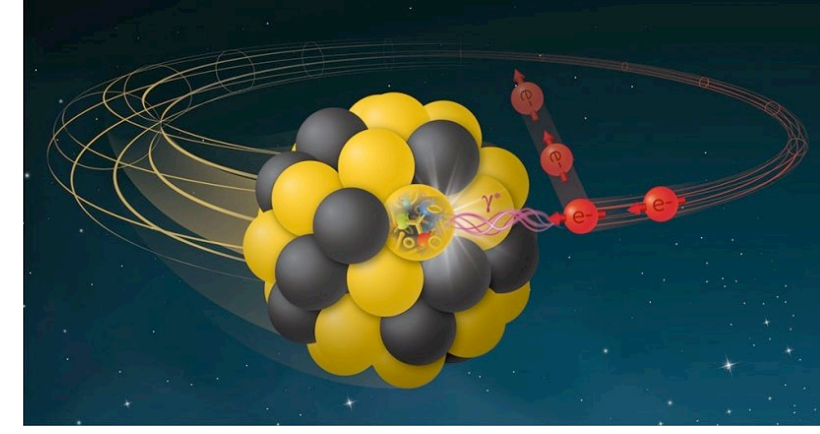
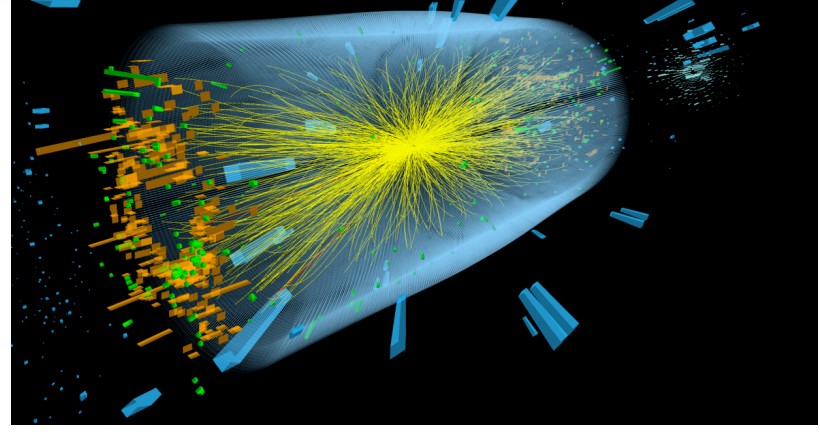
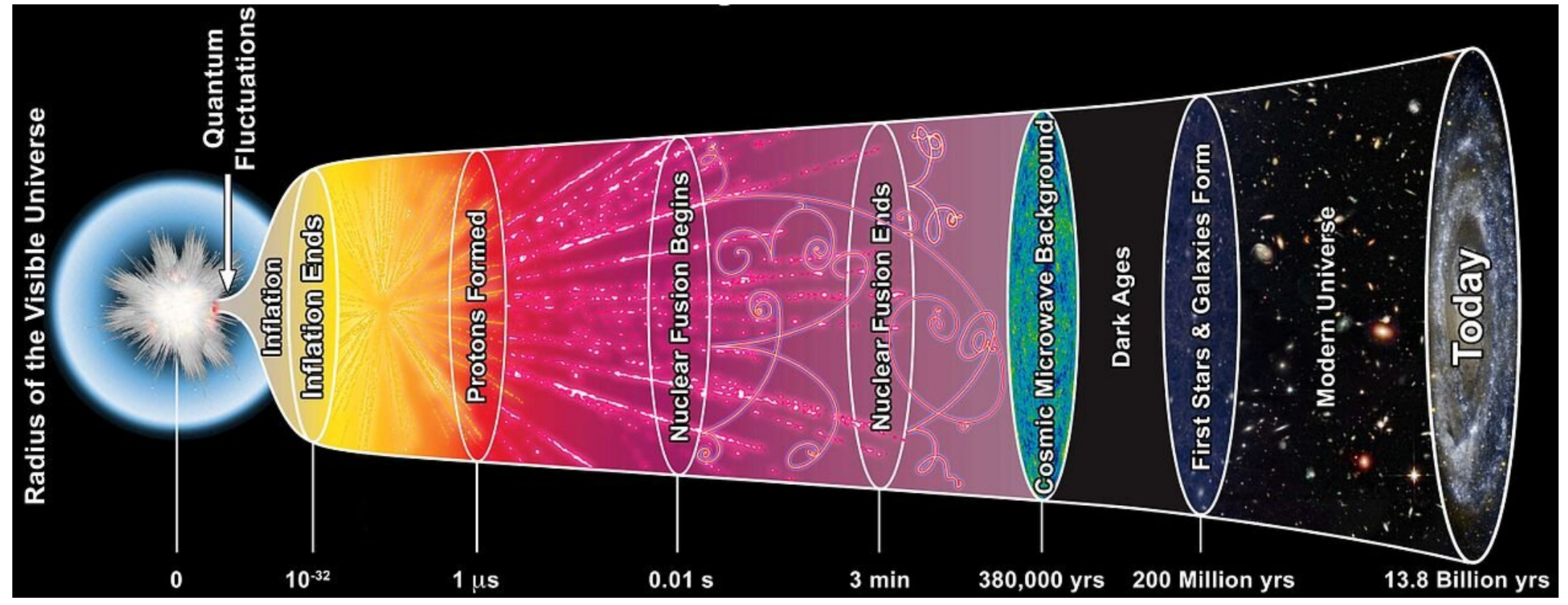


Elucidating the quark & gluon distributions in the nucleon, pion and kaon from Lattice QCD

