INT Program

Precision QCD with the Electron-Ion Collider

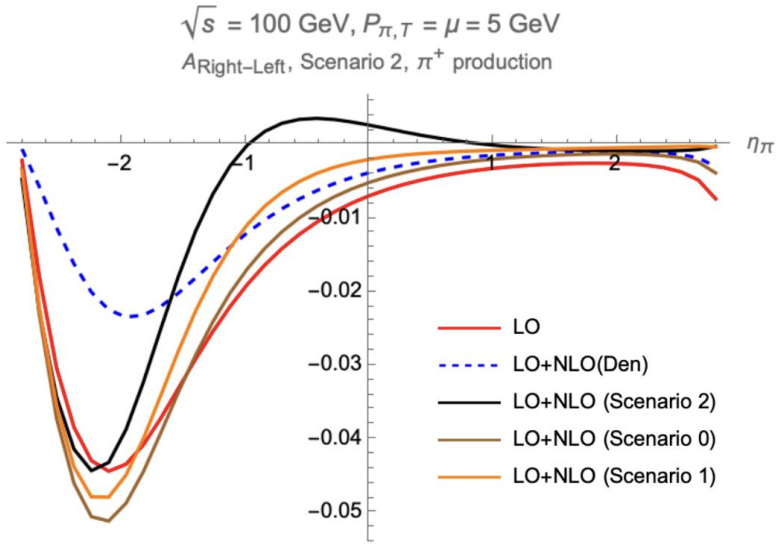
Participant Introductions

Werner Vogelsang (University of Tübingen)

Research interests: QCD corrections, resummation, spin-dependent PDFs

As seen on arXiv:

- Paper 1, NLO corrections and factorization for single-inclusive spin asymmetries (Rein, Schlegel, Tollkühn,WV) 2503.16097
- Paper 2, NNLO global analysis of polarized parton distribution functions (Borsa,de Florian,Sassot,Stratmann,WV) 2407.11635

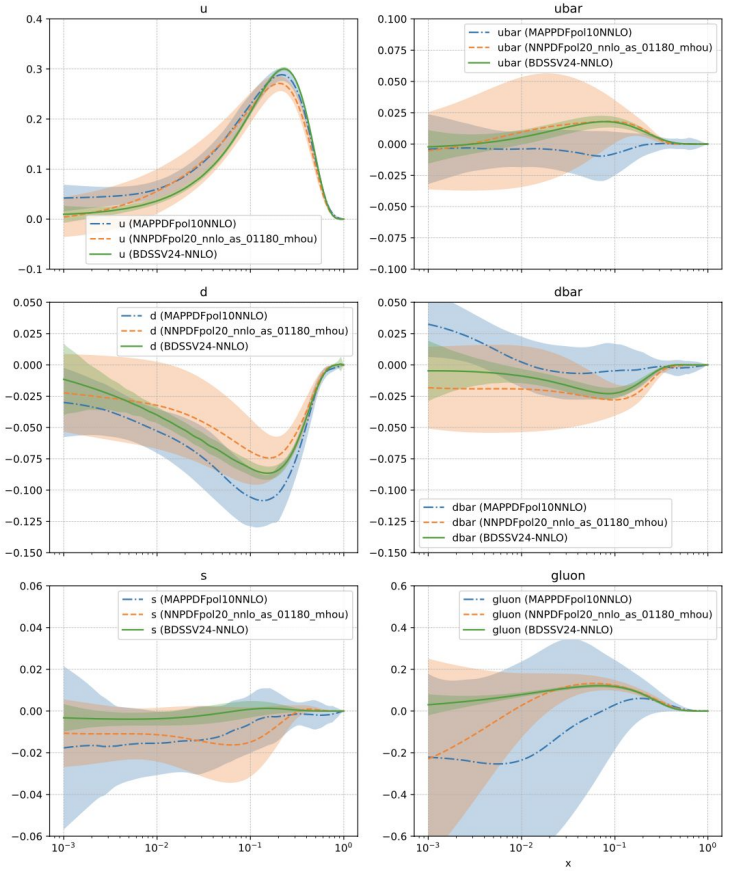


Rodolfo Sassot (Universidad de Buenos Aires)

Research interests: spin dependent PDFs and fragmentation functions

As seen on arXiv:

- Paper 1, NNLO global analysis of polarized parton distribution functions (Borsa,de Florian,RS,Stratmann,Vogelsang) 2407.11635
- Paper 2, Charged hadron FFs at high energy colliders (Borsa,de Florian,RS,Stratmann) 2311.17768

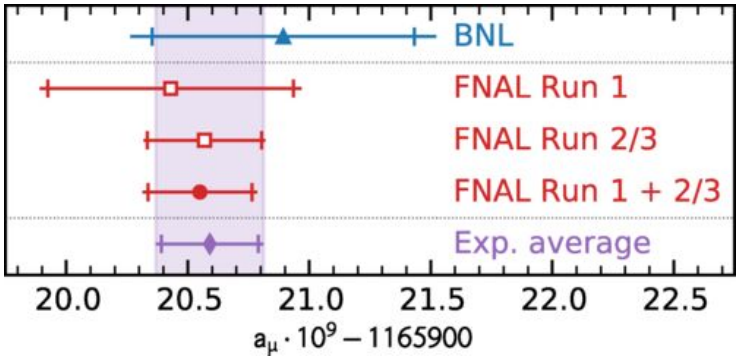


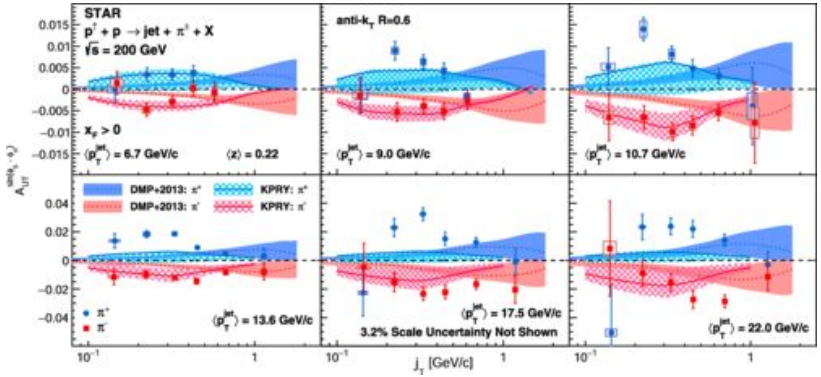
Renee Fatemi (University of Kentucky)

Research interests: Using jets to explore collinear and TMD PDFs and FFs in vacuum and nuclear matter. Muon g-2 and BSM signals at the EIC.

