Letter of Interest: Hadron Spectroscopy at the Electron Ion Collider

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LOI: https://www.snowmass21.org/docs/files/summaries/RF/SNOWMASS21-RF7_RF0-090.pdf

Hadron Spectroscopy at the EIC

Justin Stevens

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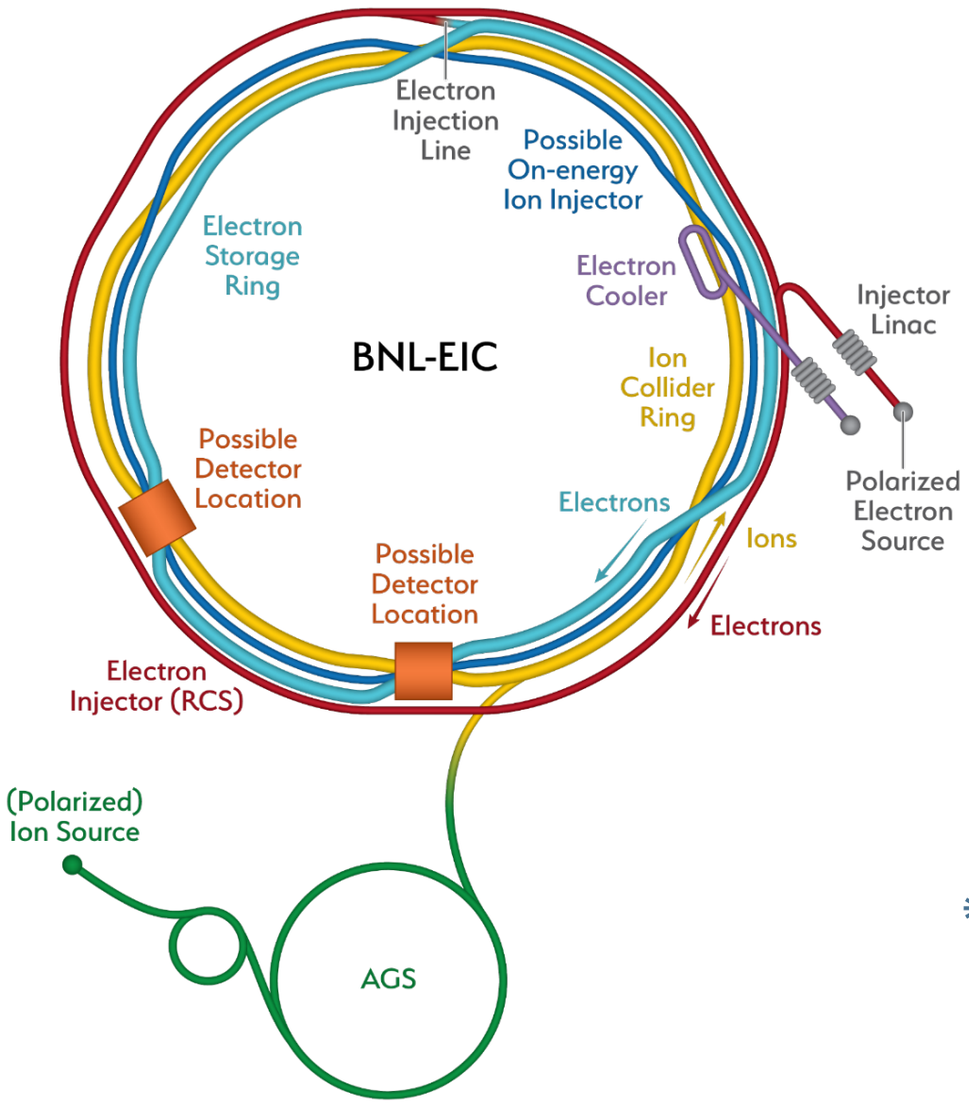
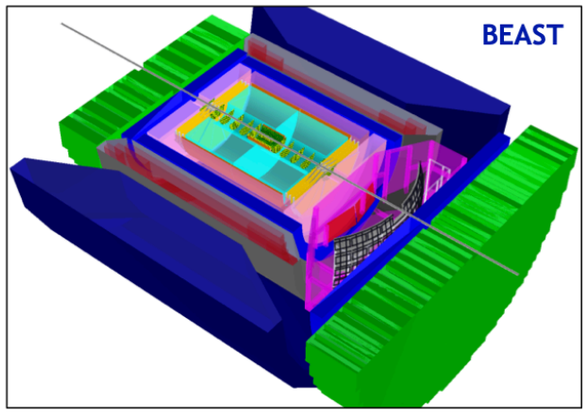
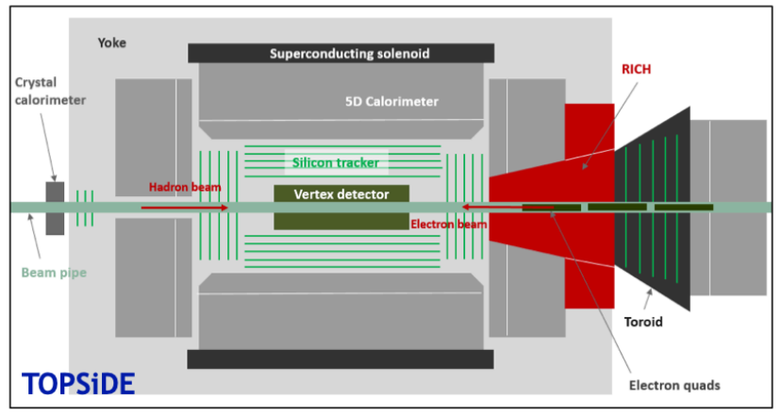
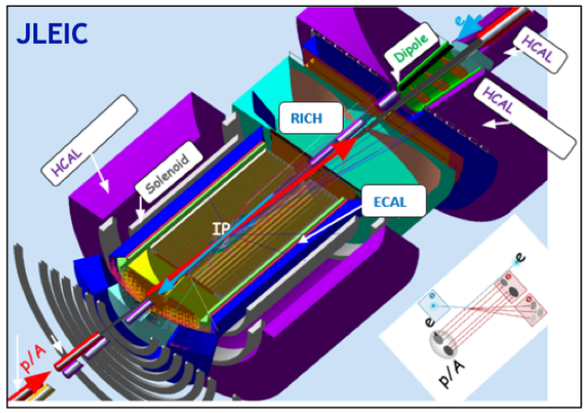
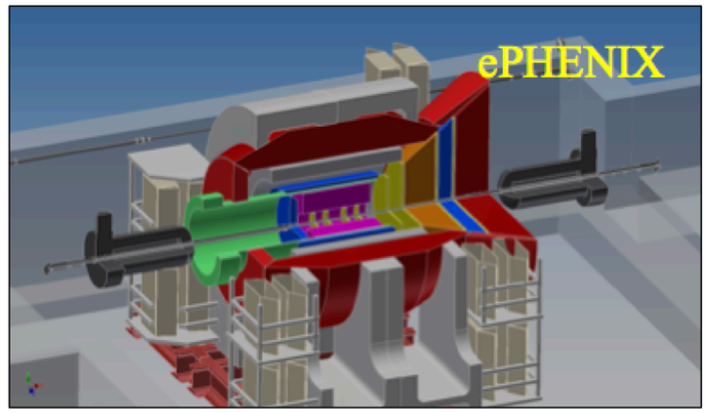
Electron Ion Collider (EIC)