Raza Sabbir Sufian

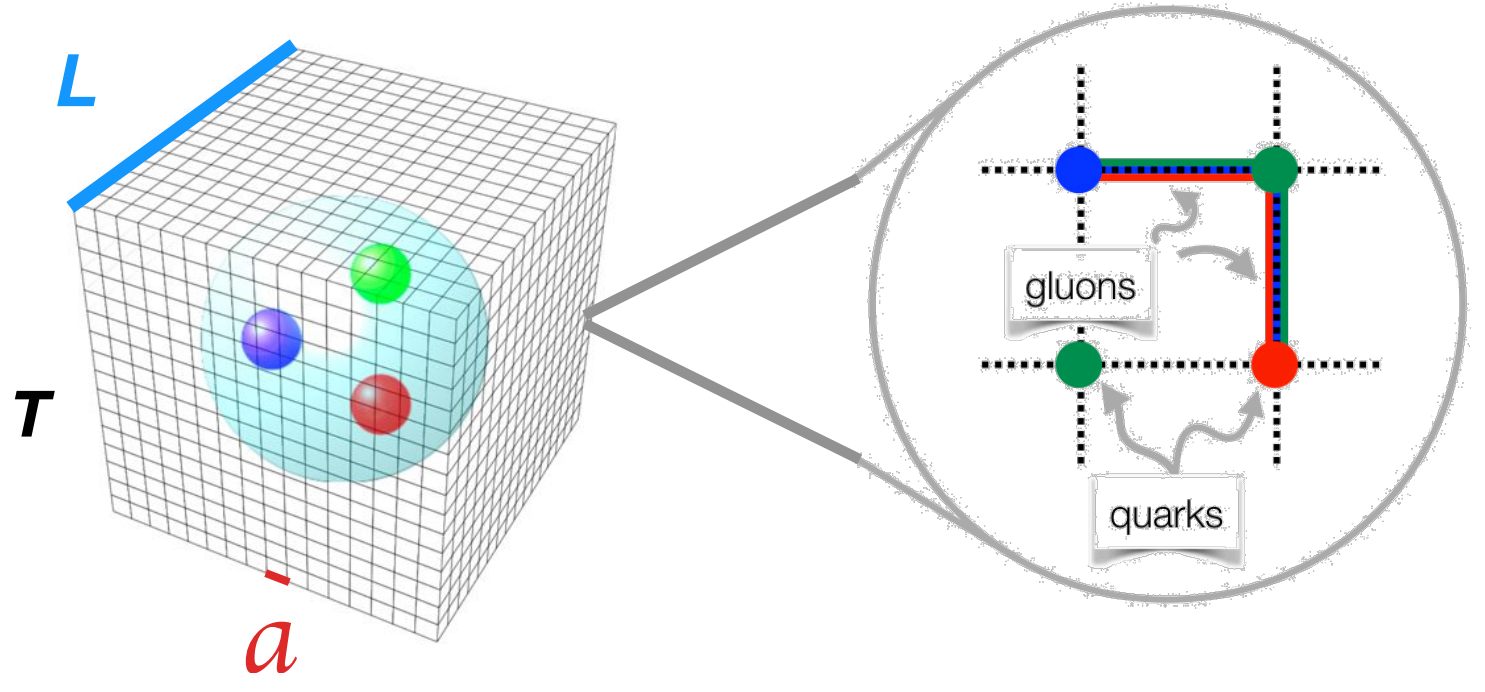
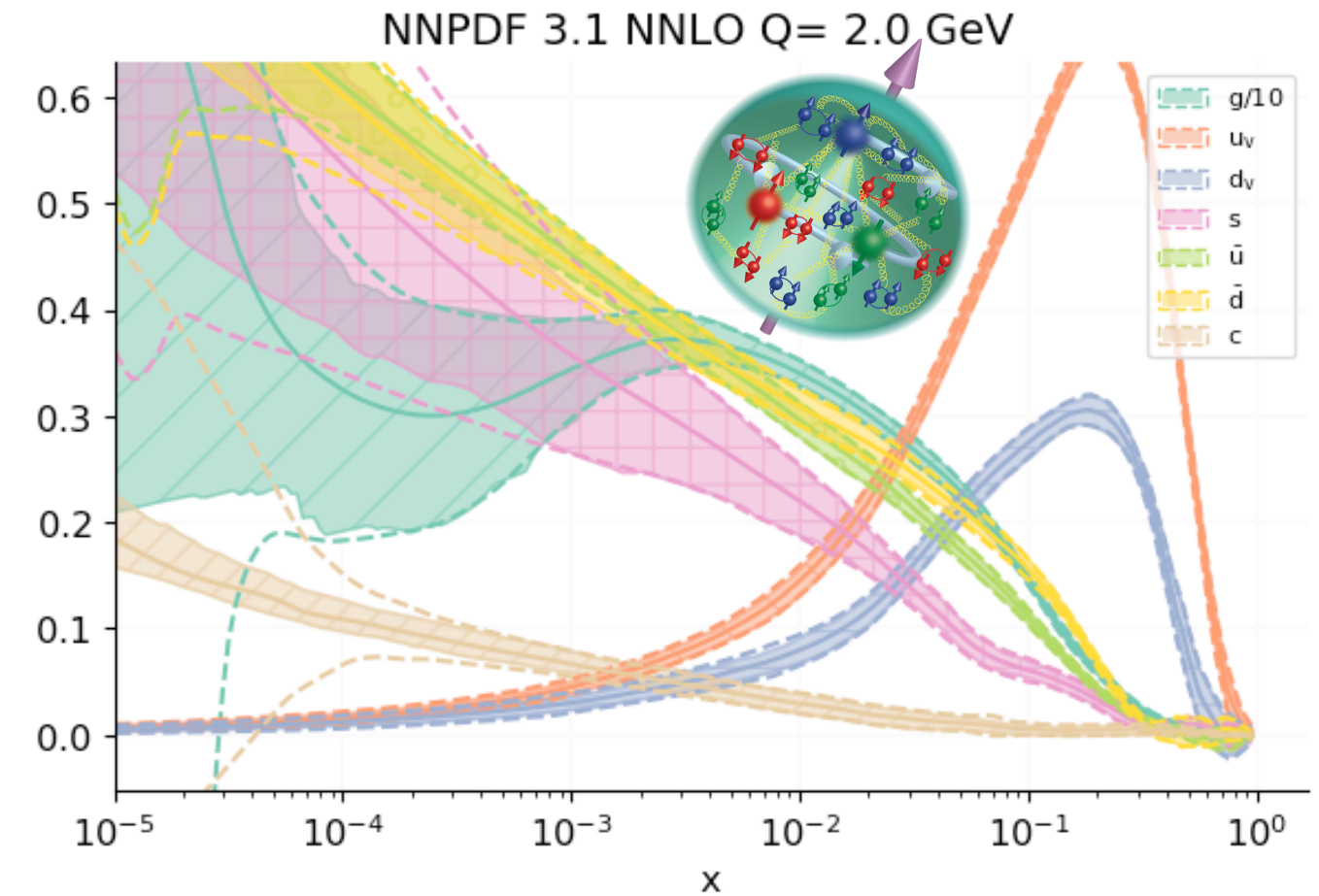