As seen on arXiv:

- Detailed report on the positive muon anomalous magnetic moment of the muon to 0.2 ppm. PRD 110, 032009 (2024)
- Performance optimization for a scintillating glass electromagnetic calorimeter at the EIC (Crafts, Fatemi,Horn,Kalinkin) JINST 19 05, C05049 (2024)
- Azimuthal transverse single spin asymmetries of inclusive jets and identified hadrons inside of jets PRD 106, 072010 (2022)



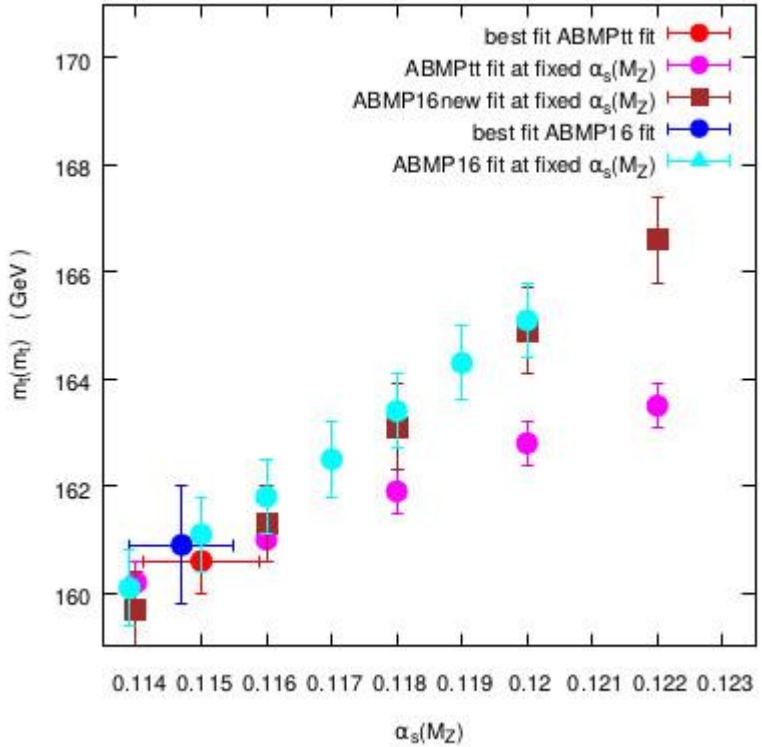


Sven-Olaf Moch (University of Hamburg)

Research interests: QCD precision calculations for colliders, top-quark physics, parton distribution functions, computer algebra, mathematics of Feynman

As seen on arXiv:

- NNLO PDFs driven by top-quark data, 2407.00545
- Four-loop splitting functions in QCD – the gluon-gluon case – 2410.08089

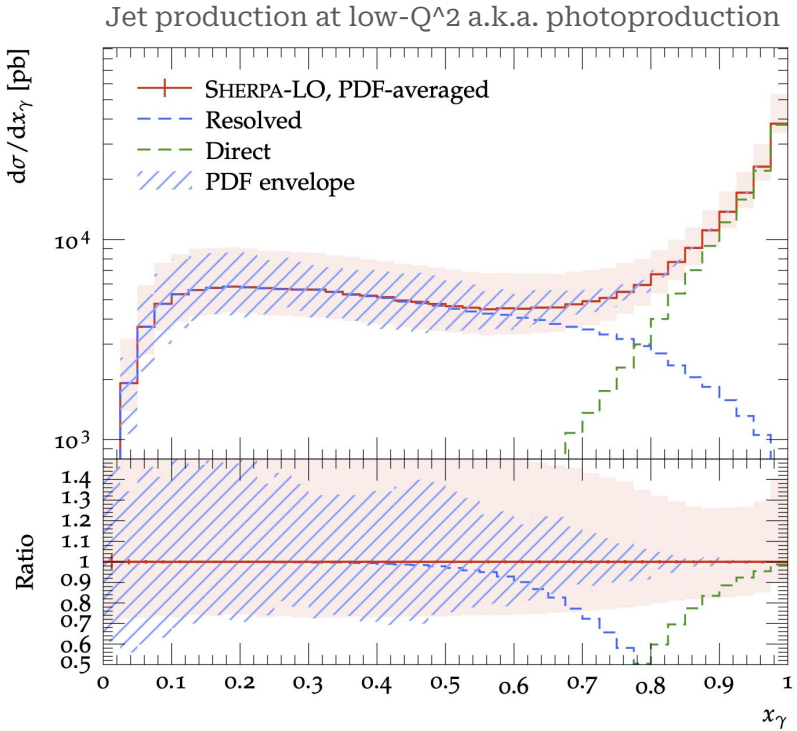


Peter Meinzinger (Zürich University)

Research interests: Collider phenomenology, precision calculations, event generation

As seen on arXiv:

- Hard Diffraction in Sherpa, 2407.02133
- Hadron-level NLO predictions for QCD observables in photo-production at the Electron-Ion Collider, 2311.14571

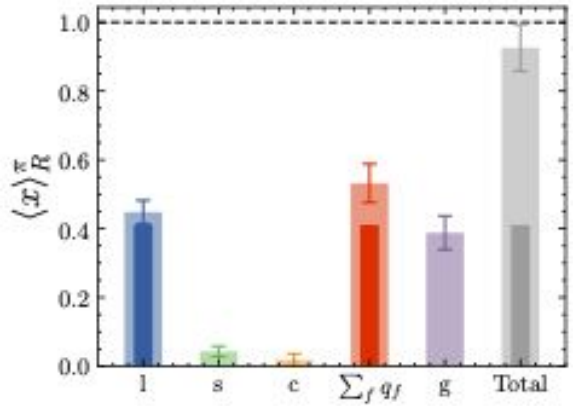


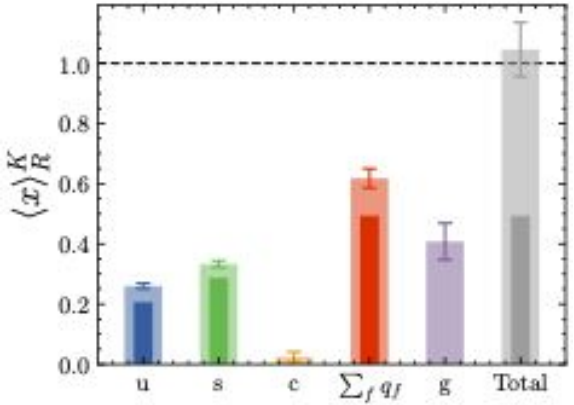
Constantia Alexandrou

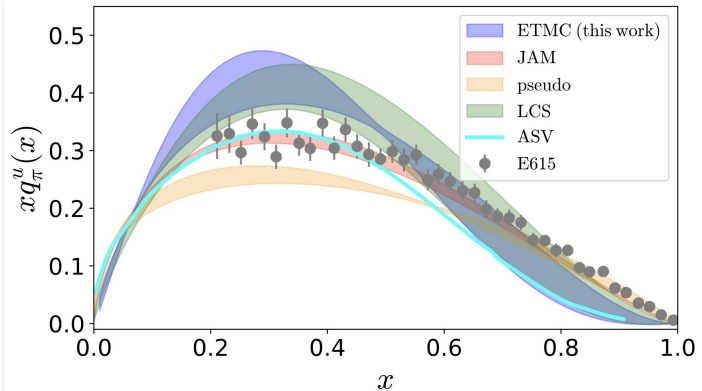
Research interests: Hadron Structure, Mellin moments, PDFs, GPDs, TMDs, g-2, lattice QCD

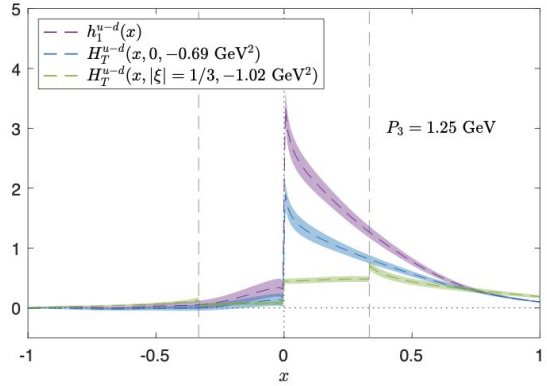
As seen on arXiv:

- Paper 1, Pion and Kaon momentum fraction, C. A. *et al.* (ETMC), Phys. Rev. Lett. 135 (2025); 2405.08529 (left plot)
- Paper 2, Pion and Kaon PDFs, C. A. et al. (ETMC) Phys. Rev. D 104 (2021) 054504; 2104.02247 (bottom left plot)
- Paper 3, Transversity GPDs of the proton, C. A. et al., Phys. Rev. D 05 (2022) 3, 034501, 2108.10789 (bottom right plot)

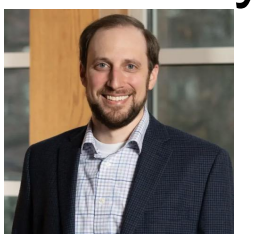




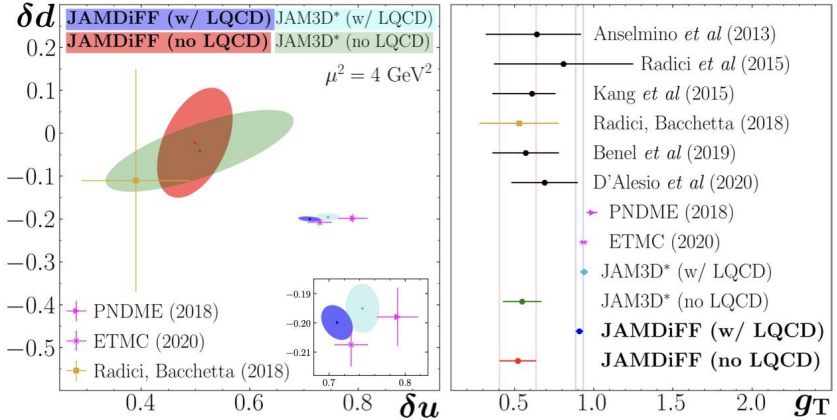




Daniel Pitonyak (Lebanon Valley College (Annville, PA))



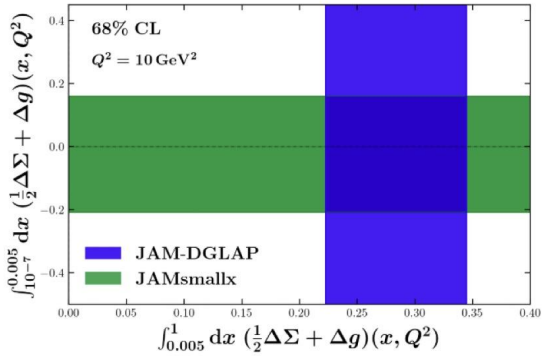
Research interests: TMDs/mult-parton correlators, transverse single-spin asymmetries, dihadron fragmentation, spin at small x



As seen on arXiv:

- C. Cocuzza, et al. (JAM Collaboration), "Transversity distributions and tensor charges of the nucleon: extraction from dihadron production and their universal nature," Phys. Rev. Lett. 132, 091901 (2024) [arXiv:2306.12998 [hep-ph]].

- D. Adamiak, et al. (JAM Collaboration), "First study of polarized proton-proton scattering with small-x helicity evolution," [arXiv:2503.21006 [hep-ph]], submitted to PRD.



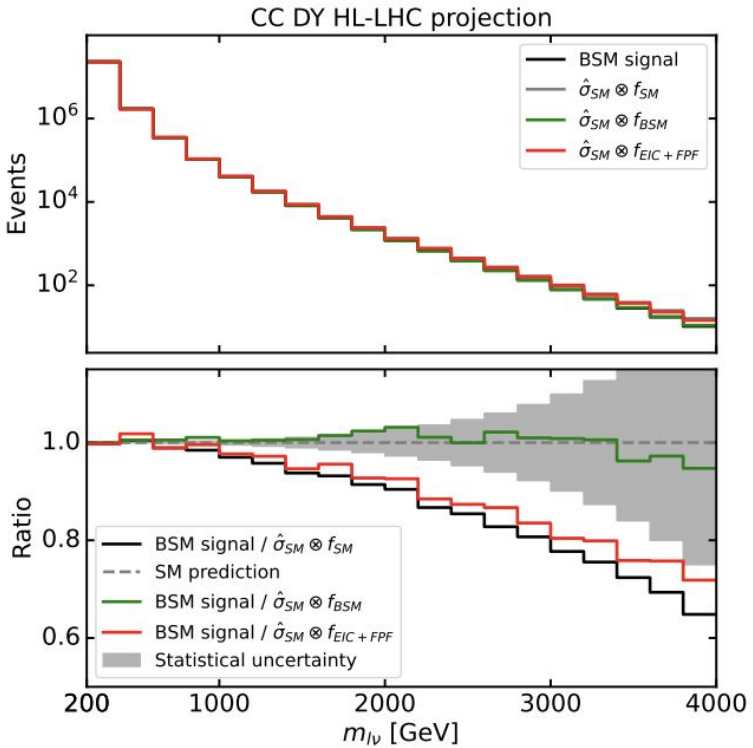
$$\int_{10^{-7}}^{1} dx \left(\frac{1}{2}\Delta\Sigma + \Delta g\right)(x, Q^2) \in [0.02, 0.51]$$

Maria Ubiali (University of Cambridge)

Research interests: collinear unpolarised PDFs, global PDF and SM parameter determination, interplay between PDFs and SMEFT

As seen on arXiv:

- Paper 1, Unravelling New Physics Signals at the HL-LHC with Low-Energy Constraints (Hammou,MU) 2410.00963
- Paper 2, Parton Distributions confront LHC Run II data: a quantitative appraisal (Chiefa,Costantini, Cruz-Martinez, Nocera, Rabemananjara, Rojo, Sharma, Stegeman, MU) 2501.10359



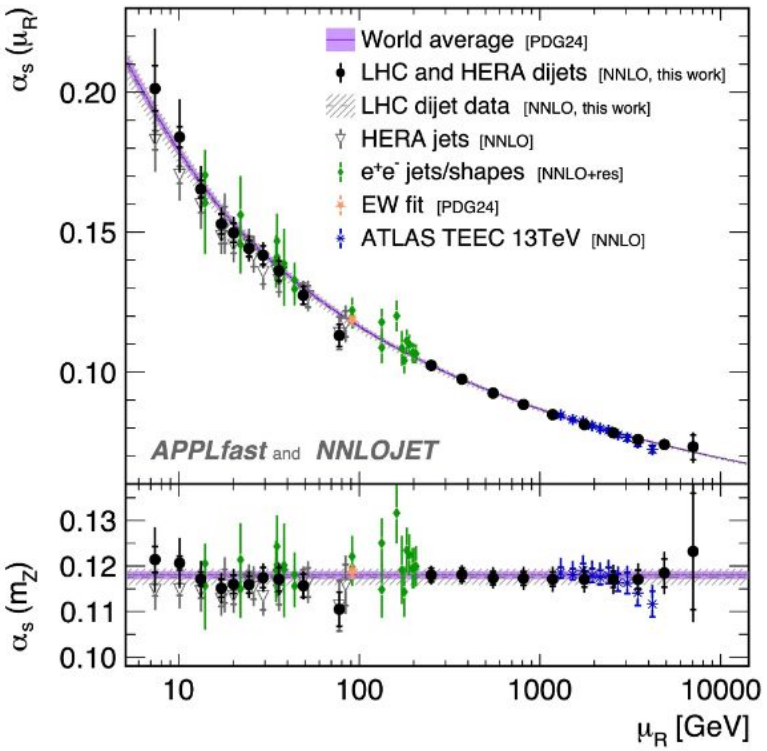
Thomas Gehrmann (Universität Zürich)

