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Loops, Recursions, and Soft Limits for Fermionic Correlators in (A)dS

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Study of correlation functions in AdS/CFT and in-in correlators in de Sitter space often requires the computation of Witten diagrams. Due to the complexity of evaluating radial integrals for these correlators, several indirect approaches have been developed to simplify computations. However, in momentum space, these methods have been limited to fields with integer spin. Here, we formulate tools for evaluating Witten diagrams with spin- $1/2$ fields in momentum space and discuss where they differ from the corresponding integer-spin analysis. We formulate our tools explicitly for massless fermions and present how appropriate Weight shifting operators with respect to the external kinematics can be used to obtain the generalization to fermions with integer mass. Further, we classify the nature of IR divergences encountered for interacting massive scalars and fermions. We also prove a novel Weinberg-like soft theorem for gauge fields coupled to matter in AdS and show that the universal terms in the leading soft factor are sensitive to the spin of the matter field. These generalize the recently discovered soft theorems for pure Yang-Mills to Yang-Mills with matter.

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