Quantum phase transitions in impurity models: What is needed to spoil the quantum-to-classical correspondence?

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Quantum phase transitions are often found to be equivalent to classical phase transitions in higher dimensions. The talk will discuss this quantum-to-classical correspondence for quantum impurity models which provide interesting realizations of boundary critical phenomena at T=0.
For instance, the physics of both the standard Kondo model and the ohmic spin-boson model can be mapped onto an Ising chain with 1/r^2 interaction.

I will focus on both fermionic and bosonic generalizations of these models. For the pseudogap Kondo model, with a power-law density of states of bath fermions, none of the critical theories is of Landau-Ginzburg-Wilson type, instead all are found to be of fermionic nature.
In contrast, the sub-ohmic spin-boson model follows the quantum-to-classical correspondence. Most interestingly, an XY-symmetric two-bath generalization of the spin-boson model displays a rich variety of phases and phase transitions, beyond any classical model.
This violation of the quantum-to-classical correspondence is shown to be connected to a "sign problem" of negative Boltzmann weights. Thus, symmetries are found to be decisive for the quantum-to-classical correspondence to hold.