marginal

$$\frac{dJ}{dD} = \frac{\rho J(J + 4U_b)}{\omega - \frac{D}{2} + \frac{U_b}{2} + \frac{1}{4}}$$

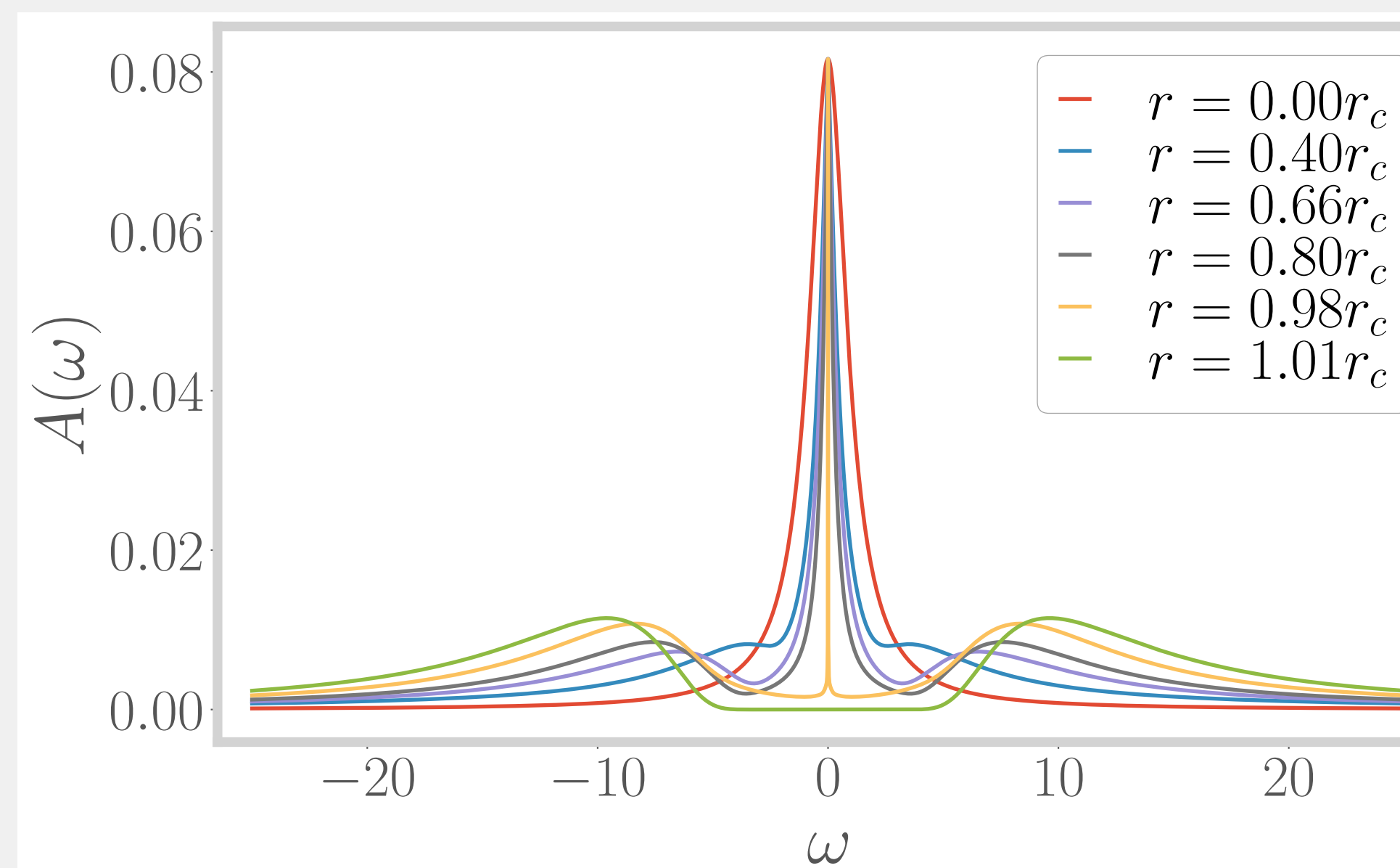


## Fixed-Point Structure

- For  $r < 1/4$ : strong-coupling Kondo screening singlet ground state
- For  $r > 1/4$ : unscreened impurity spin local moment ground state
- At  $r = 1/4$ : partially screened unstable QCP some non-Fermi liquid