Research interests: Precision calculations, amplitudes, collider phenomenology

As seen on arXiv:

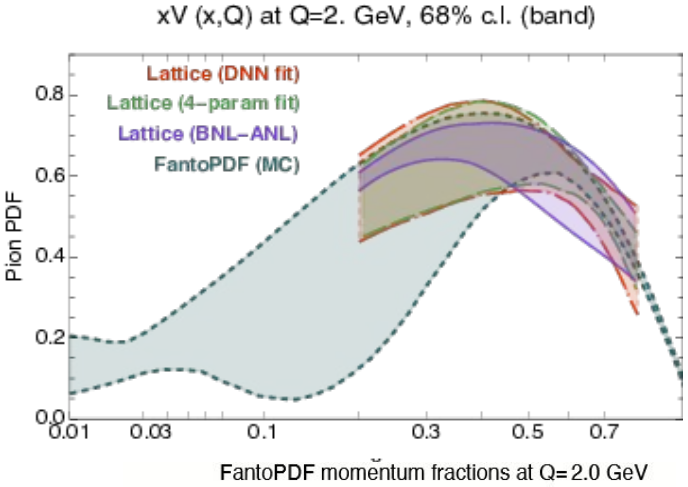
●Precise Determination of the Strong Coupling Constant from Dijet Cross Sections up to the Multi-TeV Range, [2412.21165](2412.21165)

●Identified Hadron Production in Deeply Inelastic Neutrino-Nucleon Scattering, [2504.05376](2504.05376)



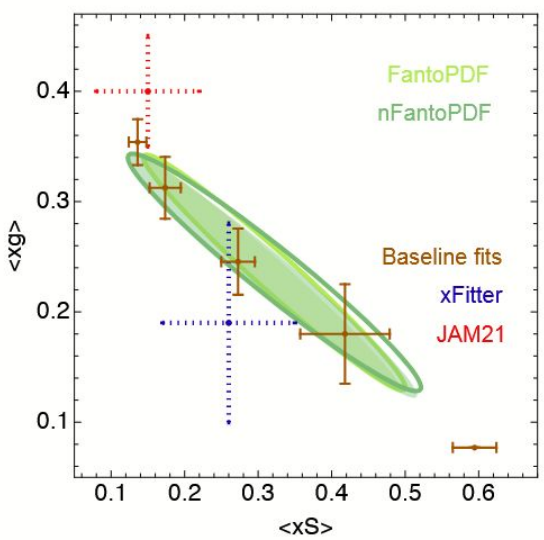
Pavel Nadolsky
(Michigan State University)

Research interests: Parton distributions, heavy-quark calculations, resummations, uncertainty quantification



As seen on arXiv:

- Polynomial universal approximators for pion and other PDFs, 2311.08447, 2505.XXXXX
- SACOT-MPS heavy-quark scheme for ZQ and other pp processes at (N)NLO, 2410.03876



FANTÔMAS4QCD

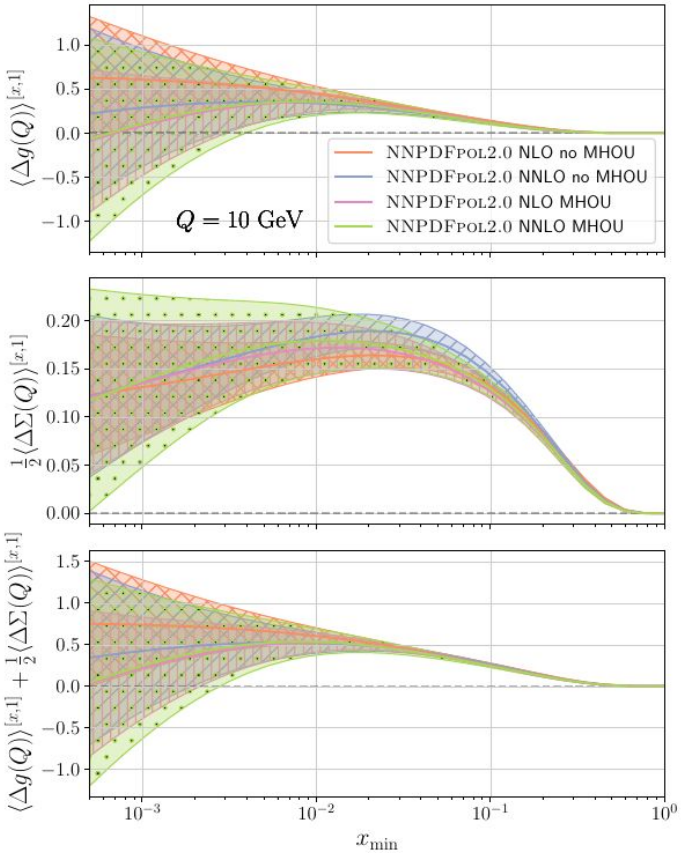
Emanuele R. Nocera (Università degli Studi di Torino & INFN)

Research interests: collinear unpolarized and polarized parton distribution functions, fragmentation functions

As seen on arXiv:

● NNPDFpol2.0: a global determination of polarised PDFs and their uncertainties at NNLO (Cruz-Martinez, Hasenack, Hekhorn, Magni, ERN, Rabemananjara, Rojo, Sharma, van Seeventer) 2503.11814

●Pion and kaon fragmentation functions at next-to-next-to-leading order (Abdul Khalek, Bertone, Khoudli, ERN) 2204.10331

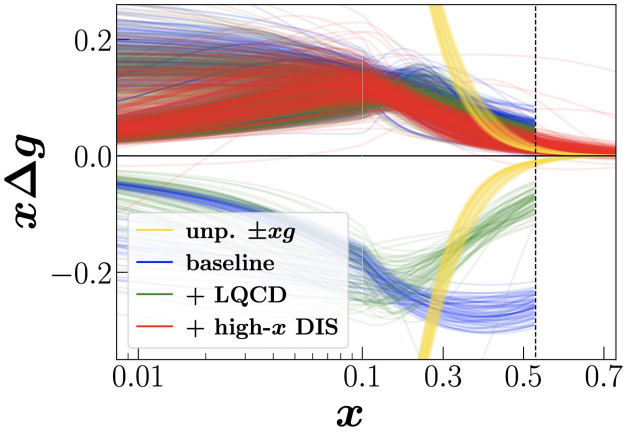


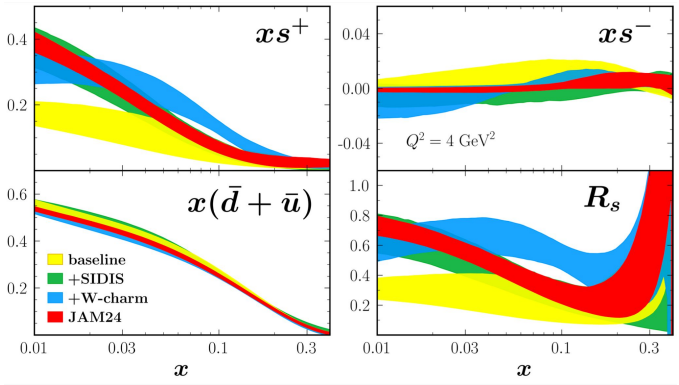
Wally Melnitchouk (Jefferson Lab)

Research interests: global QCD analysis of polarized and unpolarized parton distribution and fragmentation functions (JAM); interface with lattice QCD.