$$\sqrt{s} = 20 - 141 \text{ GeV}$$

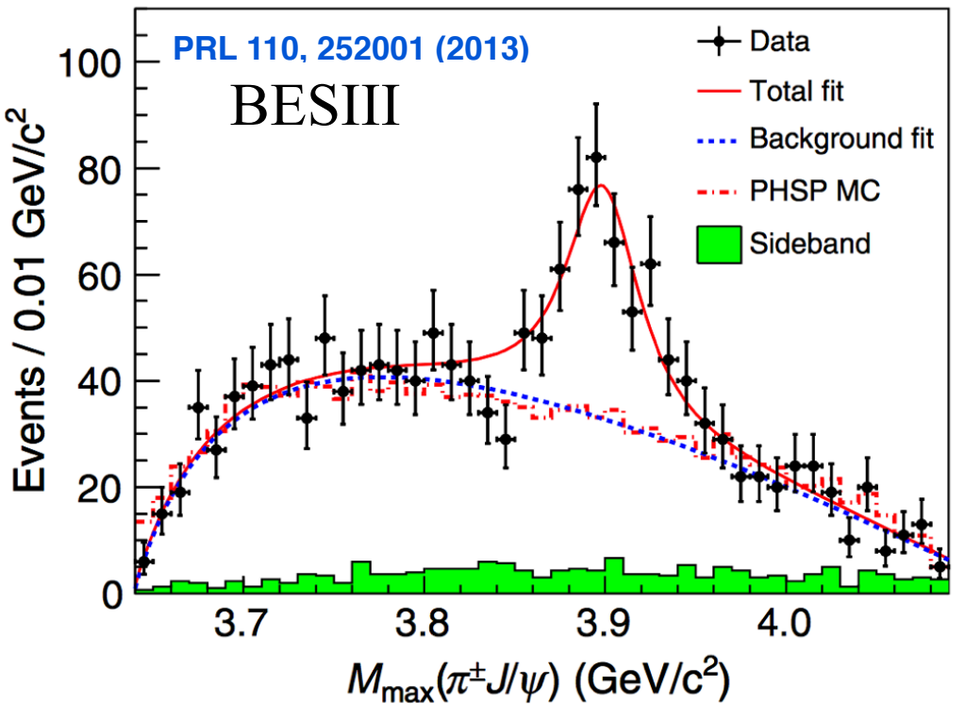
$$\mathcal{L} = 10^{34} \text{ cm}^{-2}\text{s}^{-1}$$

