Which QED truncations control Borel singularities?

Edwyn Tecedor
LPTHE • Sorbonne Université • CNRS • IPSA

1 Ward closure in QED

$$\Gamma^\mu = A\gamma^\mu + B\frac{p^\mu \not{p}}{p^2}, \quad B = 2DA$$

Two tensor structures must match.

Here $A(a,L) = G^{-1}(a,L)$, with $S^{-1}(p) = \not{p}\, G^{-1}(a,L)$.

2 Tensorial Mellin reduction

$$\mathcal{M}^\mu(x,y) = \mathcal{S}(x,y)\left[H_C(x,y)\gamma^\mu + H_L(x,y)\frac{r^\mu \not{r}}{r^2}\right]$$

The QED numerator produces two reduced Mellin coefficients.

Poles: x = 1, y = 1, x+y = −2, x = −2, x = 2

3 Ward test

$$\Delta(x,y) = H_L(x,y) - 2H_C(x,y) \neq 0$$

Not a Ward violation: a truncation diagnostic.

At linear order, $f_z = -2\gamma \Rightarrow$ multiplication by $-2x$

$$G(a,L) = 1 - \textstyle\sum_{n\geq 1}\gamma_n(a)L^n, \qquad L = \log(p^2/\mu^2).$$

Why this matters

$$(\partial_L - \beta_0\xi)\widehat{G} = \widehat{\gamma} + \widehat{\gamma}\star\widehat{G} + \widehat{\beta}'\star(\xi\widehat{G})$$

Resurgence asks which missing WSD terms change the leading Borel singularities, and which only enter at higher orders.

Come to the poster: QED Mellin coefficients, Ward closure and Borel-plane RG