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Diagrammatic analysis of Anderson's orthogonality catastrophe

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The study of the Fermi-edge singularity in x-ray absorption spectra of metals is a paradigmatic fermionic model, which exhibits logarithmic divergences in perturbation theory. Thus, it offers a playground for different diagrammatic approximations. It has been shown that a summation of parquet diagrams and, even more restricted, a 1-loop fRG approach are sufficient to include all leading-logarithmic terms of the model. Our motivation is to investigate the model beyond that and give a diagrammatic description of Anderson's related orthogonality catastrophe. For this, we developed a parquet solver using Matsubara formalism, which includes all components of the four-point vertex in a theory with two particle types. The recently introduced single-boson exchange (SBE) decomposes the four-point vertex into diagrams with lower frequency dependences simulating effective bosonic interactions. We make use of the SBE decomposition and show that multi-boson exchange (MBE) diagrams need to be taken into account in order to correctly include all the leading-logarithmic contributions of the model.

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