Challenges for lattice quasi distribution functions

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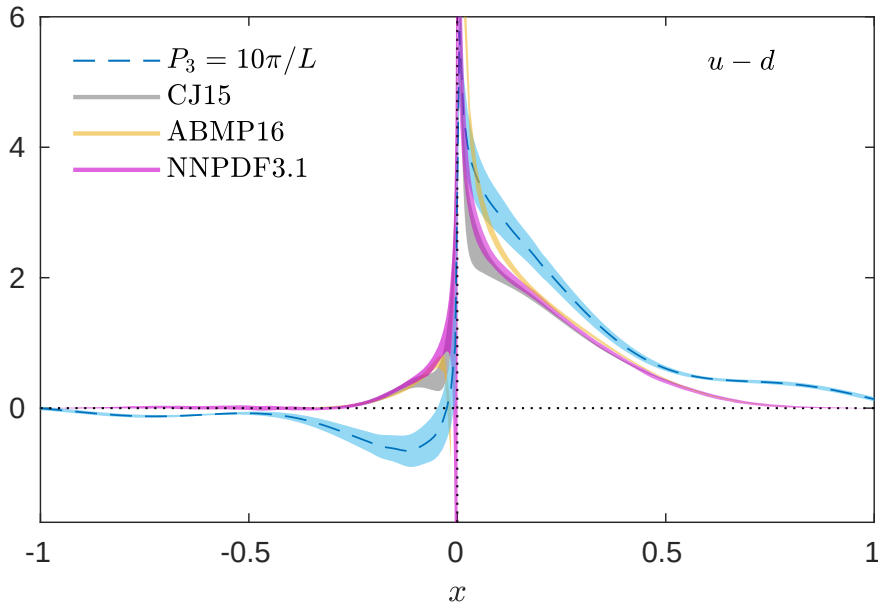
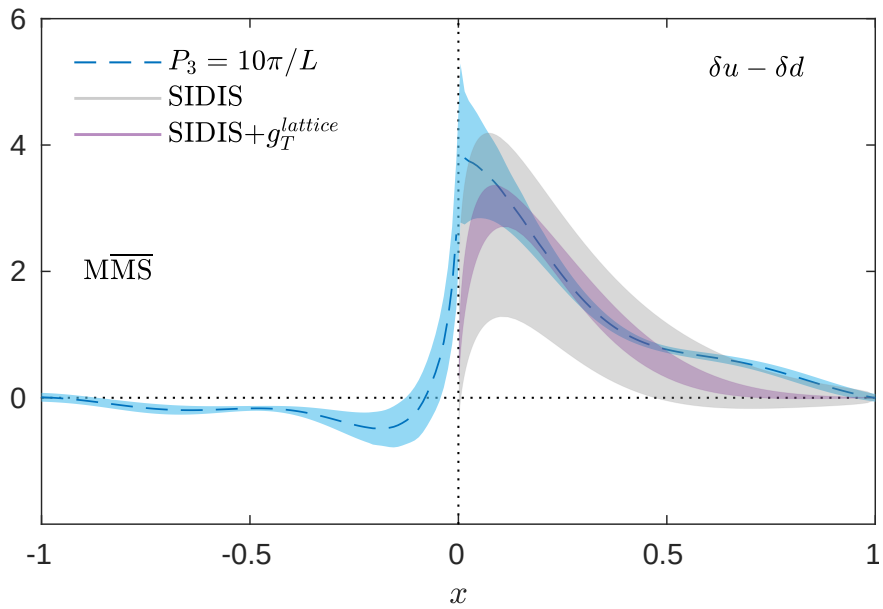
- **What we have achieved**
- **Challenges**
  - cutoff effects
  - excited state effects
  - the oscillations
  - 2-loop effects
- **Big challenge: first principle quantitative evaluation of PDFs**

Great achievements over the last years

- example: ETMC, Alexandrou et.al. Phys.Rev. D99 (2019) no.11, 114504, arXiv:1902.00587



