

UV asymptotics of the generating functional of correlators of superfield twist-2 operators in $\mathcal{N} = 1$ SYM theory

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We provide a new construction of superfield collinear twist-2 operators as infinite-dimensional, irreducible representations of the collinear superconformal algebra in the zero-coupling limit of $\mathcal{N} = 1$ supersymmetric Yang-Mills (SYM) theory in a manifestly gauge-invariant and supersymmetric-covariant fashion. This construction makes manifest their mixing and renormalization properties at one loop. We compute their asymptotic renormalization-group improved generating functional in Euclidean superspace and its planar and leading nonplanar large- N expansion. We verify that the leading nonplanar asymptotic RG-improved generating functional matches the structure of logarithm of a functional superdeterminant of the corresponding non-perturbative object arising from the glueball/gluinoball effective action, which it should be asymptotic to at short distances because of the asymptotic freedom. Hence, our large- N computation sets strong ultraviolet asymptotic constraints on the nonperturbative solution of large- N $\mathcal{N} = 1$ SYM theory that may be a pivotal guide for the search of such a solution.

Primary authors: SCARDINO, Francesco (Istituto Nazionale di Fisica Nucleare); SANTONI, Giacomo (Istituto Nazionale di Fisica Nucleare)

Presenter: SANTONI, Giacomo (Istituto Nazionale di Fisica Nucleare)

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