When The Heavy Quark Jet Bends

Trambak Bhattacharyya¹, Surasree Mazumder¹ and Raktim Abir²

¹VECC, ²SINP and presently at Wayne State University

Approximations of Jet Models

i) Soft energy of radiation ($\omega$) << energy of parent parton (E)

ii) No recoil due to scattering (Eikonal 1) i.e. transverse momentum transfer $q_\perp << E$

and no recoil due to radiation (Eikonal 2) i.e transverse momentum of emission $k_\perp << E$

iii) Collinearity i.e. radiation almost grazes the emitting parton

Relaxing eikonal 1 approximation

The present work relaxes the Eikonal 1 approximation at the level of single emission kernel with the help of the Feynman diagram techniques of pQCD for Heavy Quark-Light Quark single gluon radiative process. Five Feynman diagrams are possible.

The radiation spectrum off the heavy quark considering recoil due to scattering has been found out to be:

$$x \frac{dn_x}{dk_\perp} \propto \frac{1}{k_\perp^2} \times \text{Elastic} \times \left[ \sum_{n=2,1,0} C_n e^{2(n-1)\eta_g} \left( \frac{k_\perp^2}{k_\perp^2 + x^2 M^2} \right)^n \right] \times \text{LPM}$$

$$x = \frac{k_\perp e^{\eta_g}}{\sqrt{s}}; \sqrt{s}: \text{Mandelstam variable} \quad \eta_g: \text{Gluon rapidity}$$


Radiation spectrum non-eikonality

Conclusions

Important for studying transverse momentum broadening

Helps incorporating bending of medium energy jets

Outlook

Multiple scattering and multi-gluon emission

Similar calculation for $Qg \rightarrow Qgg$