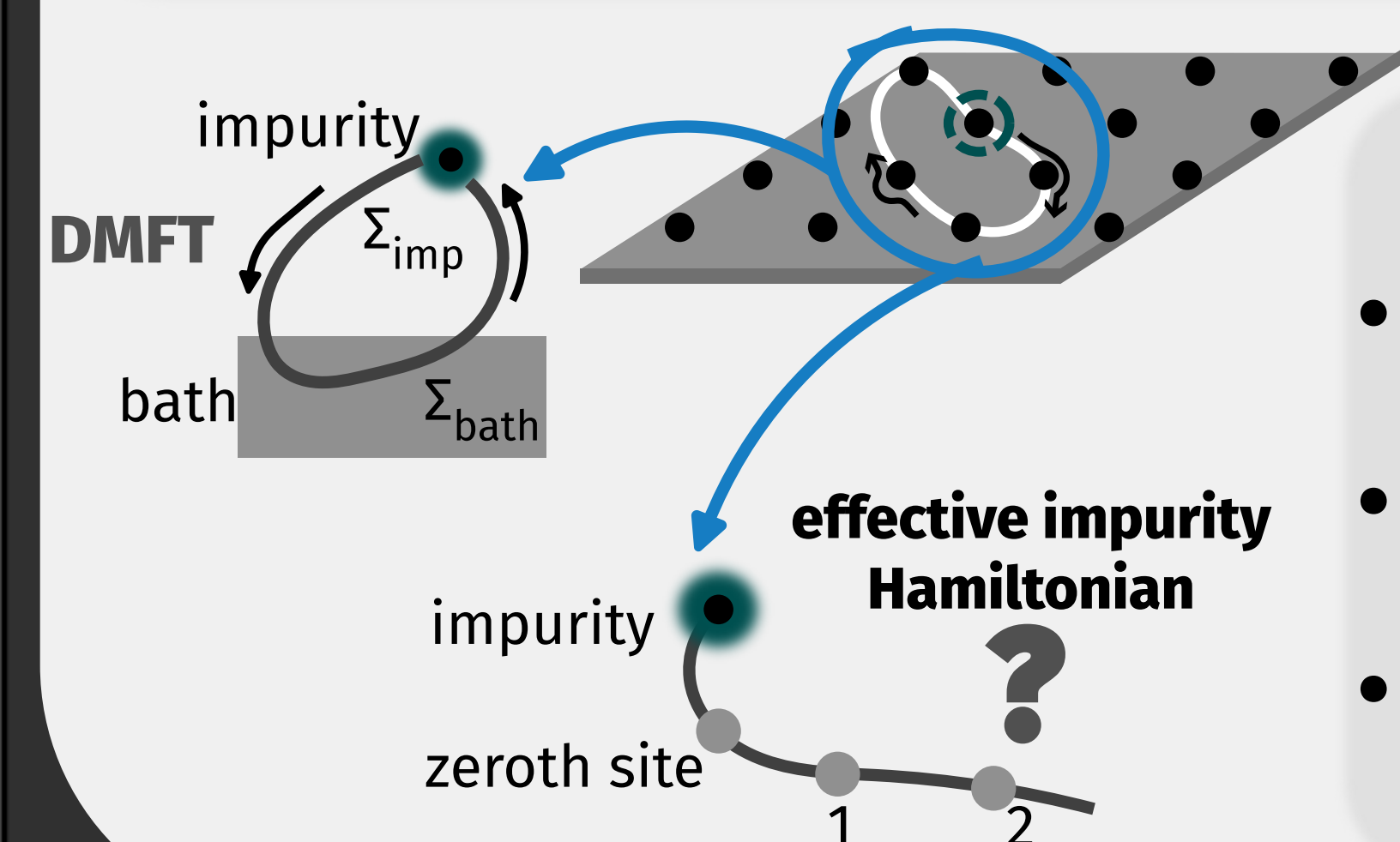
## Local metal-insulator transition

Tuning the system gaps the impurity spectral function



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