Frontiers of QCD and how Lattice QCD can contribute



● Nonperturbative quark/gluon distributions are essential for

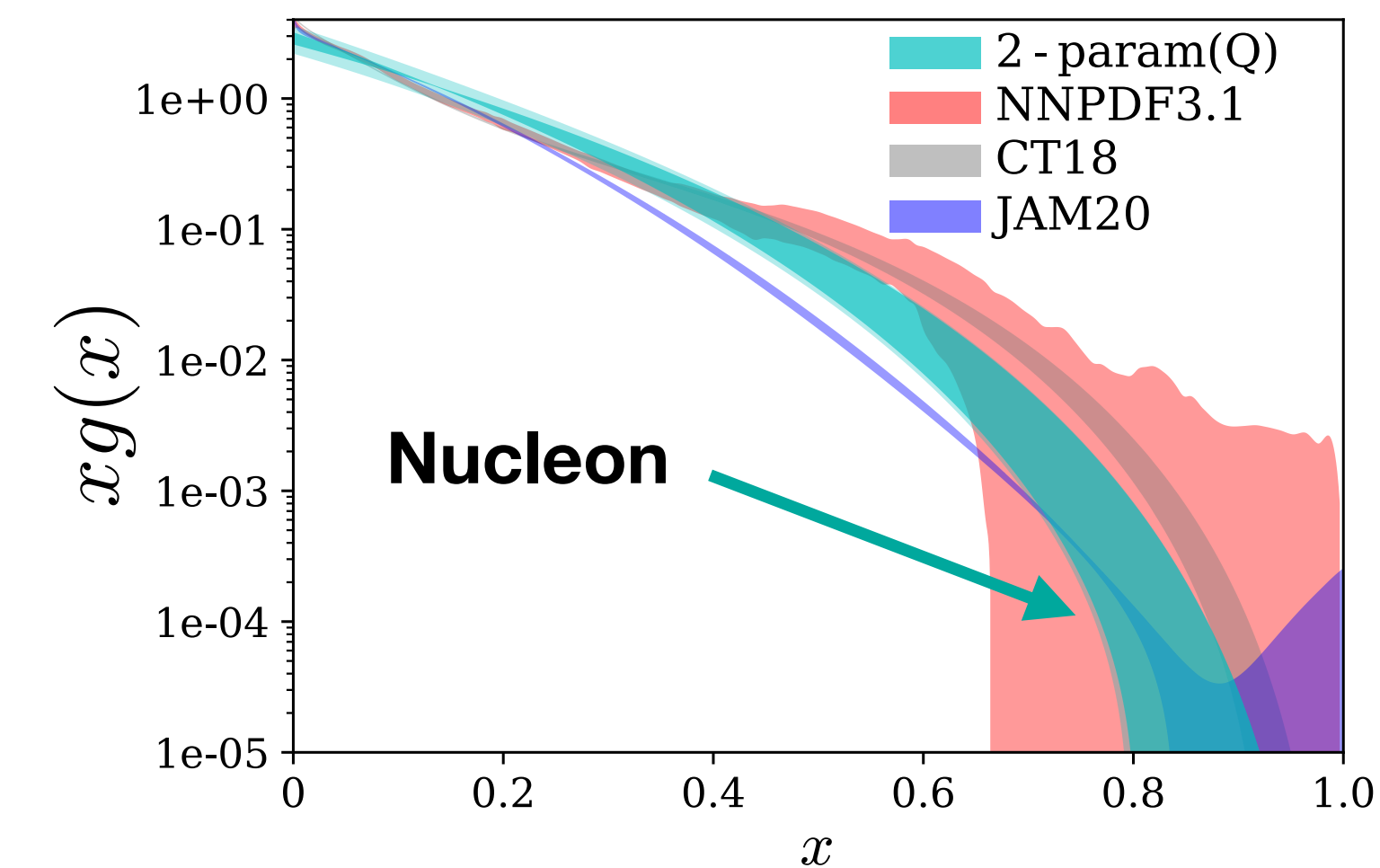
- ▶ predicting/describing outcomes from collider experiments
- ▶ understanding the role of gluon that binds us all