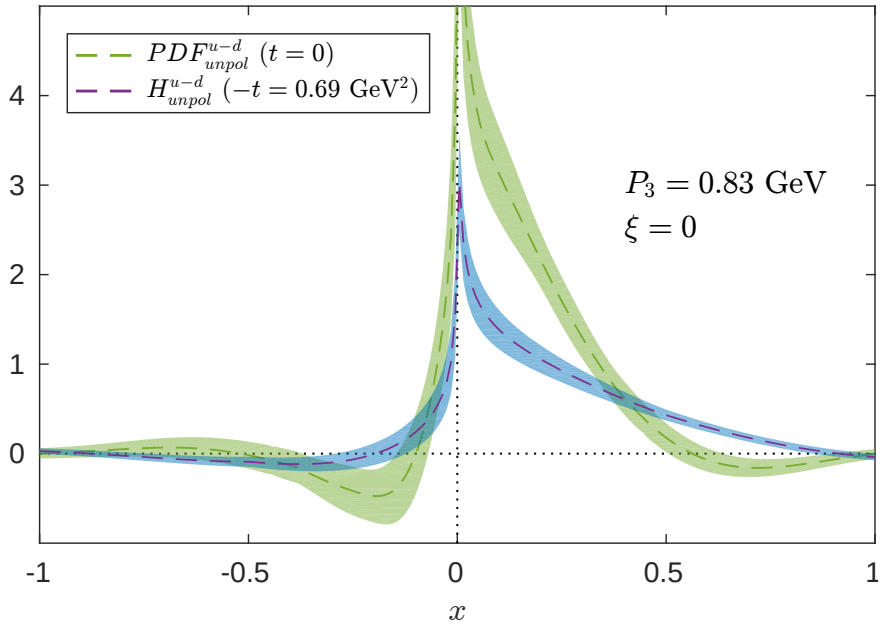
unpolarized

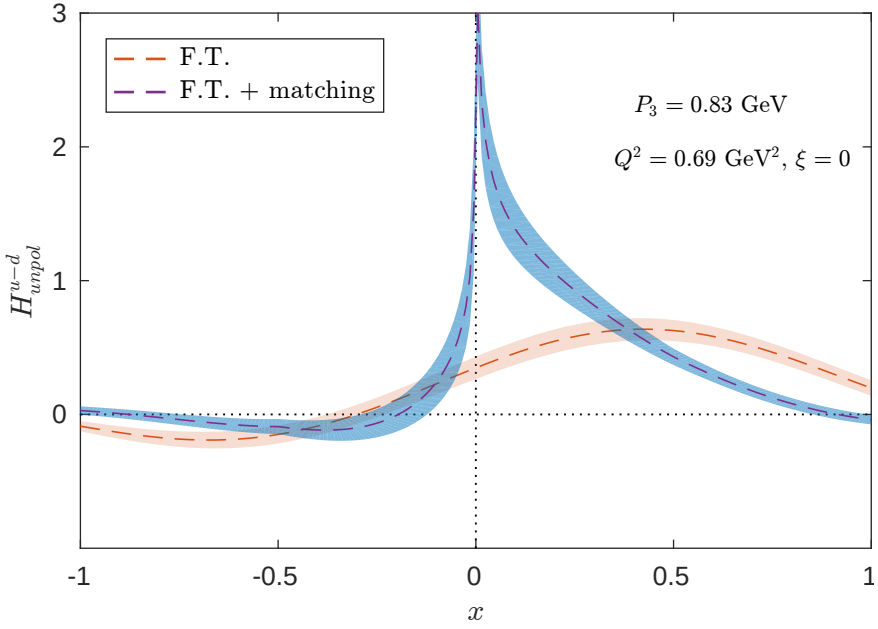


transversity

- non-perturbative renormalization
- better ground state overlap through smearing
- study of excited state effects
- different momenta, etc. etc.