As seen on arXiv:

- Paper 1, Data-driven constraints on gluon polarization in the proton (Hunt-Smith, Cocuzza, WM, Sato, Thomas, White) 2403.08117 [PRL **133**, 161901 (2024)]
- Paper 2, Strangeness in the proton from W+c and SIDIS data (Anderson, WM, Sato) 2501.00665



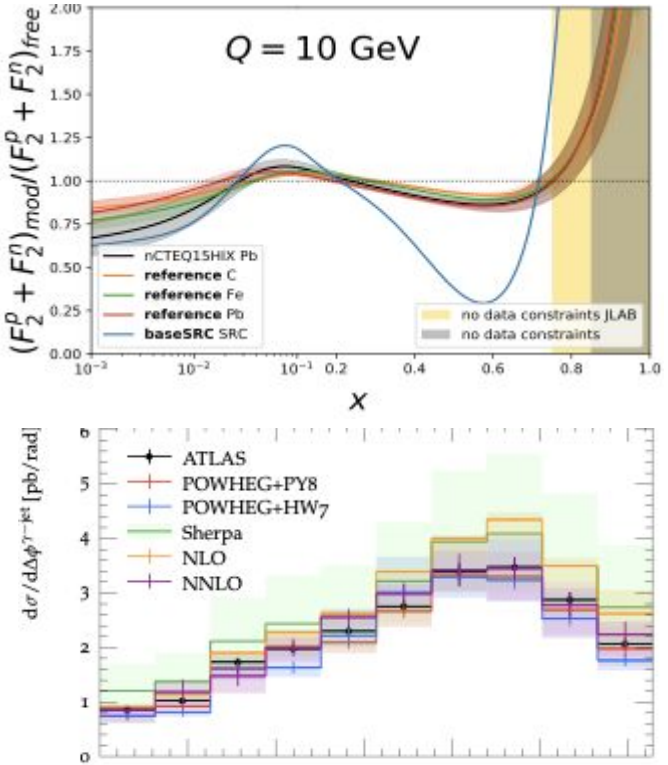


Michael Klasen (University of Münster)

Research interests: Nuclear PDFs, POWHEG

As seen on arXiv:

- Modification of quark-gluon distributions in nuclei by correlated nucleon pairs (nCTEQ Coll.) 2312.16293
- Prompt photon production with two jets in POWHEG (Jezo, MK, Neuwirth) 2409.01424

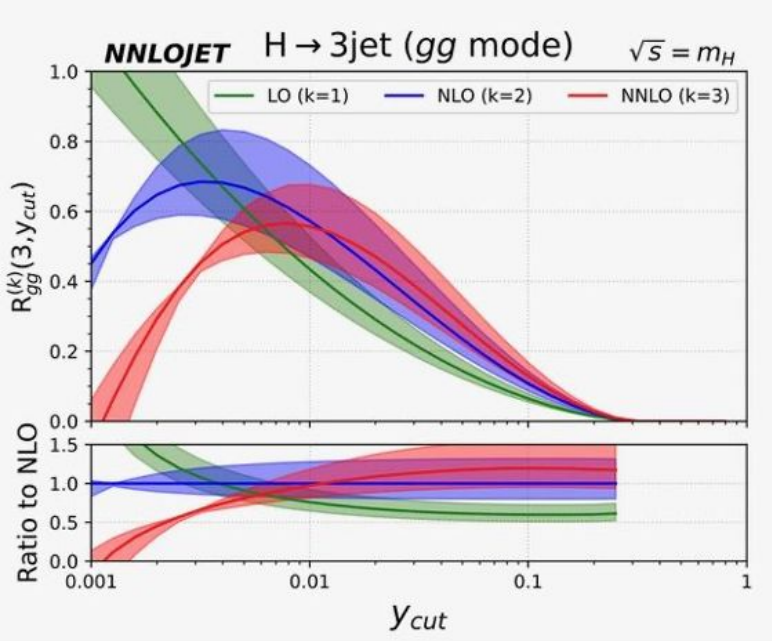


Aude Gehrmann-De Ridder (ETH Zürich)

Research interests: Precision computations in perturbative QCD and their applications to collider phenomenology

As seen on arXiv:

- Jet rates in Higgs boson decay at third order in QCD, 2502.17333
- QCD predictions for vector boson plus hadron production at the LHC, 2405.17540

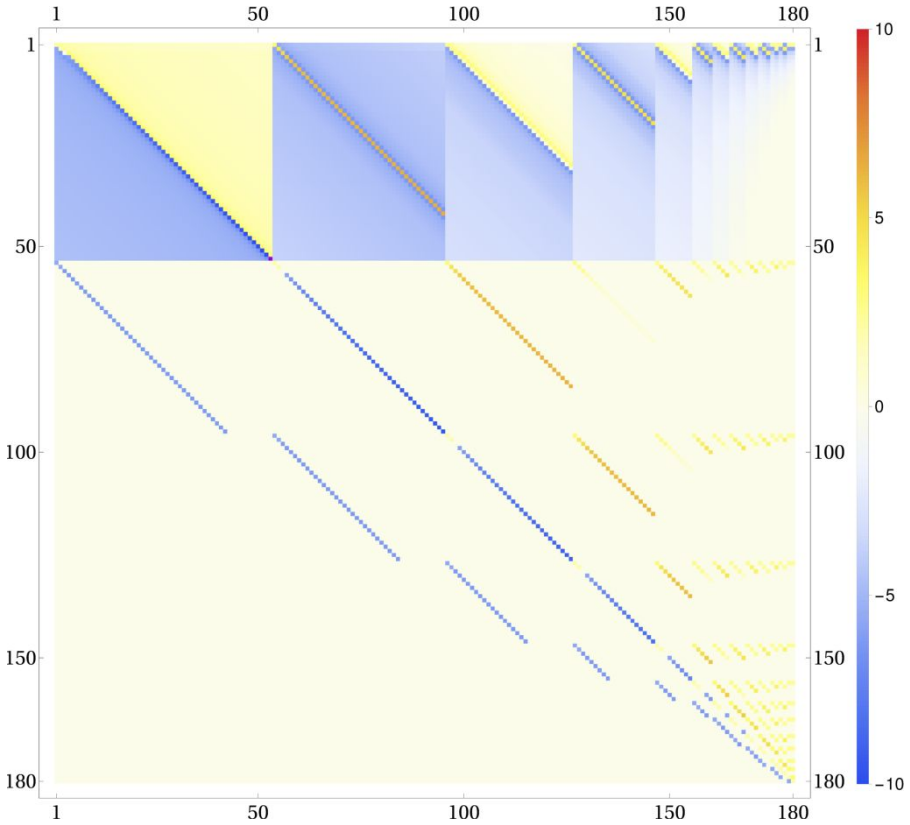


Juliane Haug (Universität Tübingen)

