Theory Working Group Update

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Introduction & Goal of the EIC Theory Working Group

- Started late 2021
  4 conveners: cover expertise in a range of EIC physics topics
  (but obv. not everything)

- SC charge: Connect experimental & theoretical EIC communities

- Coordinate theory-related discussions that are needed for the experimental design

- Address theoretical questions that come up in groups doing design/simulations

- Convener role is to connect the right people, not to solve everything ourselves

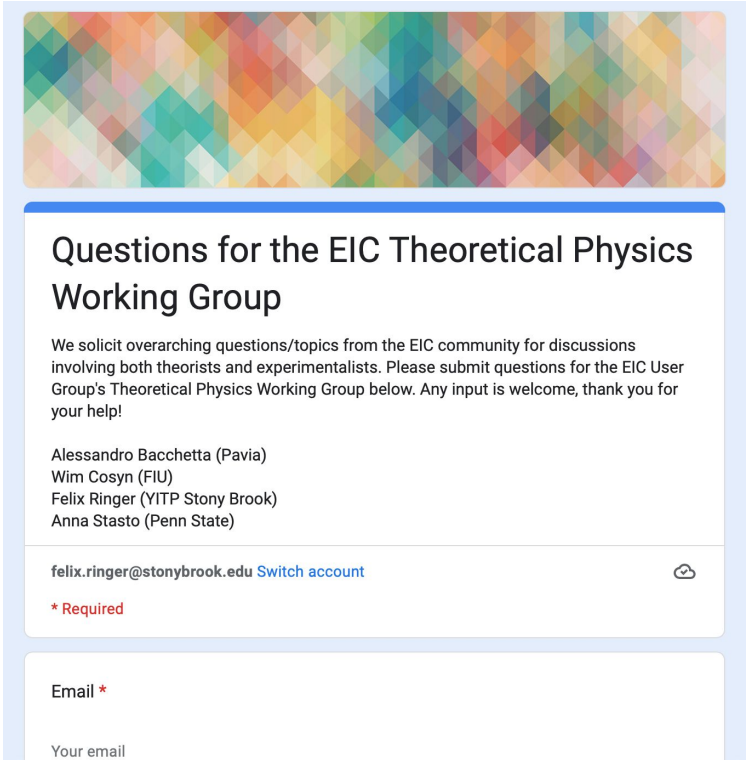
Google form to submit questions

Questions/topics from the EIC community for discussions involving both theorists and experimentalists

Especially questions with impact on the EIC experimental design

→ Google form

- Use when you want, we get notified
- Initial input: 8 questions
- Additional Q welcome of course



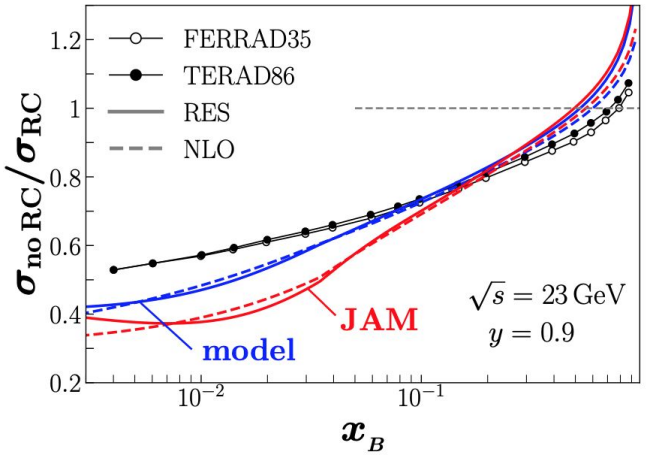
Radiative corrections

- Several people brought this up, in different ways (also during this meeting)
- General question:
  - What is available: public codes, internal codes that could be shared
  - What can be used where? What needs updating for EIC
  - Some sort of “seal of approval”

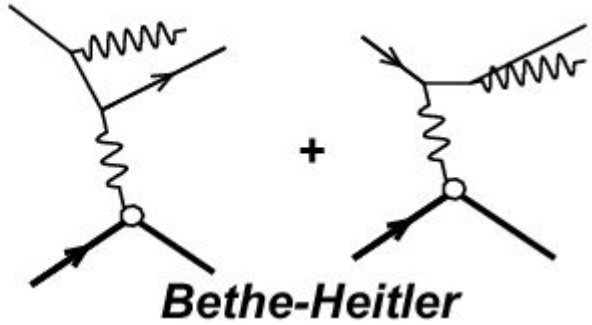
→ Would benefit from a dedicated meeting at some point

How to treat QED radiative corrections?

- Existing parton showers
- Several recent workshops (CFNS, Duke, Trento)
- Proposal by Qiu et al. (2108.13371): QED corrections depend on PDFs -> account for on theory side
- Can find consensus? Publish both uncorrected & parton shower corrected data?



