

Insights into the (n)pQCD dynamics

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Summary of the CFNS workshop

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Workshop

CFNS Workshop

Mission

To provide a theoretical and experimental framework for studying
npQCD dynamics

- ▶ Over 90 participants in person and by remote;
- ▶ Cold nuclear matter, jet physics, heavy flavors, Ultra-Peripheral Collisions (UPC) and more
- ▶ A dedicated session on the Electron-Ion Collider (EIC).

Ultra-Peripheral Collisions (UPC)

Physics Interests

- ▶ AA collisions at large $b > 2L_A$;
- ▶ At LO, access to the gluon density;
- ▶ Access to small x values $\sim 10^{-5}$: **unique observable!**

Experiments

- ▶ STAR, LHCb, CMS, ATLAS

Observations

- ▶ Recent results suggest higher shadowing:
 $R_g(10^{-4}, 10^{-3}) \sim 0.6$ and lower at $x \sim 10^{-5}$ (0.4);
- ▶ Small scale ($\mu^2 \sim m_c^2 \sim 2.5$ GeV) compared to pA data;
- ▶ **Propose a complete picture because nPDF should be universal.**

Heavy Mesons and Jet Physics

QCD Medium Effects

- ▶ **Light/heavy mesons suppression** in pA/AA collisions (small $p_{\perp} \sim M$);
 - ▶ Nuclear PDF (nPDF), radiative energy loss, broadening of p_{\perp} , nuclear absorption, etc.
 - ▶ → **still a puzzle!**

- ▶ **Hadron jet quenching** (large $p_{\perp} \gg M$) in AA collisions
 - ▶ Radiative energy loss
 - ▶ → **Great scaling!**

Proposal

- ▶ More discussions between cold and hot physics communities
- ▶ Global analysis by taking into account different variables

Jet Physics

Jet Structure

- ▶ **Probing different time scales:**
 - ▶ Parton shower, hadronization, etc.
 - ▶ Dynamics pQCD (small $t_f \ll 10$ fm) and npQCD (large $t_f \gg 10$ fm)
- ▶ **Constrain high- x behavior of the gluon PDF**
- ▶ **Different (new) observables:**
 - ▶ Absolute cross section as a function of p_{\perp}
 - ▶ Energy correlator
 - ▶ Leading and Next-to-Leading order correlations (r_c)

Next Edition

For the upcoming edition, we aim to:

- ▶ Provide a more extensive space for discussion
- ▶ Compile a list of questions in major domains
- ▶ Reach consensus on observables
- ▶ Establish agreement on various models