Research interests: SIDIS, precision calculations, parton evolution

As seen on arXiv:

- A semi-analytical x-space solution for parton evolution – Application to non-singlet and singlet DGLAP equation, 2404.18667
- The massless single off-shell scalar box integral – branch cut structure and all-order epsilon expansion, 2211.14110

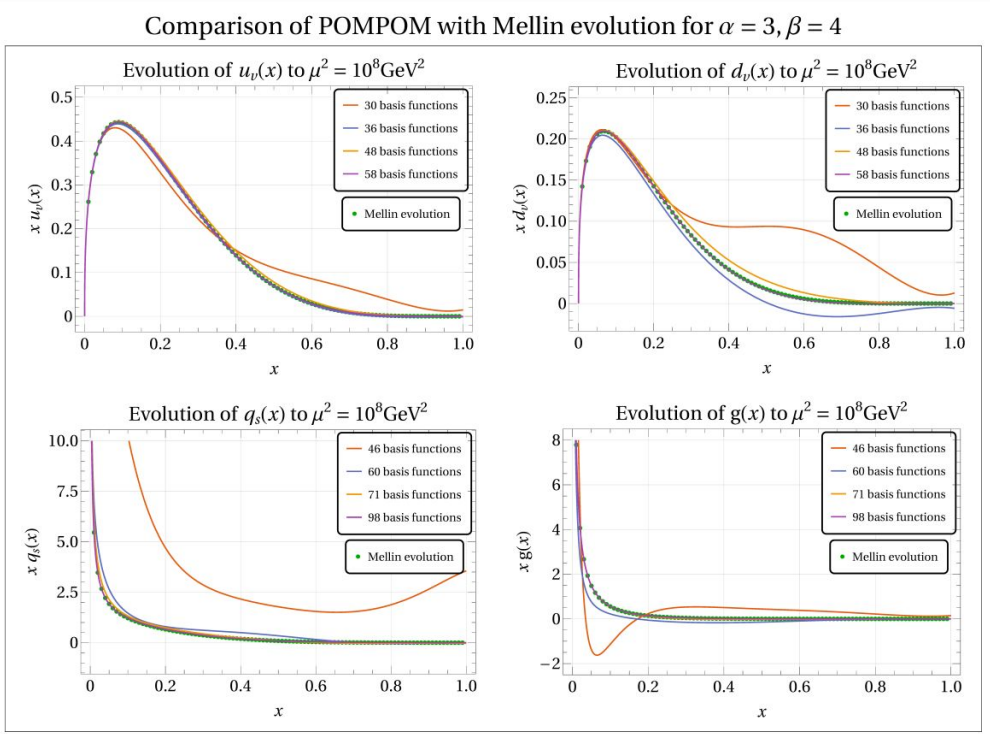


Fabian Wunder (Universität Tübingen)

Research interests: SIDIS, precision calculations, parton evolution

As seen on arXiv:

- A semi-analytical x-space solution for parton evolution – Application to non-singlet and singlet DGLAP equation, [2404.18667](2404.18667)
  - Expansion by regions meets angular integrals, [2405.13120](2405.13120)



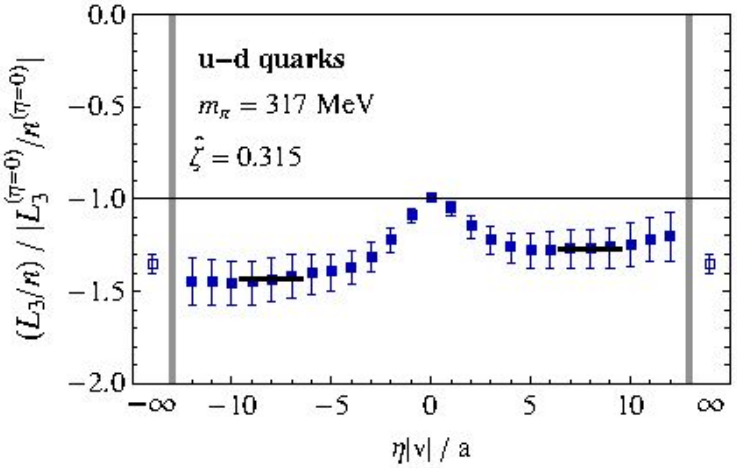
Michael Engelhardt (New Mexico State University)

Research interests: Hadron structure from Lattice QCD, focus on TMD/GTMD observables, OAM, sum rules

As seen on arXiv:
TMDs for long. pol. nucleons ..., (M.E., N. Hasan, T. Izubuchi, et. al [LHPC]), 2301.06118

Am interested in:
Transverse momentum moments, (O. del Rio, A. Prokudin, I. Scimemi, A. Vladimirov), 2402.01836

2008.03660

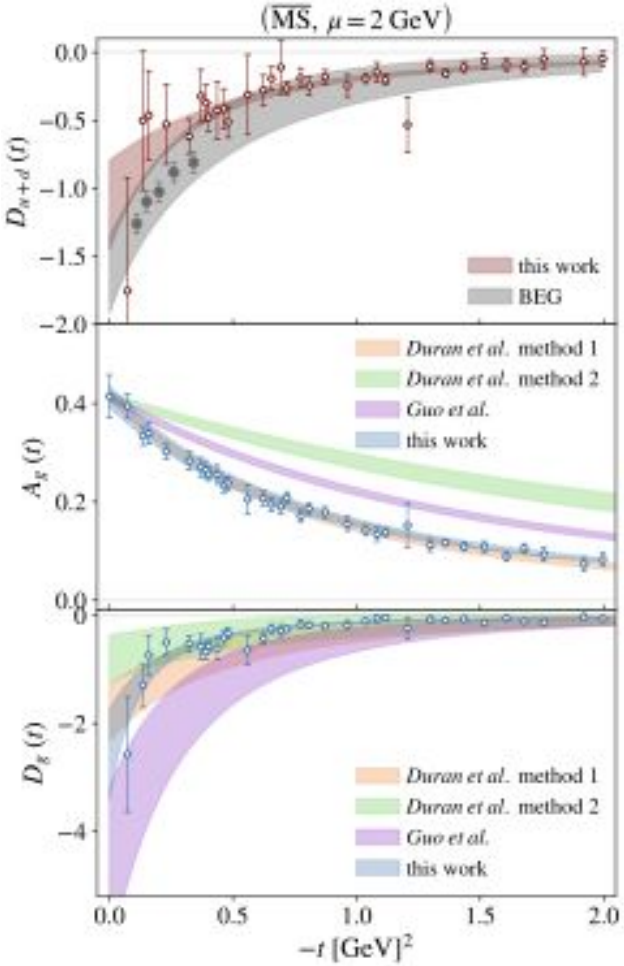


Phiala Shanahan (MIT)

Research interests: Proton and nuclear structure incl. PDFs, FFs, TMDs, Collins-Soper kernel including gluon CS kernel, from lattice QCD

As seen on arXiv:

- *Determination of the Collins-Soper Kernel from Lattice QCD,* Artur Avkhadiev, Phiala E. Shanahan, Michael L. Wagman, Yong Zhao 2402.06725
- *Gravitational Form Factors of the Proton from Lattice QCD,* Daniel C. Hackett, Dimitra A. Pefkou, Phiala E. Shanahan 2310.08484