Polarized Bethe-Heitler process



Elastic ep scattering

$\sigma = \sigma_u + P_e P_P \sigma_p = \sigma_u(1 + P_e P_P a)$

It's important to know $a = \sigma_p/\sigma_u$ in order to monitor exactly the EIC luminosity

A calculation of σ_u and σ_p is available in Afanasev, Akushevich, Merenkov [hep-ph/0102086]

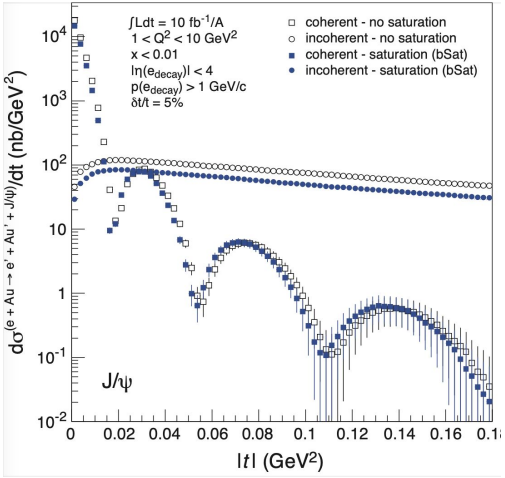
We asked to authors if they can provide us with more details and if it is still possible to use the code mentioned in the paper (MASCARAD)

Designated as more urgent

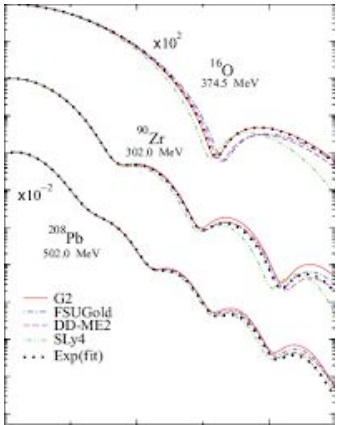
Diffractive minima in eA scattering

- Are these minima washed out in eA collisions?
- Consulted with J.M. Udias (Complutense Madrid)
  - Smearing (distortion) of the diffraction minima is mostly due to Coulomb interaction
  - Most relevant for low E_e (< 300 MeV) and heavy nuclei
  - For EIC 'distorted wave approximation' is not needed, and the plane-wave diffraction patterns will survive to a large extent
  - Position of the minima, however, would depend on the nuclear distribution
  - Accuracy of few % ok, if you want <0.1% careful review of assumptions needed
- Still collecting additional opinions

EIC white paper



Elastic eA NIKHEF data



Studies of the crossing angle at the EIC

- Note motivated SC to put crossing angle topic forward

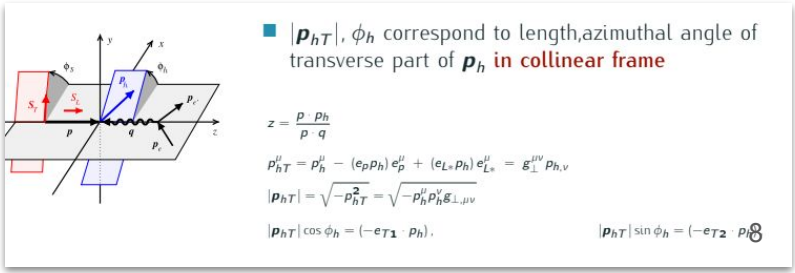
July 11, 2021

Technical note | Open Access

Accelerator and beam conditions critical for physics and detector simulations for the Electron-Ion Collider

Adam, Jaroslav; Aschenauer, Elke-Caroline; Diefenthaler, Markus; Furletova, Yulia; Huang, Jin; Jentsch, , Alexander; Page, Brian

- Couple of meetings in late 2021, theory input from A. Bacchetta, WC, C. Weiss
  - No immediate issues uncovered, implementations and simulation tools available
  - Theory input: calculations of kinematic variables (incl. azimuthal angles and polarizations) as Lorentz invariants → frame does not matter, as long as one stays consistent
  - Thoughts to incorporate in updated note → apologies for the delays..



Other questions that we received

- (x2): What role can Lattice QCD play for EIC
- General Analysis framework of PDFs/TMDs/GPDs

→ Larger than the scope of the WG, can be addressed community-wide

- Modification of jets (broadening/narrowing) in eA
- Threshold vector-meson production
- EIC studies for small systems

→ Submitted by paper authors

Involvement of experimentalists & theorists

- It can be difficult to recover results in theory papers that were written ~20 or 30 years ago.
  Especially, if code is not available or difficult to mesh with current practices

- Potentially missing incentive structure for (young) theorists to redo calculations
  → work like this does not land grants or positions (unfortunately)

- Plan is to summarize topics addressed + open questions/problems on the wiki page

- Encourage theorists to participate & reach out if able to contribute

Conclusions & Outlook

- Enable discussions and meetings between experiment & theory
- Solicit questions from the EIC community
- Several issues are being looked at (initial stages)
  → plan follow up with dedicated Zoom meeting where needed
- Need involvement from theorists, but more incentives needed (?)
- Is there anything you want us to do differently or additionally ?