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Spectral Functions in Banks-Zaks QCD

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The question of unitarity in perturbatively non-renormalisable field theories such as asymptotically safe quantum gravity is notoriously difficult to answer. A possible way to make progress lies in analysing spectral functions given by the Källén-Lehmann representation of the propagator. For spectral functions of scalar quantities, unitarity requires positive definiteness as well as normalisability. Such properties or even the existence of the Källén-Lehmann representation are however not clear for gauge fields or the graviton. To address these difficulties, we consider QCD in the Banks-Zaks phase which allows studying spectral functions of all elementary fields analytically using perturbative methods. In particular, this gives access to the propagator in the whole complex plane, which is difficult to achieve using conventional ERG methods. We analyse existence properties of spectral functions and test whether they fulfil positive definiteness and normalisability due to unitarity. Implications for spectral functions of conventional QCD or quantum gravity are discussed.

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