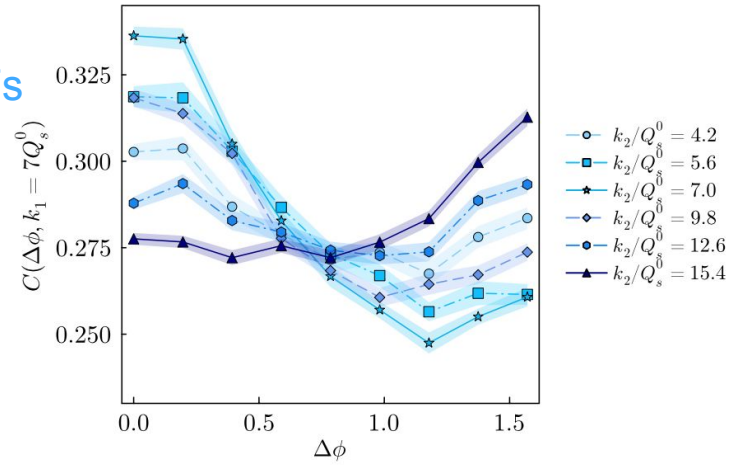


Vladi Skokov (North Carolina State University)

Research interests: high energy QCD, small-x, saturation

As seen on arXiv:

- Paper 1, Perturbative Corrections to Quark TMDPDFs in the Background-Field Method: Gauge Invariance, Equations of Motion, and Multiple Interactions (Mukherjee, V.S.,Tarasov,Tiwari) 2502.15889
- Paper 2, Incoherent diffractive dijet production and gluon Bose enhancement in the nuclear wave function(Kar, Kovner, Li, V.S.) 2312.04493
- Paper 3, Unified description of DGLAP, CSS, and BFKL evolution… (Mukherjee, V.S.,Tarasov,Tiwari) 2311.16402

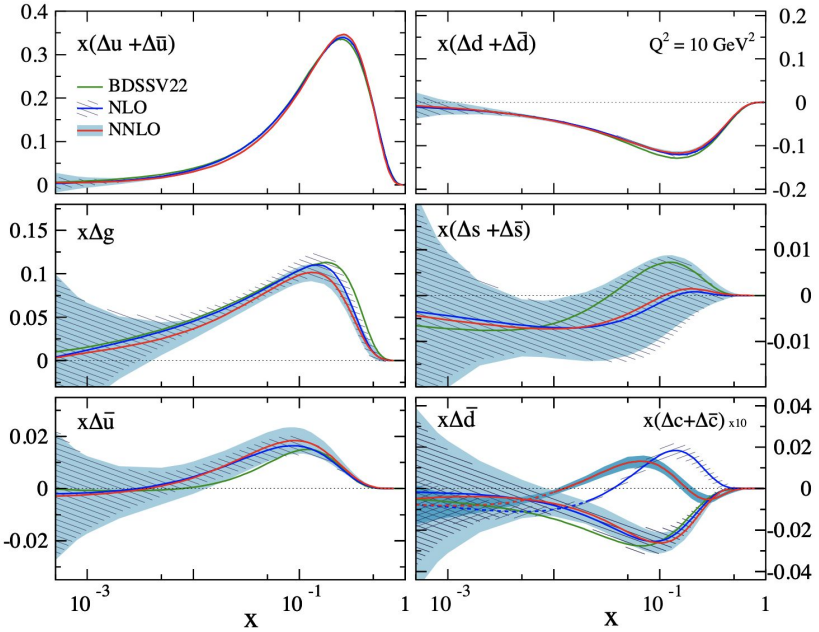


Ignacio Borsa (Universität Tübingen)

Research interests: Precision calculations in QCD, polarized parton distributions, fragmentation functions.

As seen on arXiv:

- NNLO Global Analysis of Polarized Parton Distribution Functions (IB, de Florian, Sassot, Stratmann, Vogelsang), 2407.11635
- Parton-shower effects in polarized deep inelastic scattering (IB, Jäger), 2404.07702



Raza Sabbir Sufian (New Mexico State University & BNL)

Research interests: Hadron structure (PDFs, GPDs, and hadronic tensors) using lattice QCD and holographic light-front QCD, quantum computing and machine learning applications

I will not be able to join in-person due to a family situation, my apologies!

Paper 1: Gluon unpolarized, polarized, and transversity GPDs from lattice QCD: Lorentz-covariant parametrization, J. Schoenleber, R. Sufian, T. Izubuchi : *Phys.Rev.D 111 (2025) 9, 094510*

Paper 2: Polarized and unpolarized gluon PDFs: Generative machine learning applications for lattice QCD matrix elements at short distance and large momentum, T Chowdhury, T. Izubuchi, M. Kamruzzaman, N. Karthik, T. Khan, T. Liu, and R. Sufian, *Phys.Rev.D* 111 (2025) 7, 7

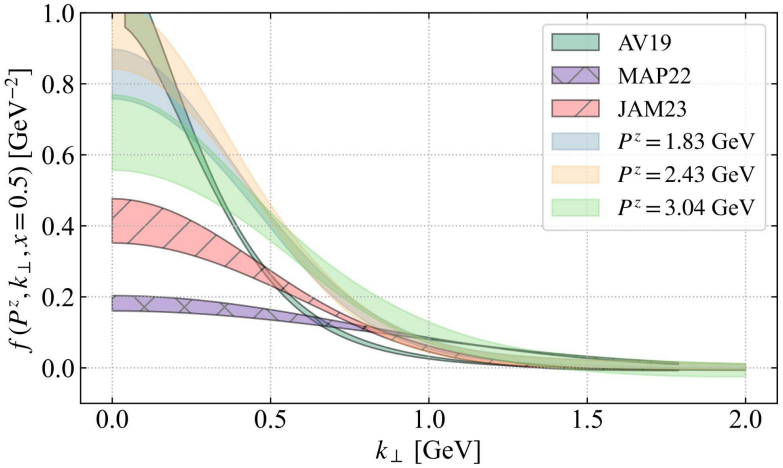
Paper 3: QCD running coupling in the nonperturbative and near-perturbative regimes, G. de Teramond, A. Paul, S. Brodsky, A Deur, H Dosch, T. Liu, R. Sufian, *Phys.Rev.Lett. 133 (2024) 18, 181901*

Yong Zhao (Argonne National Laboratory)

Research interests: Effective field theories, lattice gauge theory, 3D quark-gluon structure of the nucleon.

As seen on arXiv:

- Transverse Momentum Distributions from Lattice QCD without Wilson Lines (YZ) 2311.01391
- Transverse-momentum-dependent pion structures from lattice QCD: Collins-Soper kernel, soft factor, TMDWF, and TMDPDF (D. Bollweg, X. Gao, J. He, S. Mukherjee and YZ) 2504.04625



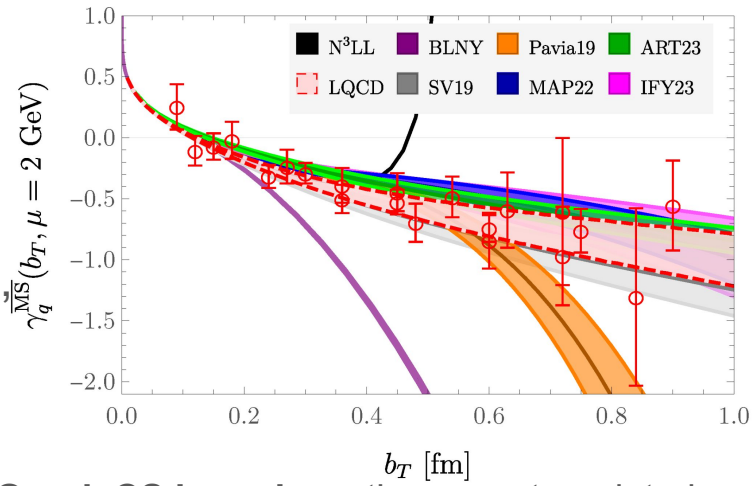
Pion valence TMDPDF calculated at different momenta, compared to global fits.

