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Gluon fragmentation functions in the NJL model

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We derive gluon fragmentation functions in the Nambu-Jona-Lasinio (NJL) model by approximating a gluon as a fictitious color-octet quark-anti-quark ($q\bar{q}$) pair. Gluon elementary fragmentation functions are derived from the quark and anti-quark elementary fragmentation functions for emitting specific mesons in the NJL model under the requirement that the $q\bar{q}$ pair maintains in the flavor-singlet state after meson emission. An iteration method and an inverse matrix method based on the gluon elementary fragmentation functions then yield the gluon fragmentation functions at the model scale. It is found that the resultant gluon fragmentation functions are stable with respect to variation of relevant model parameters, especially after QCD evolution to a higher scale is implemented. We show that the inclusion of the gluon fragmentation functions into the theoretical predictions from only the quark fragmentation functions greatly improve the agreement with the SLD data for the pion and kaon productions in e^+e^- annihilation. Our proposal provides a plausible construct for the gluon fragmentation functions, which are supposed to be null in the NJL model.

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