Missing Stefano

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The master formula for the logarithmic integrals in the "regular" part is:

$$g_{(v)}(\lambda) \equiv \int_0^\infty \frac{dq^2}{q^2}\, R\!\left(\frac{q^2}{M^2}\right) \left(\frac{q^2}{M^2}\right)^\lambda = \frac{1}{\lambda^2}\left[\frac{\Gamma^2(1+\lambda)}{\Gamma(1+2\lambda)} - 1\right] = -\zeta_2 + 2\zeta_3\lambda + \frac{1}{2}(\zeta_2^2 - 7\zeta_4)\lambda^2 + \dots$$

$$1 + \lambda \ln\!\left(\frac{q^2}{M^2}\right) + \frac{1}{2}\lambda^2 \ln^2\!\left(\frac{q^2}{M^2}\right) + \dots$$

Treatment of the "singular" part:

reinsert original notation

$$\int_0^{M^2} \frac{dq^2}{q^2}\, a_\varepsilon(q^2) \ln\frac{M^2}{q^2} = \int_0^{M^2} \frac{dq^2}{q^2}\, \tilde{a}(\alpha_s(q^2); \varepsilon) \ln\frac{M^2}{q^2} =$$

here, integration over q^2 leads to DOUBLE and SINGLE ε-poles for each power of $\alpha_s(M^2)$

$$= \int_0^{M^2} \frac{dq^2}{q^2}\, \underbrace{\tilde{a}(\alpha_s(q^2); \varepsilon = \beta(\alpha_s(q^2)))}_{\text{cusp anomalous dimension } A_\gamma(\alpha_s(q^2))} \ln\frac{M^2}{q^2} \; +$$

add and subtract $\varepsilon = \beta(\alpha_s)$

→ this term leads to DOUBLE and single ε-poles: its structure is similar to analogous term in ε-POLES of VIRTUAL Amplitudes

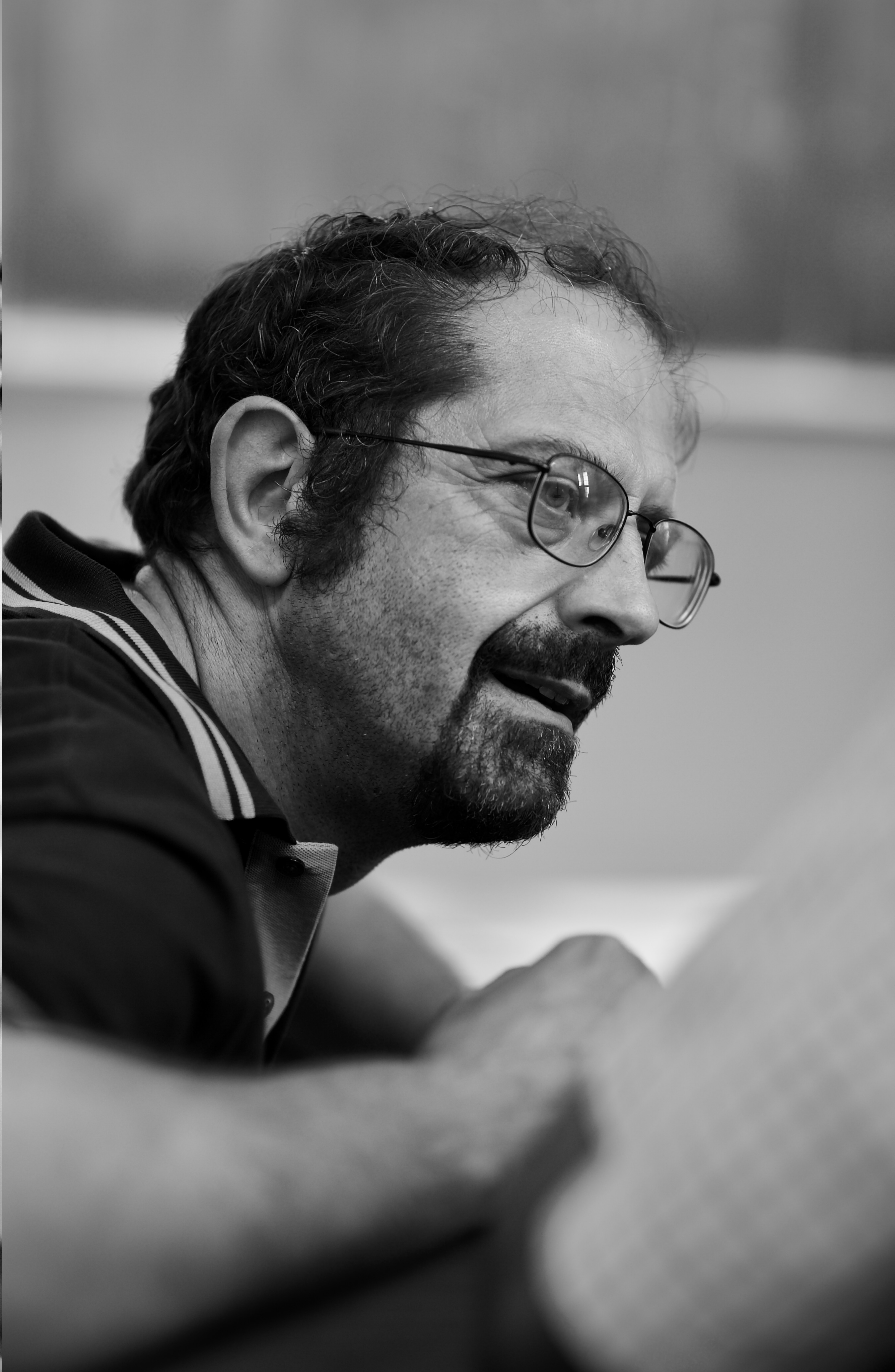
$$+ \int_0^{M^2} \frac{dq^2}{q^2} \left[\tilde{a}(\alpha_s(q^2); \varepsilon) - \tilde{a}(\alpha_s(q^2); \varepsilon = \beta(\alpha_s(q^2)))\right] \ln\frac{M^2}{q^2}$$

this term should lead to SINGLE ε-poles and regular terms in ε

$\Rightarrow$ the single ε-poles should be recasted in a form that is similar to that of the ε-POLES of VIRTUAL Amplitudes

Stefano at GGI

thanks to Yuri Dokshitzer


What about SCET?