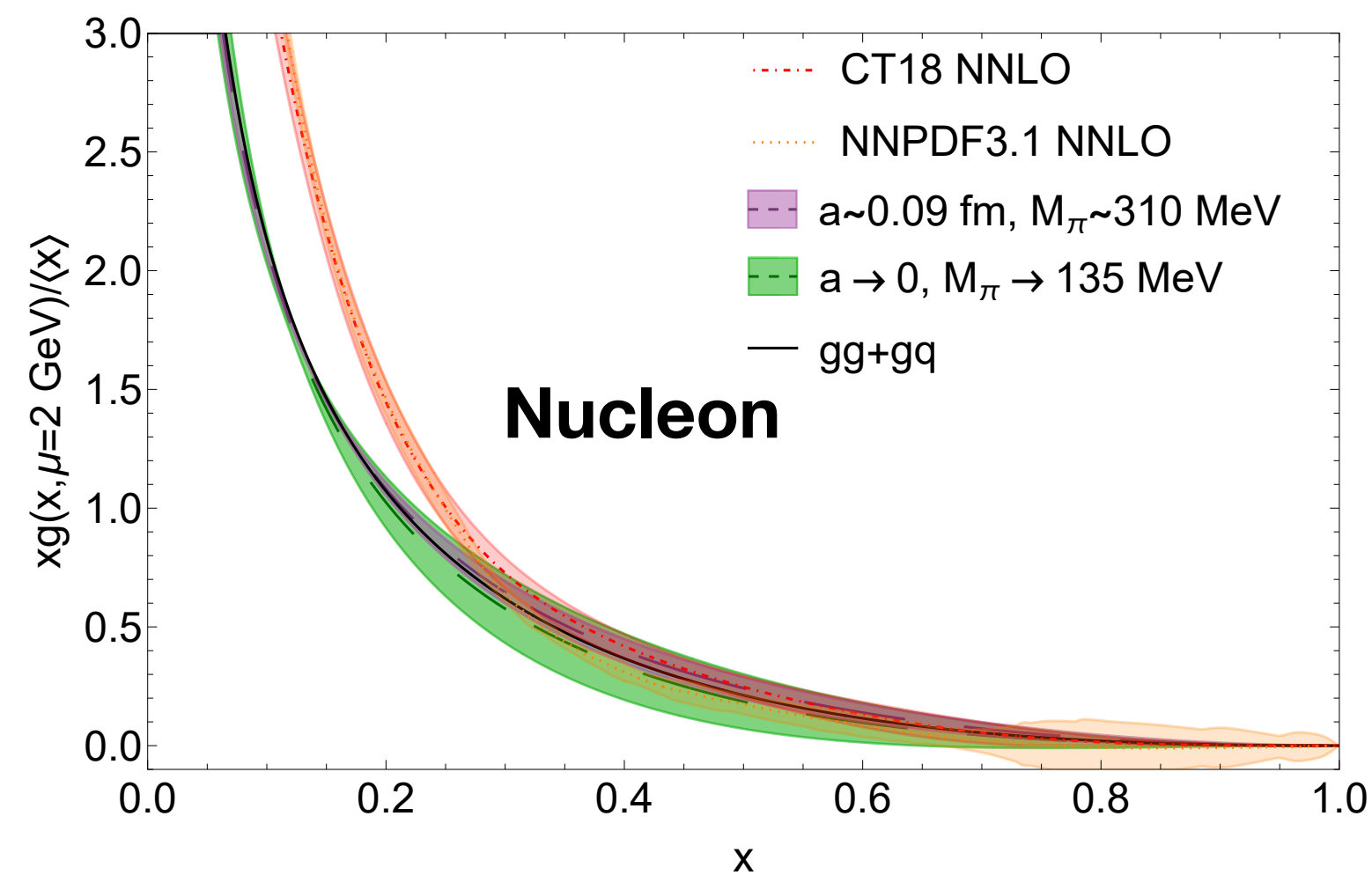
Lattice QCD

Potential impacts of Lattice QCD (e.g. gluon distributions)

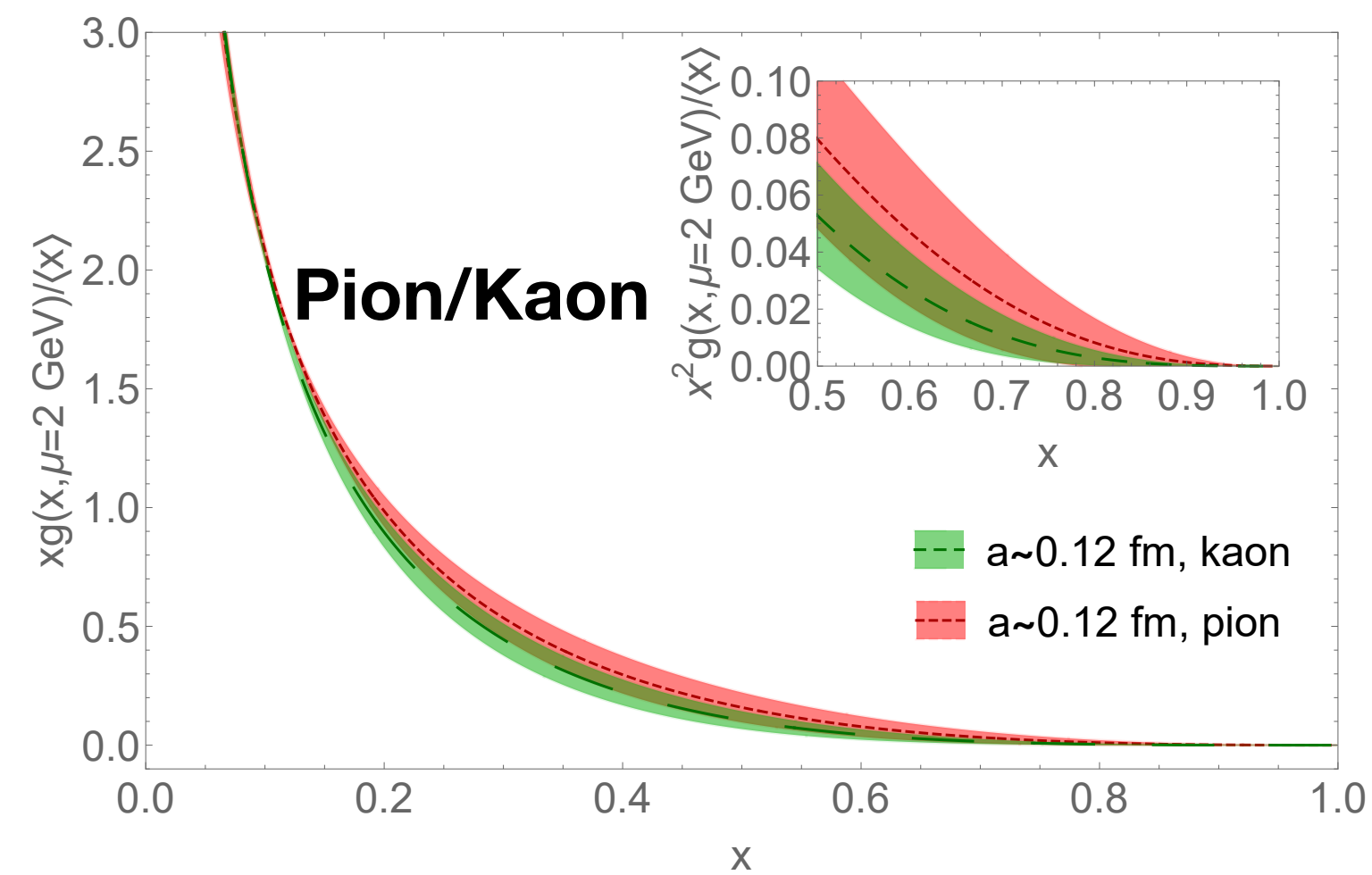
Unpolarized gluon PDF



Khan, RSS, et al (HadStruc)(2021)