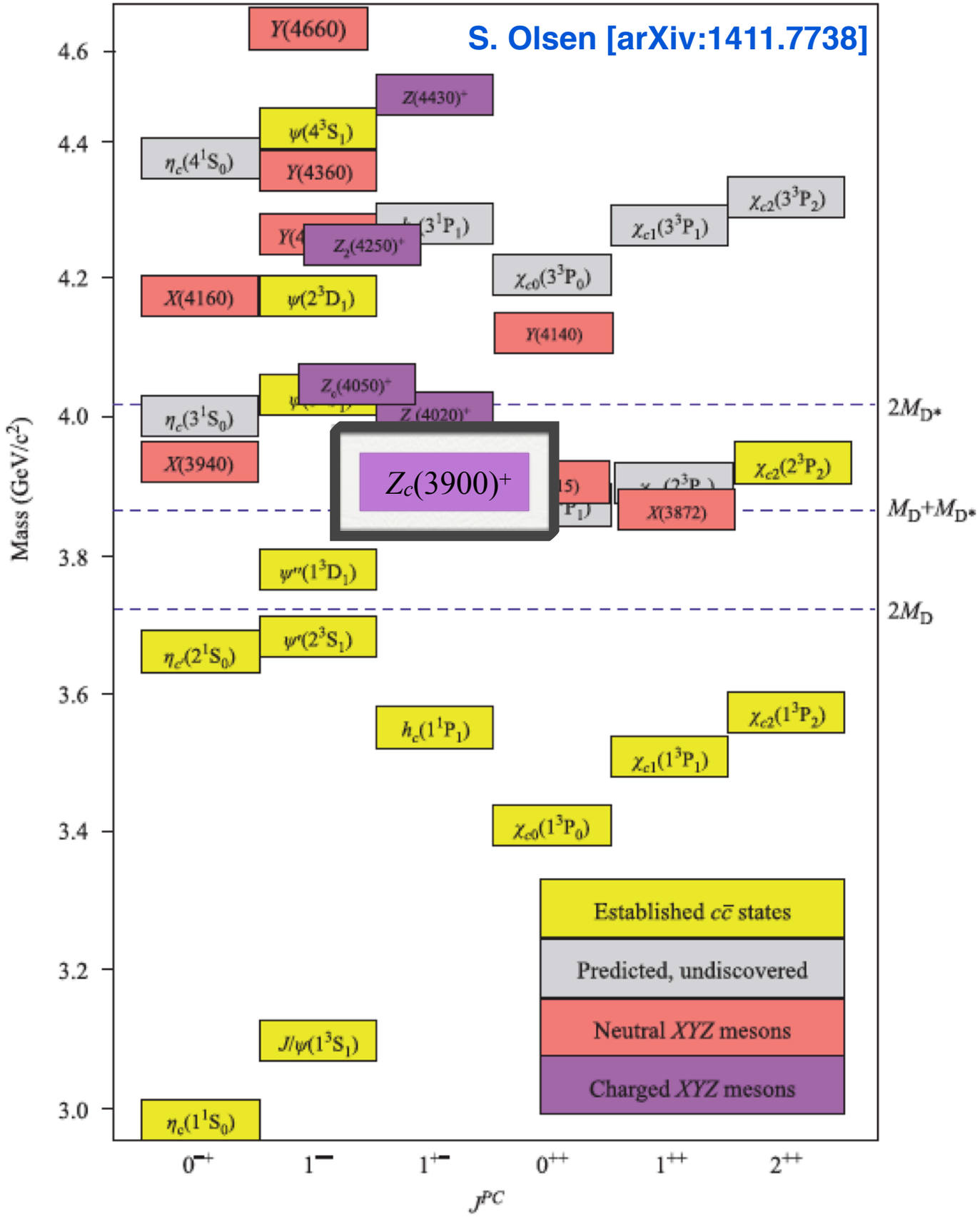
- Versatile high-luminosity, polarized e+p and e+A collider, recently received DOE CD0
  - Nucleon spin and 3D structure
  - High gluon density and saturation
- Very active development of detector conceptual designs (EIC Yellow Report)