Generalized parton distribution functions



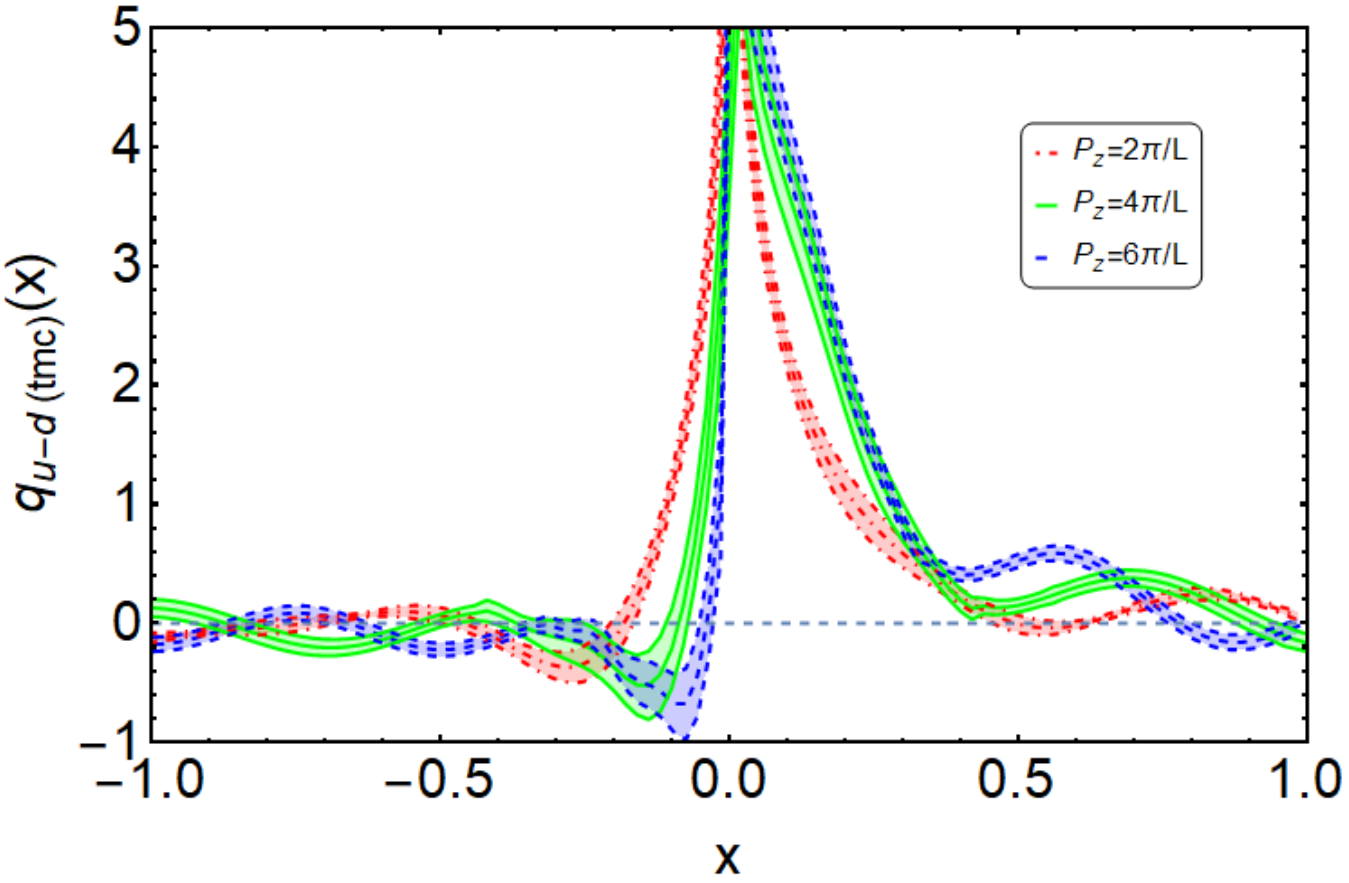


First results for quasi GPDFs are appearing

→ see talks by A. Scapellato and K. Cichy, arxiv:xxx

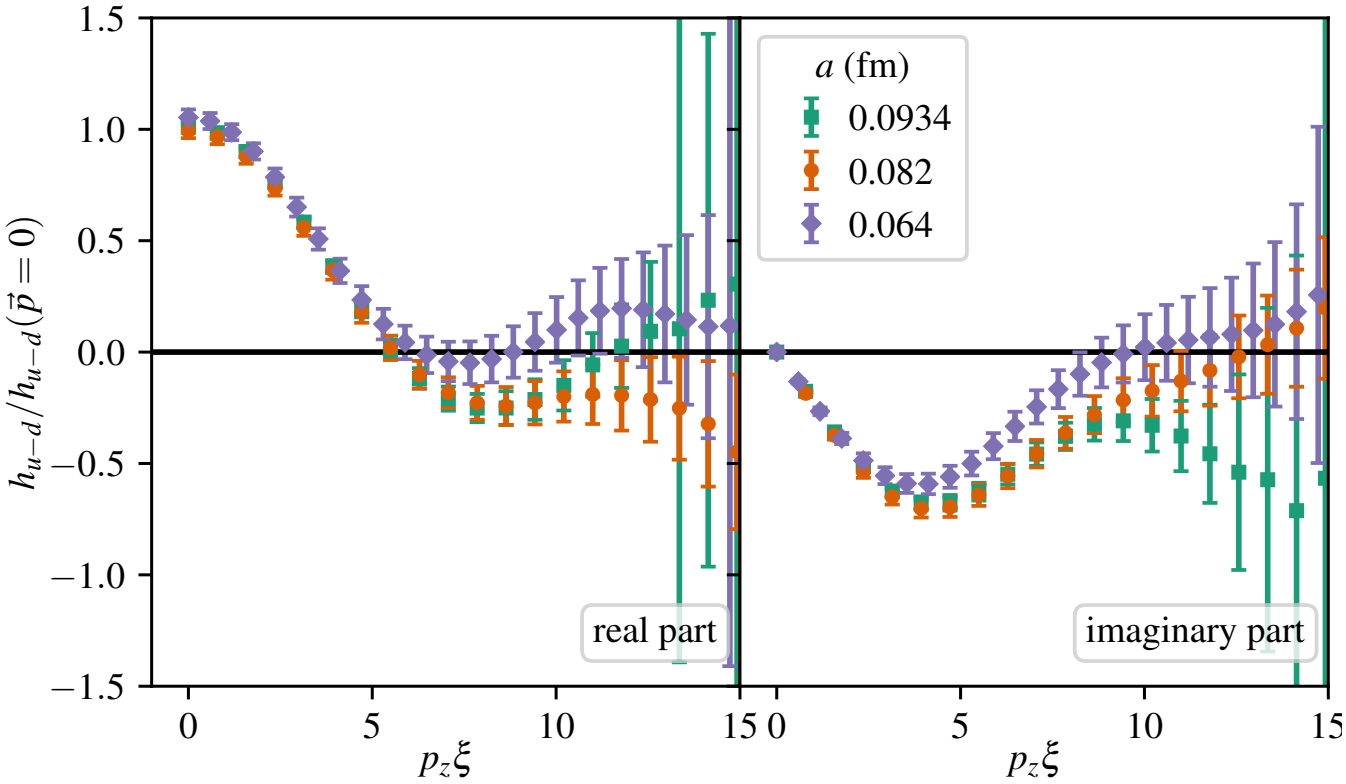
Δ distribution functions

Yahui Chai, Yuan Li, Shicheng Xia, Constantia Alexandrou, Krzysztof Cichy, Martha Constantinou, Xu Feng, Kyriakos Hadjiyiannakou, Karl Jansen, Giannis Koutsou, Chuan Liu, Aurora Scapellato, Fernanda Steffens



