Particle Physics

III. Feynman Diagrams

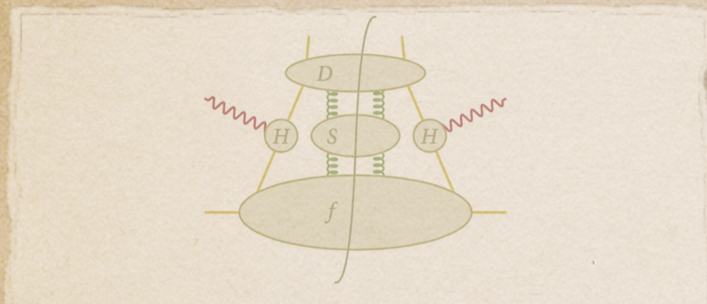


Figure 8.11: Factorisation in SIDIS: the bull diagram. All IR divergences are absorbed in the soft factor S, that hence only interacts with the TMD and FF. Note that

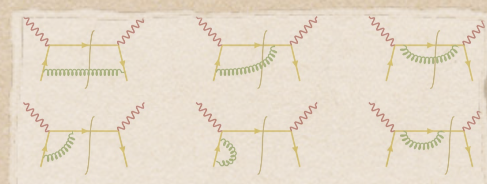
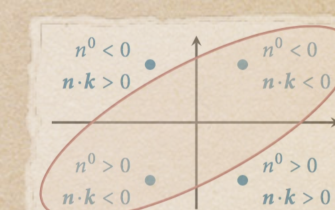
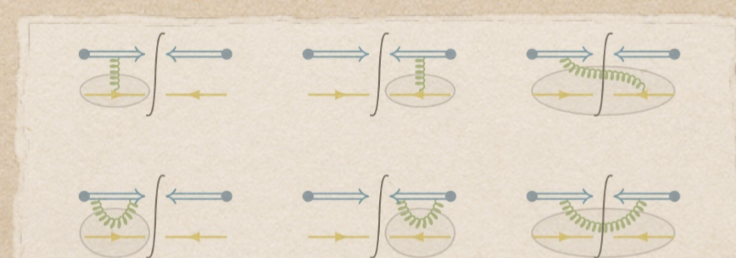


Figure 5.8: All types of first order corrections to the DIS process. Real corrections are on the upper line; virtual on the lower line.

Figure 2.1: As a parallel transporter transforms in function of its path endpoints only, all paths shown will give rise to equivalent $\mathcal{U}_{(y;x)}$'s, shifting a field at x to a field at y.





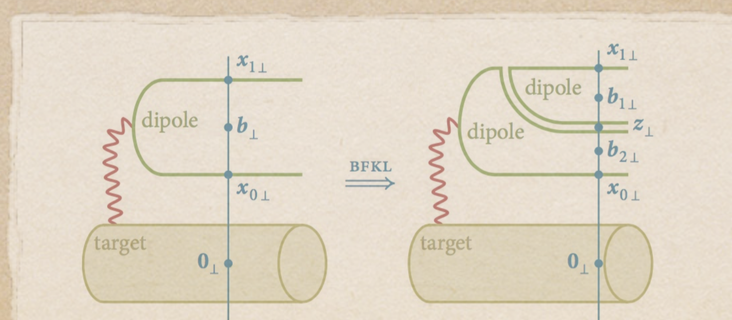


Figure 9.6: In the dipole picture, the BFKL evolution is an evolution in dipoles, i.e. new dipoles are created during the evolution. A gluon that is radiated from the dipole can be represented as two fundamental lines (see Equation 10.13). This essentially splits the dipole in two at the point $z_\perp$, as is illustrated in the second diagram.

$$\oint_C dx \cdot A = \int_\Sigma d\sigma \cdot (\partial \wedge A)$$

and similarly for the seven remaining diagrams.

We list some other common Minkowskian integrals:

Goals

¿ Feynman diagrams ?

¿ Feynman diagrams ?

¿ Feynman diagrams ?

¿ Feynman diagrams ?

→ feel free to interrupt
& ask questions

Feynman Diagrams

- Are an easy visual way to calculate elementary processes

Exercises

- **Draw Feynman diagrams for the following processes using the weak interaction:**

$$\pi^+ \rightarrow \mu^+ + \nu_\mu$$

$$\Lambda \rightarrow p + e^- + \bar{\nu}_e$$

$$K^0 \rightarrow \pi^+ + \pi^-$$

$$\pi^+ \rightarrow \pi^0 + e^+ + \nu_e$$

- **Draw Feynman diagrams for the following processes using the strong interaction:**

$$\omega^0 \rightarrow \pi^+ + \pi^- + \pi^0$$

$$\rho^0 \rightarrow \pi^+ + \pi^-$$

$$\Delta^{++} \rightarrow p + \pi^+$$

S'Cool LAB

Challenge Exercise

CERN

A proton target is hit by a proton beam with momentum $|p|$=12GeV/c. In one specific event, 6 tracks are observed. Two of these point to the interaction point and from their curvature we know these are positively charged particles. The other tracks form two pair of opposite charge. Both pairs are visible only a few cm past the interaction point. It is hence clear that two neutral particles where produced that later decayed into charged particles.

1. Make a sketch of this event
2. Discuss which mesons and baryons would be possible candidates for these decays (use the particle data - mass and lifetime - from the PDG booklet. Look for decay channels into two charged particles)
3. The measured momenta for the two pairs are:
    a. $|p_+|$ = 0.68 GeV/c $|p_-|$ = 0.27 GeV/c θ_{+-} = 11°
    b. $|p_+|$ = 0.25 GeV/c $|p_-|$ = 2.16 GeV/c θ_{+-} = 16°

    with a measurement error of 5%. Calculate the total energy to decide with hypothesis from 2. agrees with these measurements
4. Use these results to draw a Feynman diagram. Is this the only possible solution?