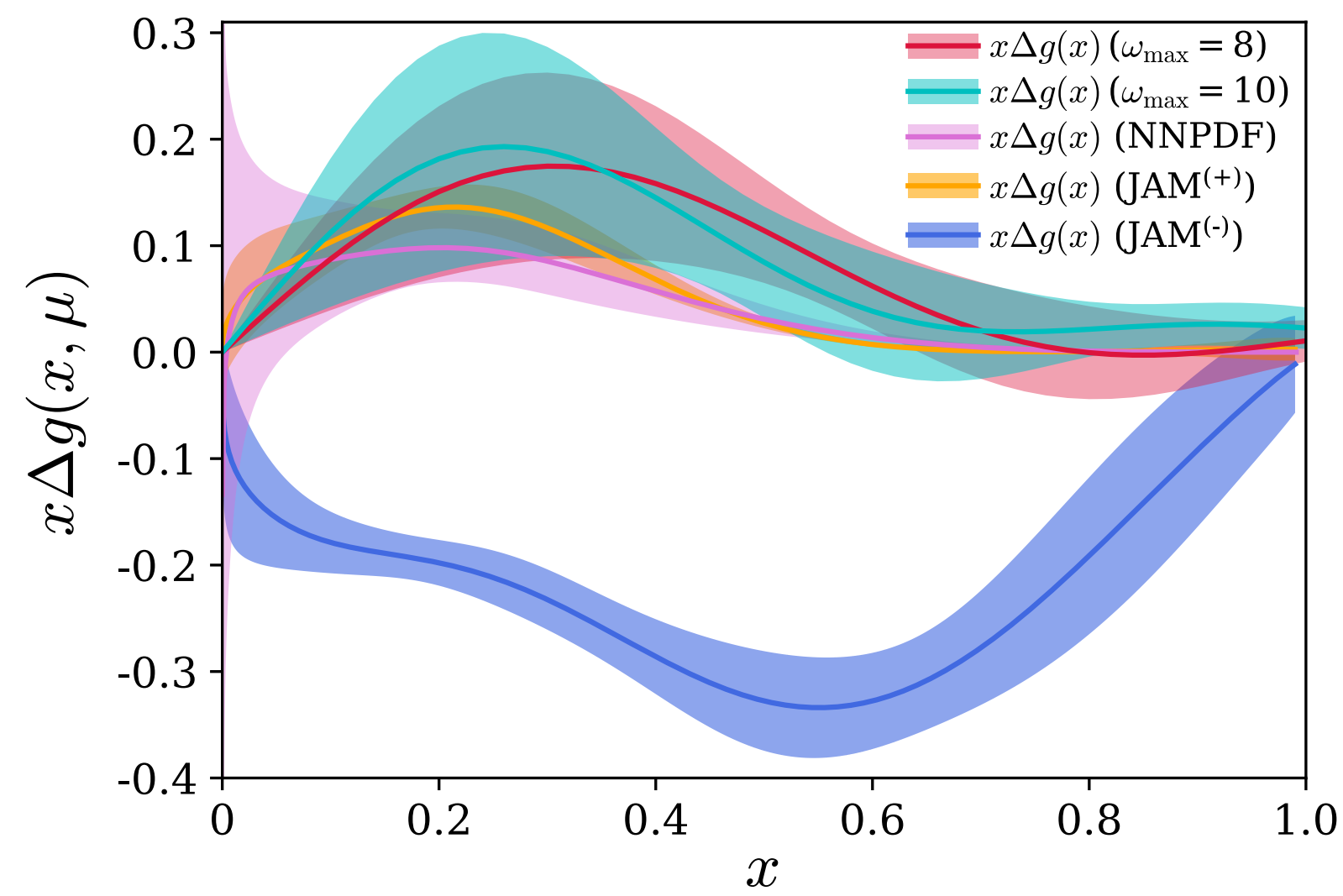


Fan, Lin, et al (MSU Latt)(2022)



