Comments

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Comment on "Multiloop integrals, counterterms, and renormalization of Yang-Mills theories in the light-cone gauge"

A. Bassetto
Dipartimento di Fisica "G. Galilei," Universitá di Padova, Istituto Nazionale di Fisica Nucleare, Sezione di Padova, Italy

R. Soldati
Dipartimento di Fisica "A. Righi," Universitá di Bologna, Istituto Nazionale di Fisica Nucleare, Sezione di Padova, Italy

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Some statements, which appeared in the quoted paper, containing an unjustified criticism of previous results obtained by the authors, are confuted also in the light of further existing literature.

First of all we disagree with the statement[1] that the principal-value (PV) prescription is well suited for axial gauges $nA=0$ with $n^2\neq 0$. There are indeed well-known inconsistencies related to the conflict betwen the positivity of the polarization tensor in the residue of the vector propagator (unitarity) and the need of interpreting the spurious double pole as the derivative of the PV. For discussions on this point and for Wilson loop calculations which exhibit such inconsistencies, see Refs. 2–10. Quite apart from that, we stress that the proof of renormalization in the light-cone gauge we have given in Ref. 11 is indeed at all orders [for further explanations see the papers (Refs. 12 and 13) the present authors do not quote]; as a matter of fact, at one loop the result is known explicitly. Our result at all orders (to call it an "ansatz" is too big a praise to our skill; it was instead the outcome of a tough investigation) is *exactly confirmed* by the present authors [compare their Eqs. (1.5) and (3.22) with our Eqs. (5.8) and (5.11), respectively], which however claim[1] that our proof was based on a theorem which is not valid in the multiloop case. We think it should be their task to explain carefully to which theorem they refer and why and where such a theorem fails, were it the case. On the contrary the argument they use contains inaccuracies. For instance it is not true that the right-hand side of Eq. (2.15) as it stands, has no pole at $nl_1=nl_2$, as can be checked in the simple example:

$$\mathrm{div}\int \frac{d^{2\omega}k}{k^2}\frac{1}{nk+nl_1}\frac{1}{nk+nl_2} = -\frac{2i\pi^2}{2-\omega}\frac{n^*(l_2-l_1)}{n(l_2-l_1)}\frac{1}{nn^*}\,.$$

Nevertheless their final outcome [Eqs. (1.5) and (3.22)] is correct.

Then it might be interesting to realize that our conclusion can be reached by a somehow different path of reasoning and it is gratifying to know that the renormalization procedure in the light-cone gauge seems to be definitely settled.

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