$\Rightarrow$ can address other baryons

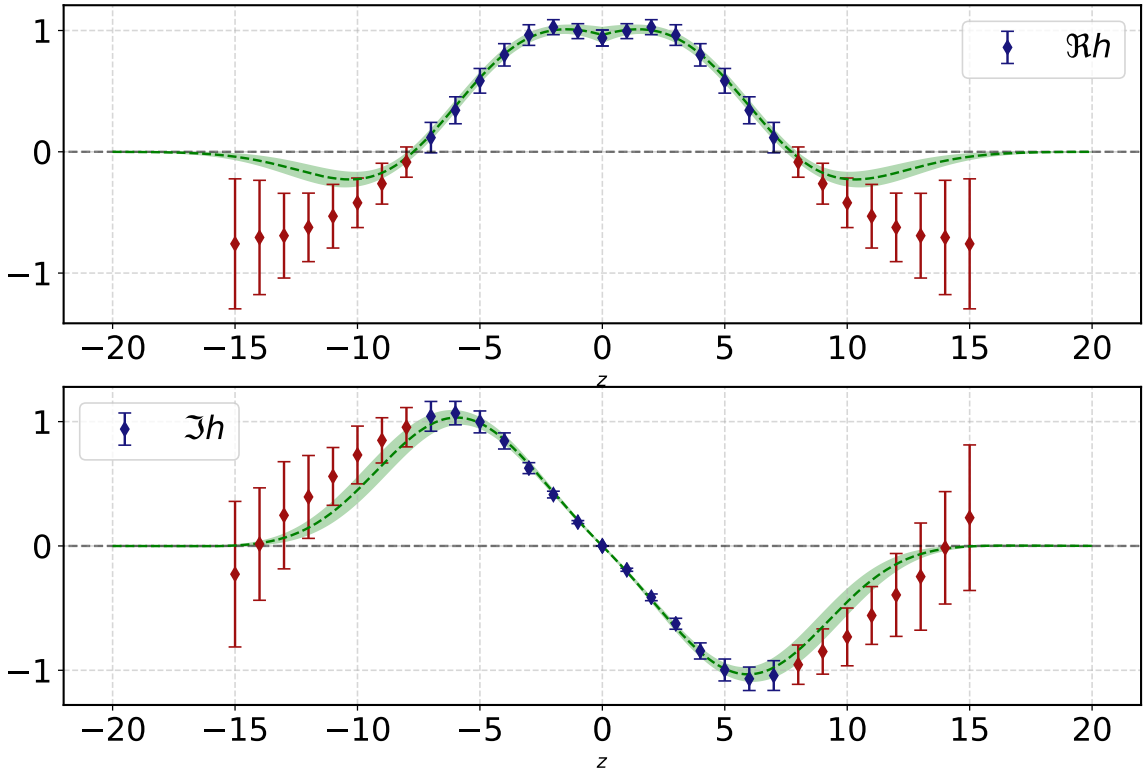
Challenge: continuum limit



- unpolarized quasi PDF: no noticable cut-off effects

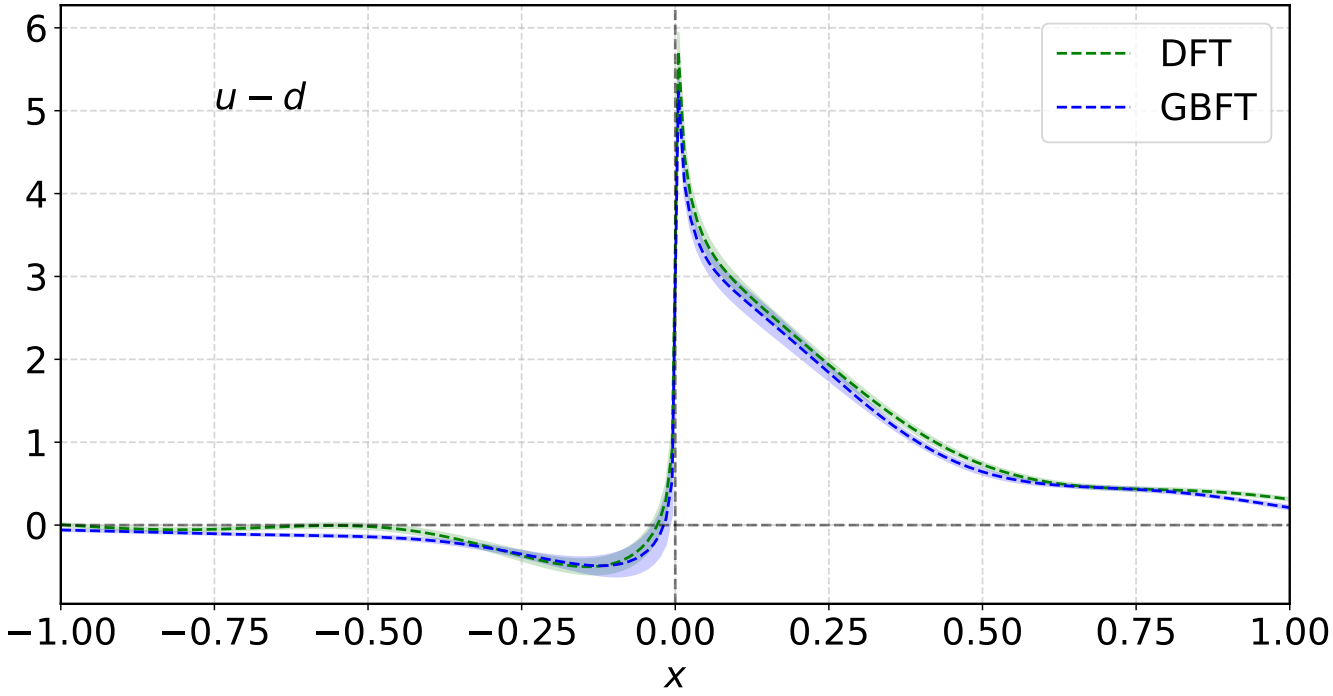
The oscillations I

- discrete Fourier Transformation seems to be problematic
- try parameter-free fit to lattice data
  $\rightarrow$ obtain smooth function
- here: Baysean based Gaussian process regresion
  (poster by F. Manigrasso)



The oscillations II

- can perform continuous Fourier transformation
- effect on quasi PDF?



The challenges

- continuum limit
- 2-loop formulae
  - matching formulae
  - conversion factors
- understanding and removing the oscillations
- reach a quantitative understanding of quasi PDFs
  - control systematic effects
  - come to prediction level
- we are on a very way to come there