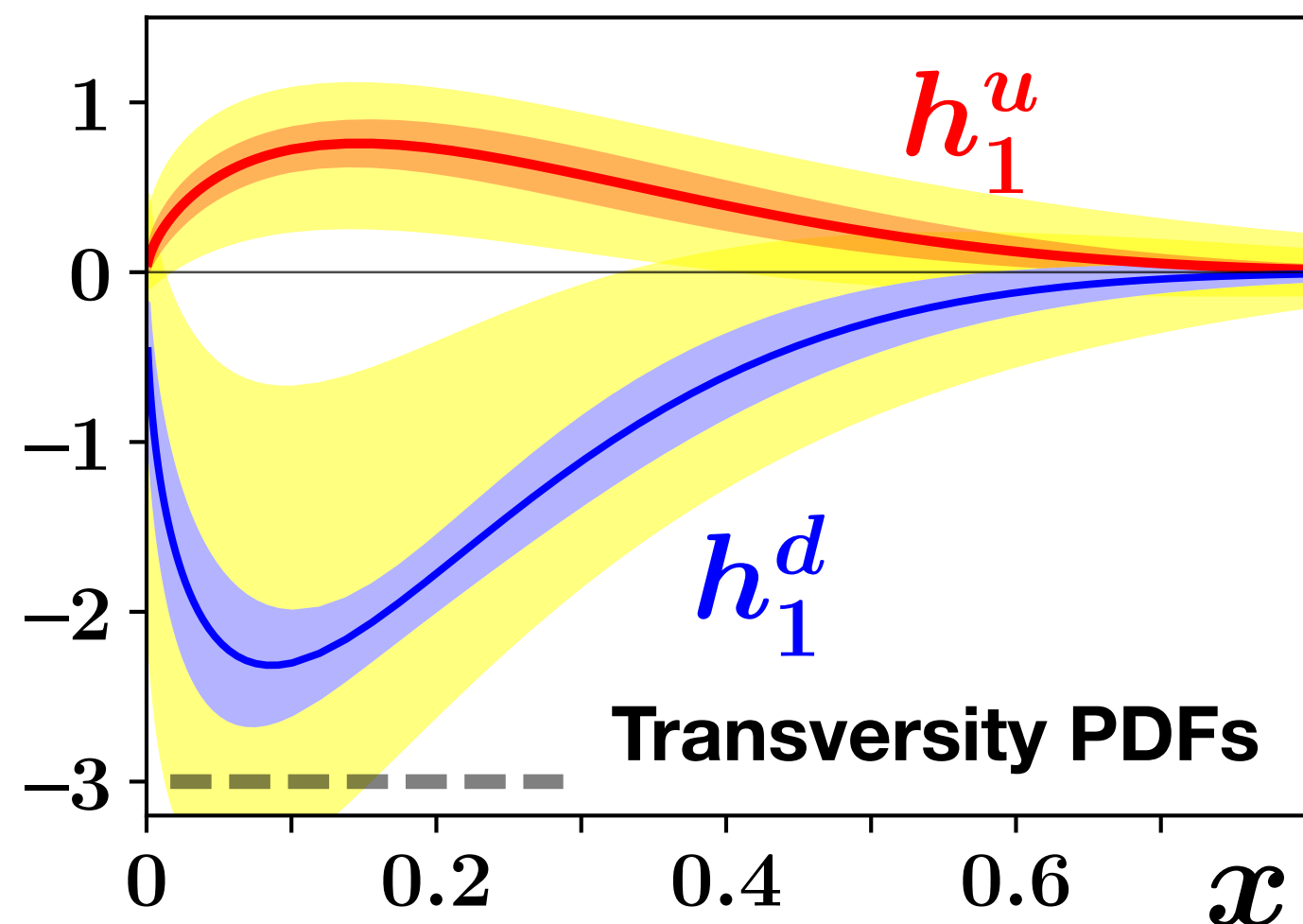
Fan, Lin, et al (2022)

Gluon helicity PDF (Lattice QCD + ML)

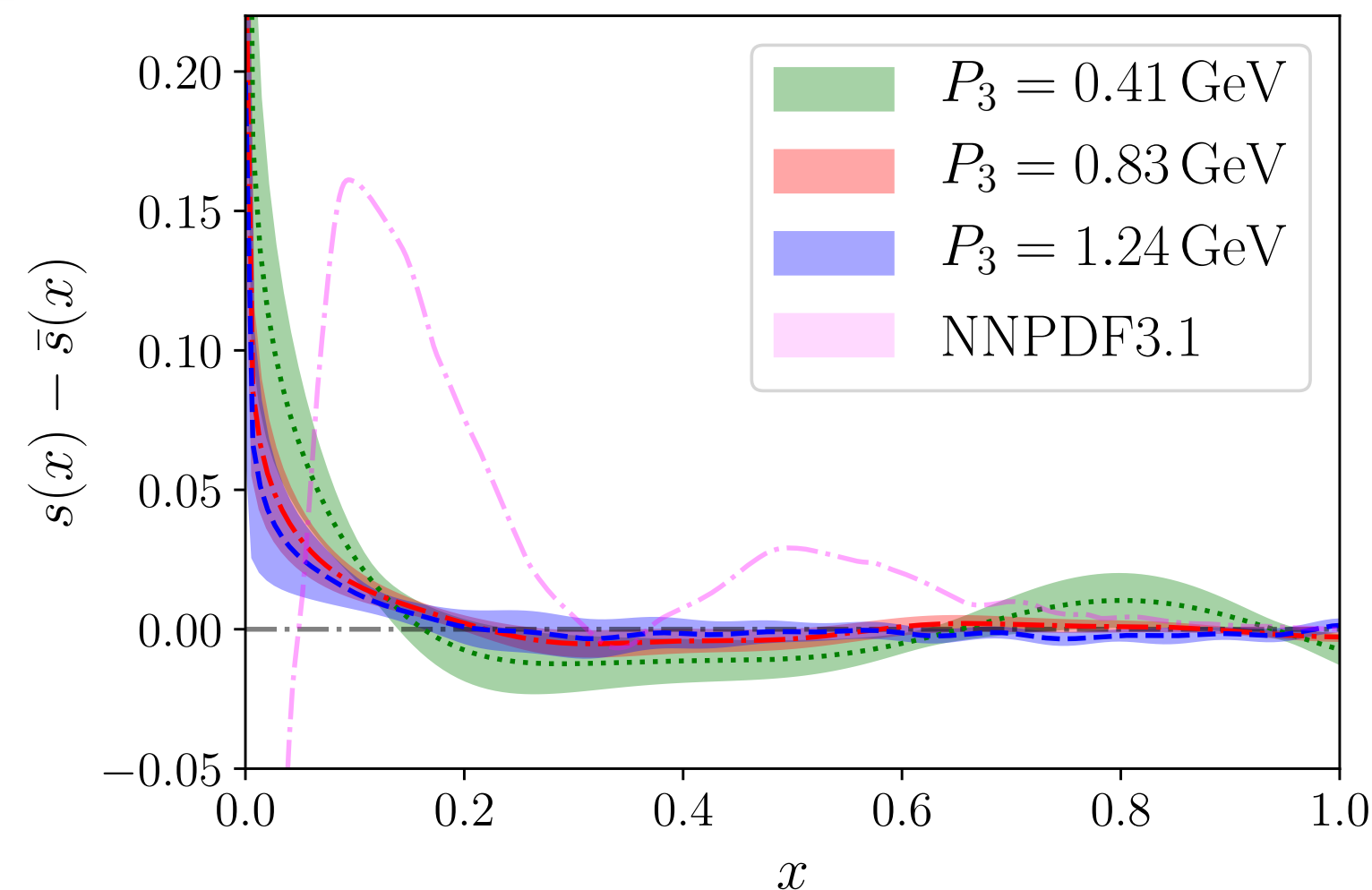


Khan, Liu, RSS (2022)

