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Positive-definite gluon fragmentation into quarkonia

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We revisit the fragmentation processes $g \to \chi_{cJ}+g$, $g \to \eta_c+g$, $g \to J/\psi+g+g$ and propose and alternative method to regularize the infrared and collinear divergencies. We argue that the conventional technique (i.e., the dimensional regularization) are unphysical, as they expand the perturbation theory beyond its applicability limits. At the same time, the conventional calculations ignore some important physical phenomena, such the finite size of the quarkonium bound states and the presence of confinement. The latter ones can take credit for a physical rather than mathematical reasoning for the regularization. We propose a simple semi-phenomenological method that restores the physical behavior of all fragmentation functions making them positive-definite, smooth, and vanishing at the endpoints D(z=1) = D(z=0) = 0.

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