XYZ states

- Many new states observed in the last ~decade
- Not predicted by the standard charmonium models
- Many models for interpretation: resonant states, meson molecules, re-scattering effects, etc.

$$e^+e^- \to \pi^+\pi^- J/\psi \ (4260 \text{ MeV})$$

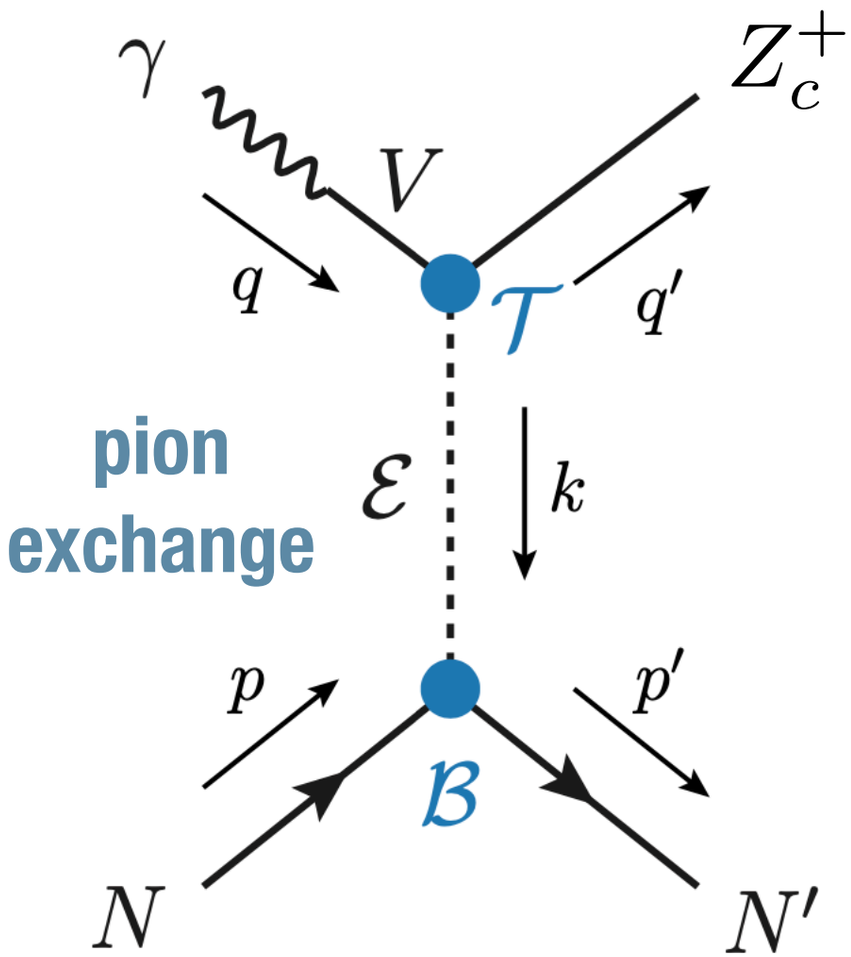


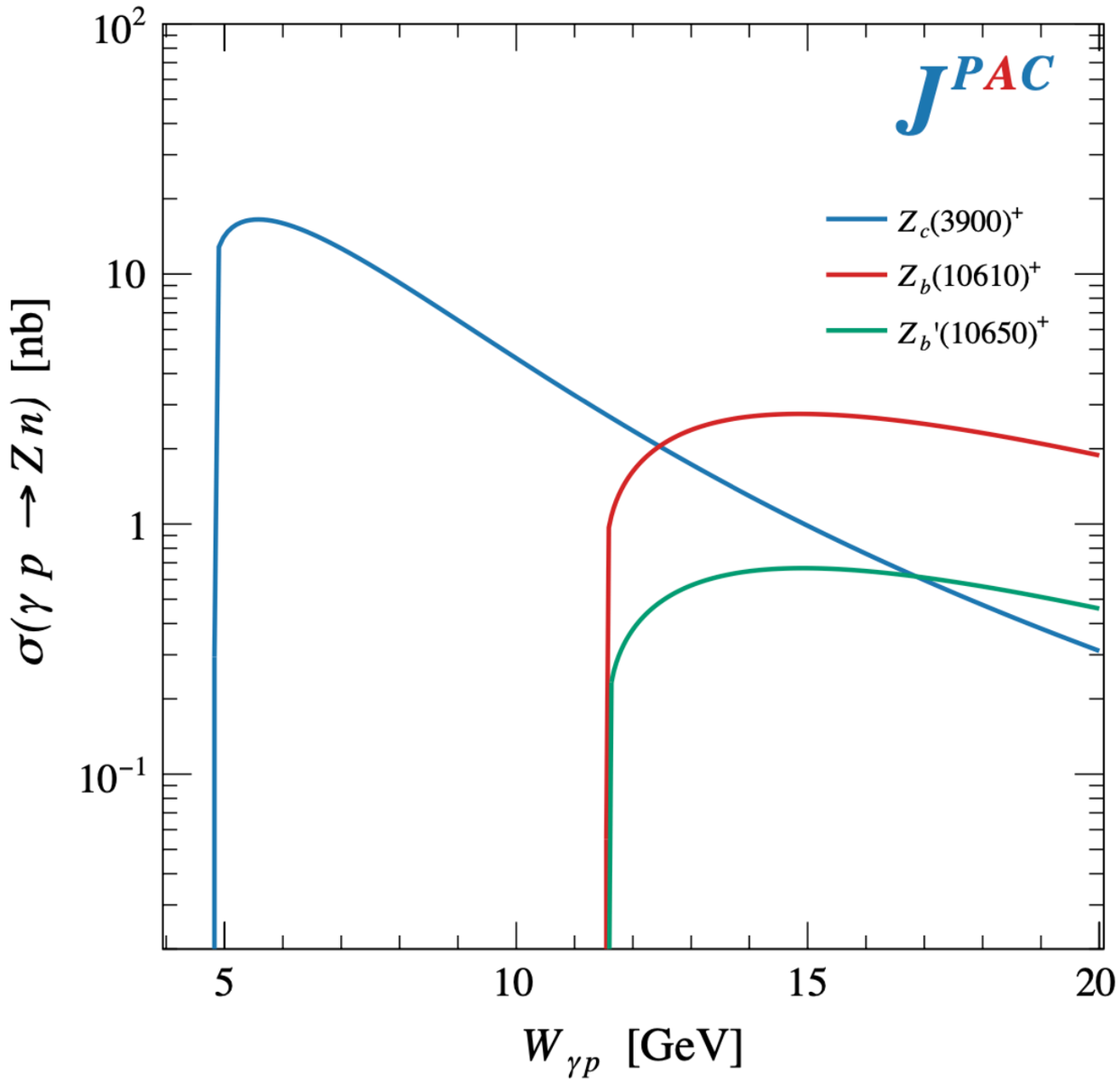


Exotic Photoproduction @ EIC

- High energy provides opportunities in XYZ, P_c, etc.