Artur Avkhadiev (MIT → Argonne)

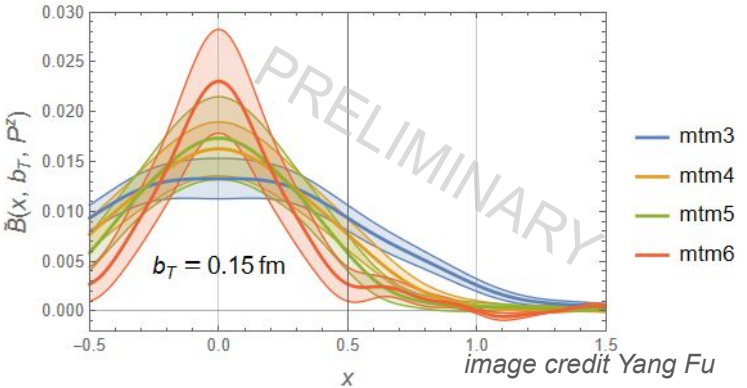
Research interests: Quark and gluon CS kernels, polarized TMDs — from lattice QCD.

As seen on arXiv:

- Paper 1, *Determination of the Collins-Soper kernel from Lattice QCD* (AA, Shanahan, Wagman, Zhao) 2402.06725
- Paper 2, *Collins-Soper kernel from lattice QCD at the physical pion mass* (AA, Shanahan, Wagman, Zhao) 2307.12359



Quark CS kernel: continuum-extrapolated lattice data + fit to lattice data



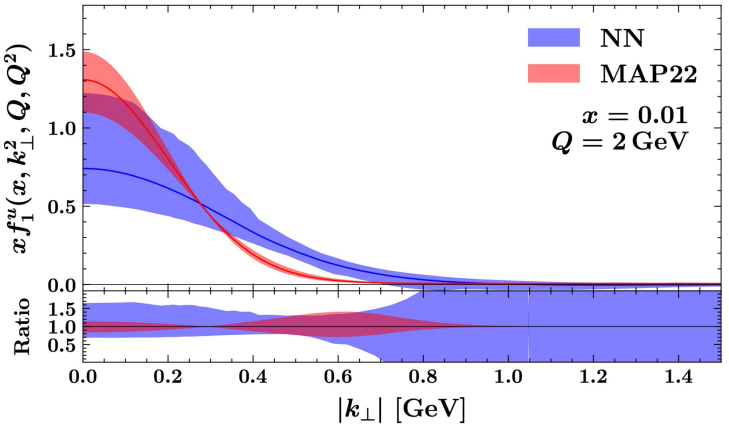
Gluon TMD beam functions for first lattice calculation of **gluon CS kernel** *(in progress)*

Valerio Bertone (CEA Paris-Saclay)

Research interests: Hadron structure (PDFs, FFs, TMDs, GPDs), resummation.

As seen on arXiv:

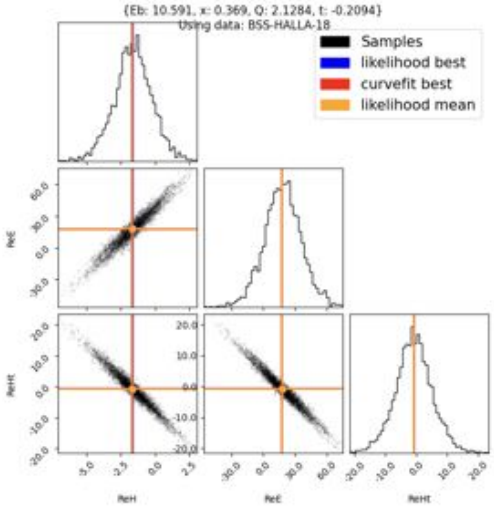
- Paper 1, *A neural-network extraction of unpolarised transverse-momentum-dependent distributions* (MAP Collaboration) 2502.04166
- Paper 2, *One-loop matching for leading-twist generalised transverse-momentum-dependent distributions* (Bertone, Echevarria, Del Rio, Rodini) 2502.07576



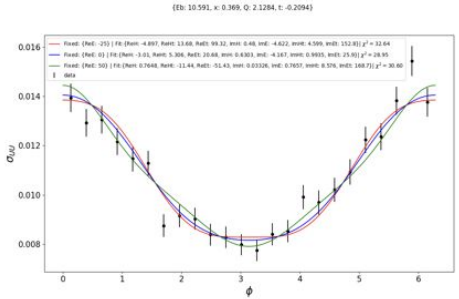
$$\begin{pmatrix} \mathbb{F}_i^{[Y],e}(\mu,\zeta) \\ \mathbb{F}_i^{[Y],o}(\mu,\zeta) \end{pmatrix} = R_i\left[(\mu,\zeta) \leftarrow (\mu_b,\mu_b^2)\right] \begin{pmatrix} \cos(\phi(\mu)) & -\sin(\phi(\mu)) \\ s\sin(\phi(\mu)) & s\cos(\phi(\mu)) \end{pmatrix} \left[\begin{pmatrix} \mathcal{C}_{i/j}^{Y/\Gamma,e} \\ \mathcal{C}_{i/j}^{Y/\Gamma,o} \end{pmatrix} \otimes f_j^{[\Gamma]} \right](\mu_b,\mu_b^2)$$

Simonetta Liuti, University of Virginia

Covariance of CFF Results



Degeneracy of Curve Fit Results



[Research Interests](): Correlated Spin Structure of the Nucleon and Nuclei from Deeply Virtual Exclusive Processes

Recent Publications

- A.Dotson, Z.Panjsheeri, A.R.Singireddy, D.Q. Adams, E. Ortiz-Pacheco, M. Cuic, Y. Li, H.W. Lin, S. Liuti, M. Sievert, *et al.*

``Generalized Parton Distributions from Symbolic Regression," [arXiv:2504.13289 [hep-ph]].

- D. Q. Adams, J. Bautista, M. Cuic, A. Khawaja, S. Pandey, Z. Panjsheeri, G. W. Chern, Y. Li, S. Liuti and M. Boer, *et al.*

``Likelihood and Correlation Analysis of Compton Form Factors for Deeply Virtual Exclusive Scattering on the Nucleon," [arXiv:2410.23469 [hep-ph]].

- M.Almaeen, T.Alghamdi, B.Kriesten, D.Adams, Y. Li, H. W. Lin and S. Liuti,

``VAIM-CFF: a variational autoencoder inverse mapper solution to Compton form factor extraction from deeply virtual exclusive reactions,"

Eur. Phys. J. C85, 499 (2025)