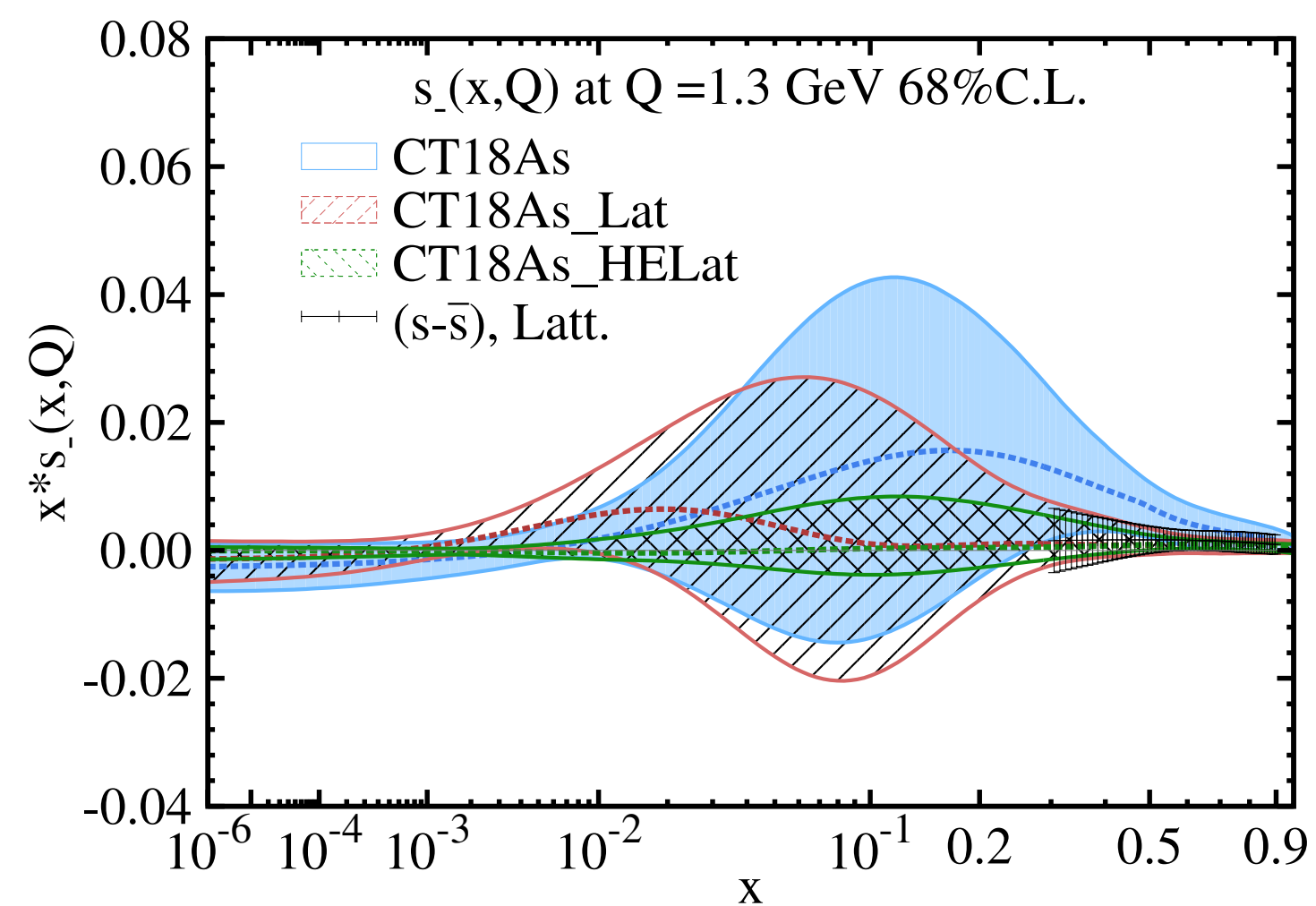
Potential impacts of Lattice QCD on global fits of PDFs



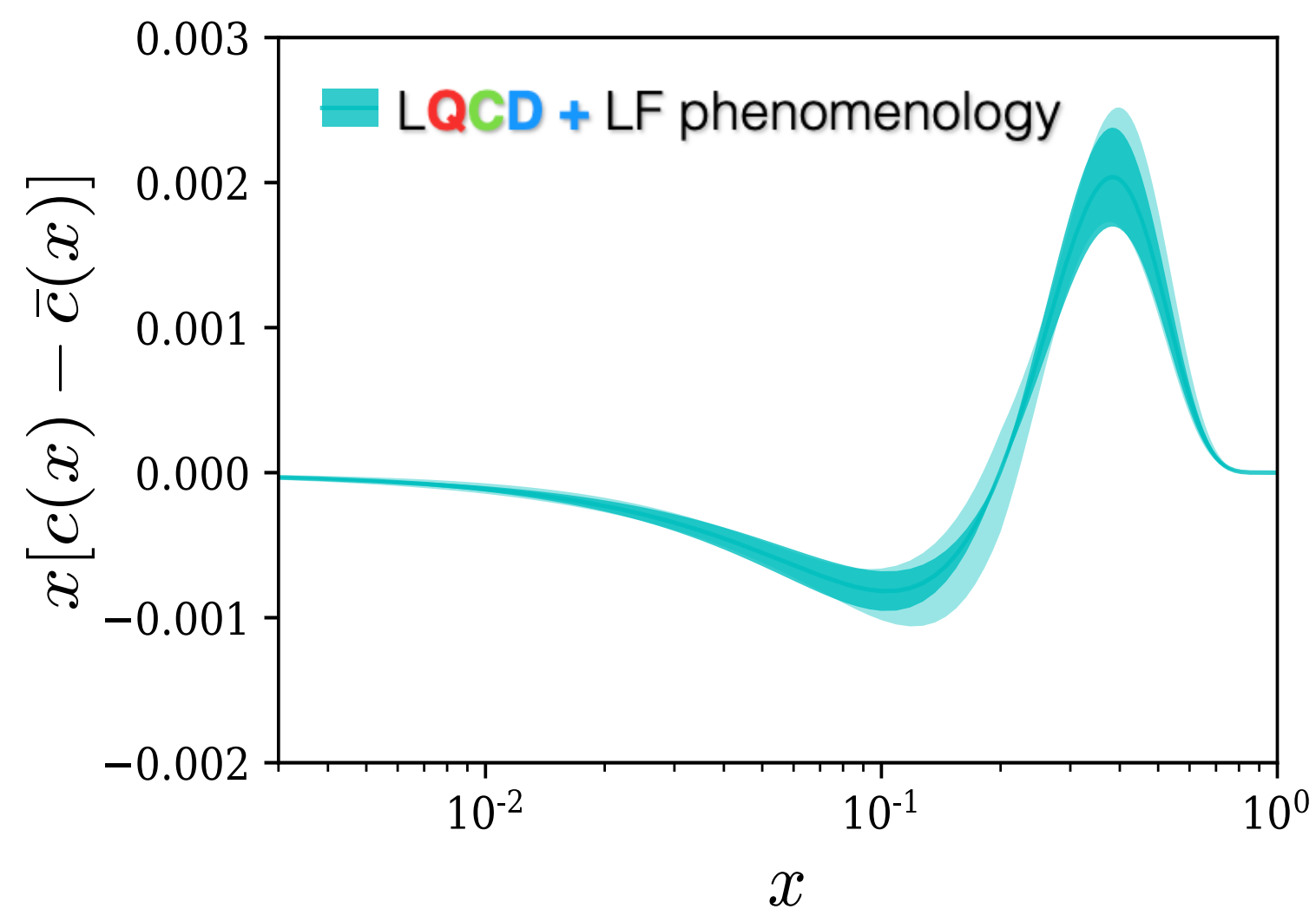
Lin, et al (2018)