JPAC arXiv:2008.01001





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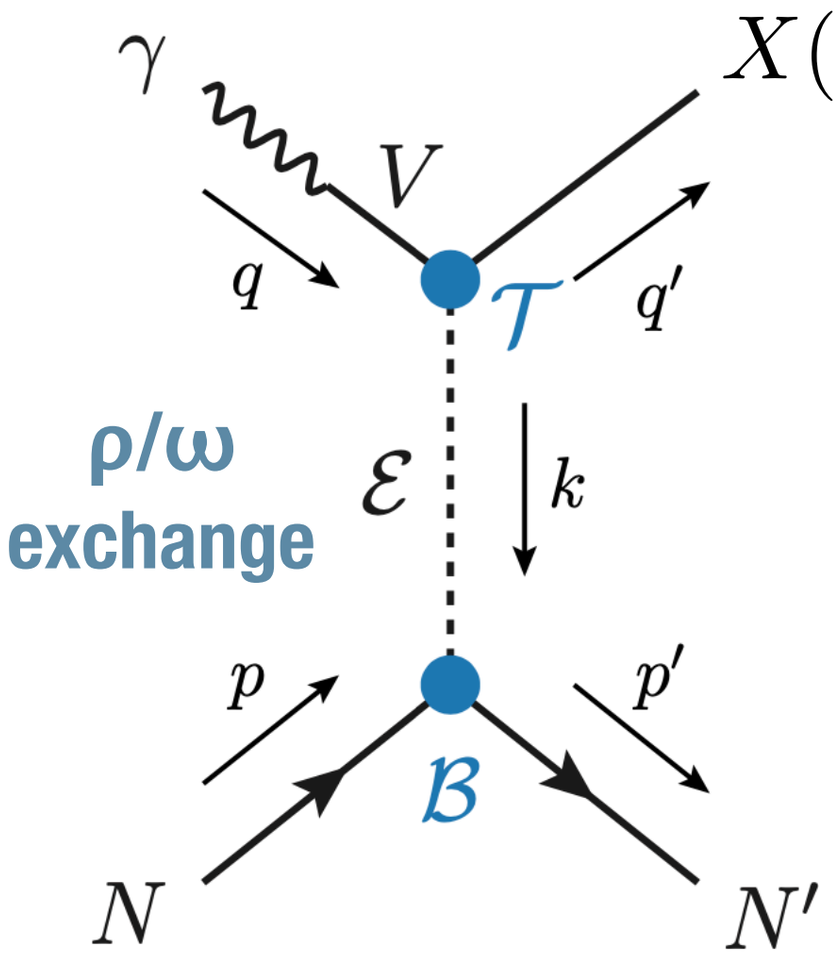
