

# Spectral Functions of Lorentzian Quantum Gravity

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The asymptotic safety scenario, according to which a quantum field theory of gravity is made non-perturbatively renormalizable via an interacting renormalisation group fixed point, is a viable contender for the theory of quantum gravity.

Using modern functional RG methods adapted to Lorentzian signatures, we compute the asymptotically safe non-perturbative Kallen-Lehmann spectral functions for all graviton modes. To that end, we determine the interacting UV fixed point in Lorentzian signature, find UV-IR trajectories that connect to a general-relativity regime, and solve a coupled system of running Kallen-Lehmann spectral representations. The resulting spectral functions are compatible with causality and unitarity. They provide direct access to the full quantum propagators and the quantum effective action up to quadratic order in the curvature. Renormalisation schemes that simplify the RG flows are identified, which paves the way for the computations of non-perturbative scattering amplitudes directly in Lorentzian signatures.

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