Alexandrou, et al (ETMC)(2021)



LQCD + CTEQ-TEA global analysis
[Hou, Lin, et al (2022)]



RSS, Liu, Brodsky et al (2021)

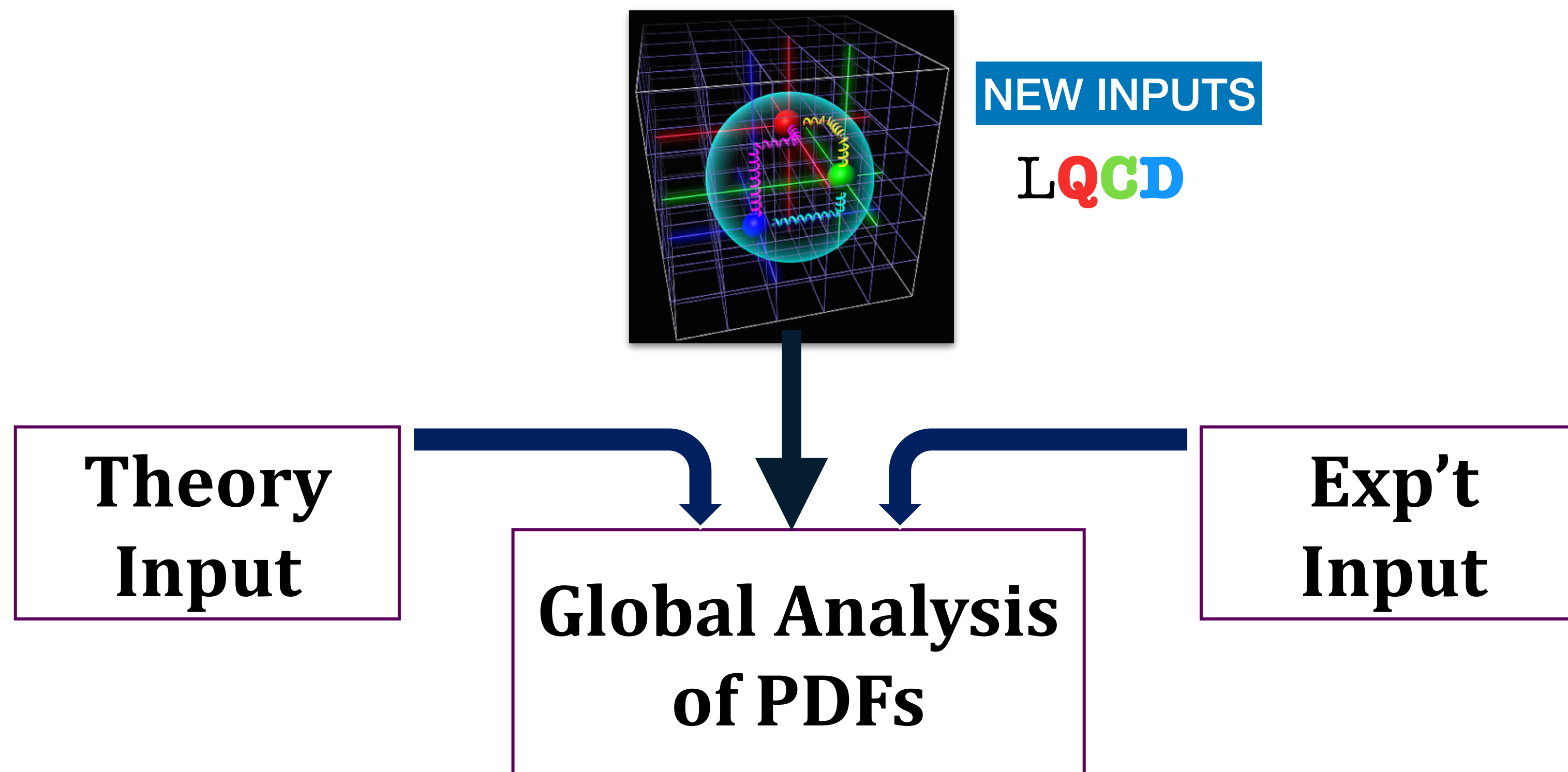
Supported by subsequent LHCb experiment (PRL 2022)

Challenges + Resources



New opportunities + impactful physics insights

- Precision calculation and study of systematics are planned for near future
- ▶ Precision and progress are limited on resources (computing resources, human resources, etc)



- Exciting time for LQCD to study PDFs

For more : Snowmass 2021 whitepaper: Proton structure at the precision frontier

Thank you