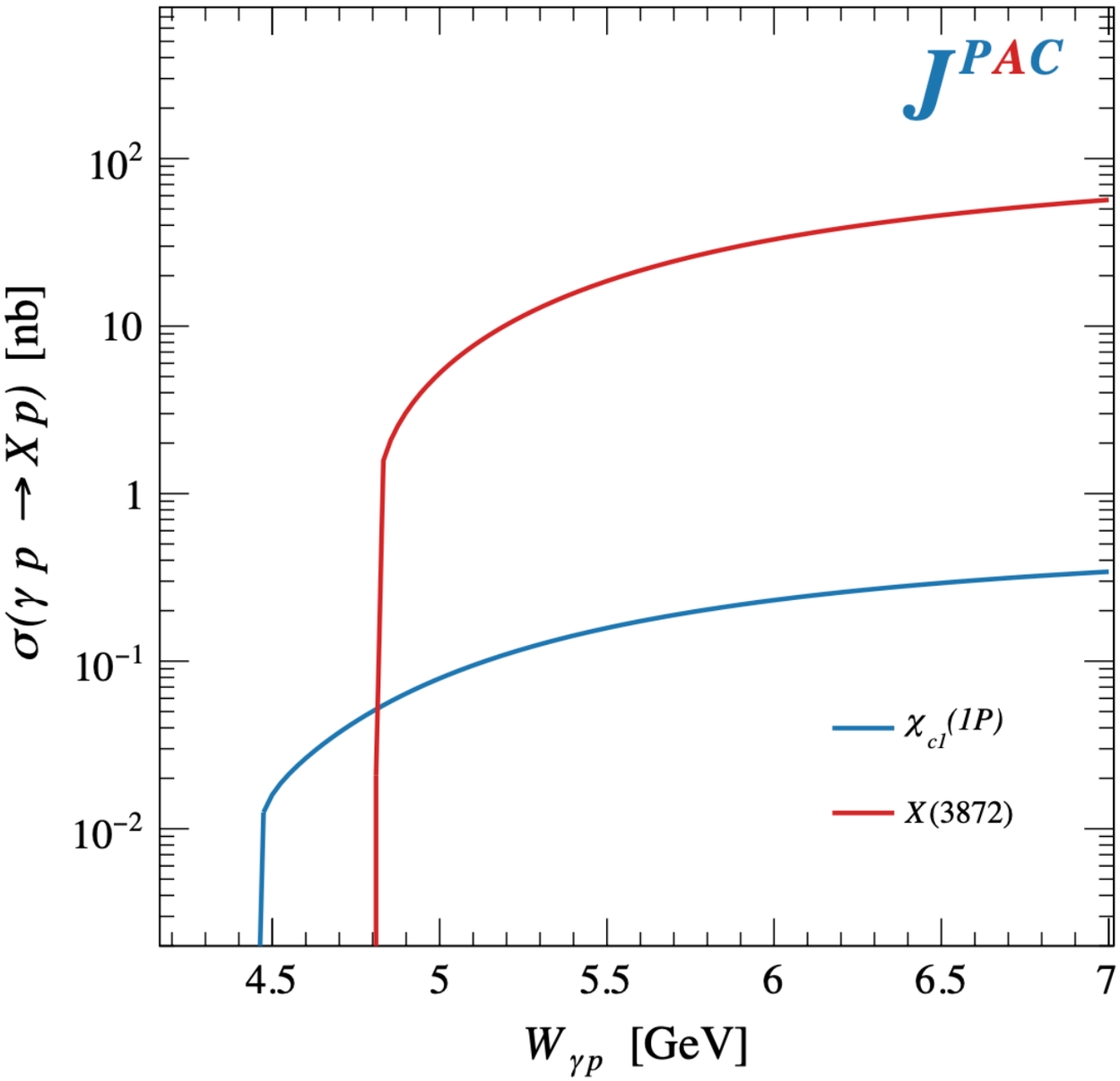
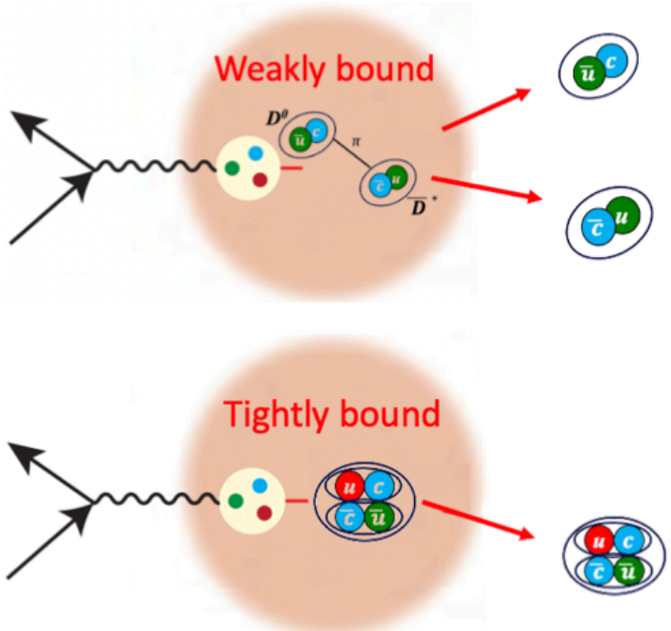


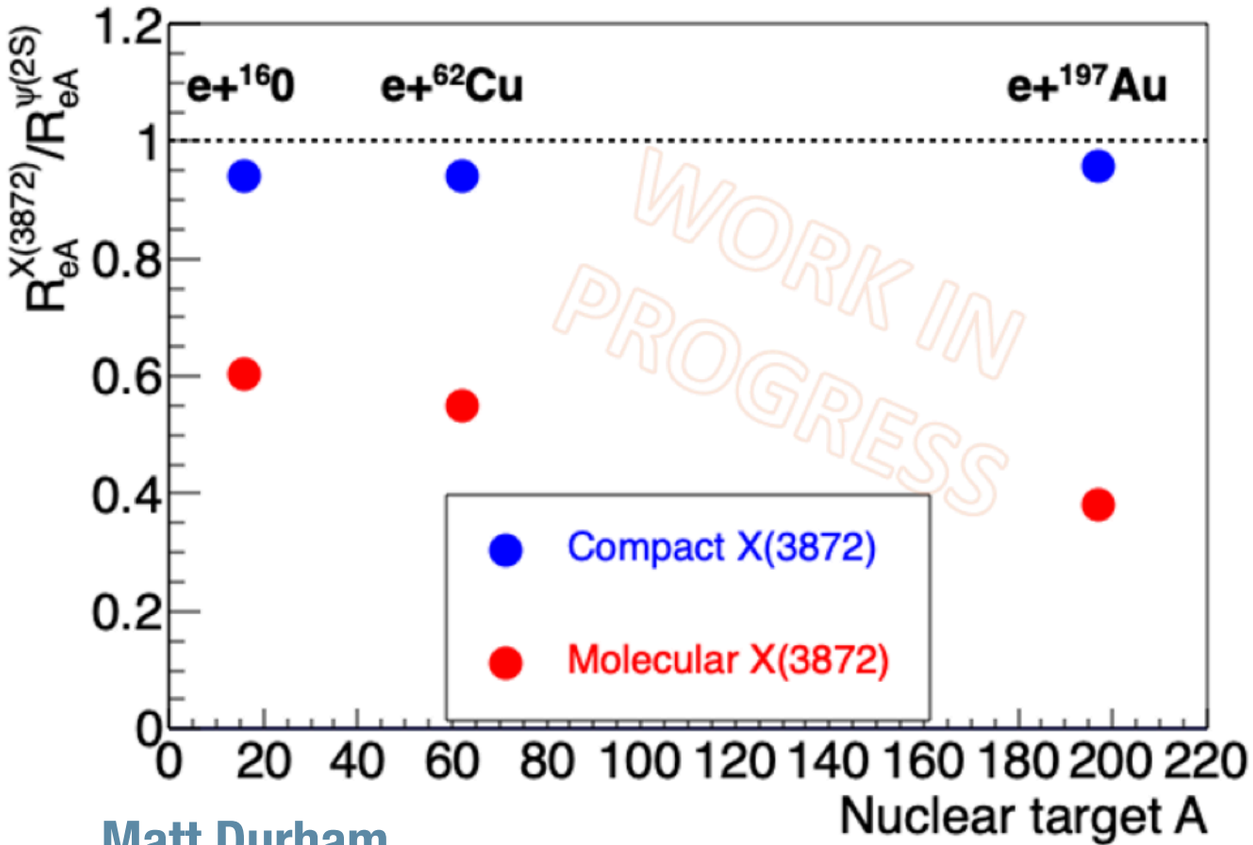


In-medium effects @ EIC

- High energy provides opportunities in XYZ, P_c, etc.
- Dependence of breakup of X(3872) in nuclei?

- **Therefore, exotic structure can be studied by measuring suppression in eA collisions.**





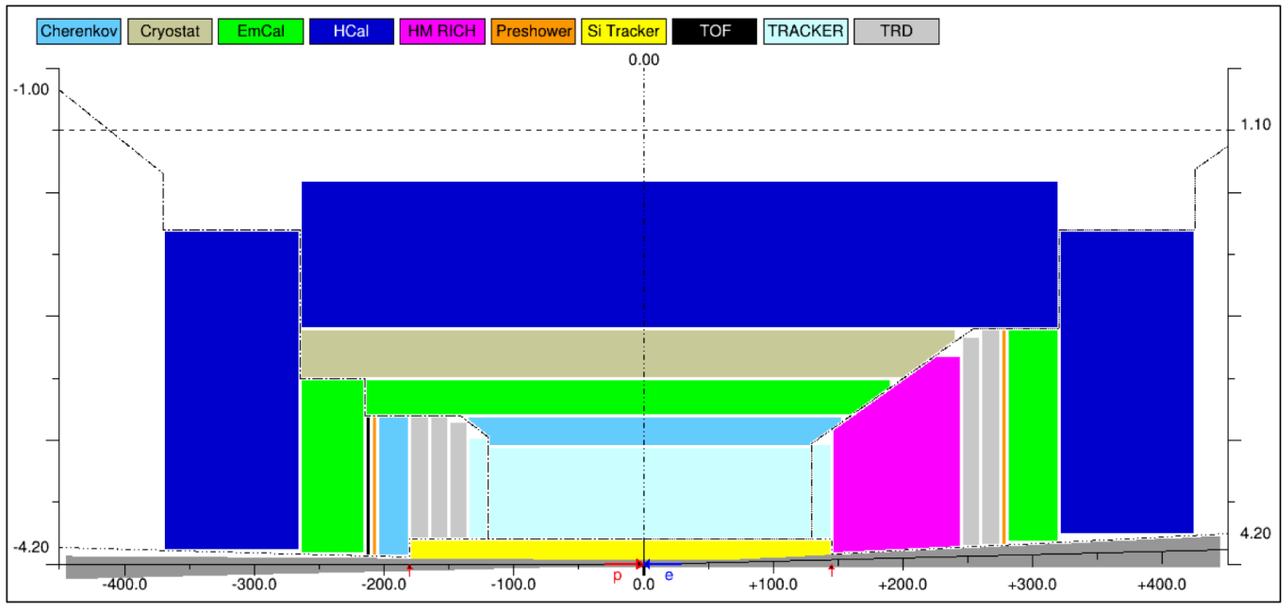
Matt Durham

https://indico.bnl.gov/event/8231/contributions/37696/attachments/28300/43650/EIC_Pavia_JHF_Ping_Xuan_Matt_v4.pdf

Hadron Spectroscopy @ EIC

- High energy provides opportunities in XYZ, P_c, etc.
- Encourage interactions between EIC and HEP communities to study exotic production mechanisms
- Parallel effort [EIC Yellow Report]: defining detector detector requirements for EIC, to be completed in 2020

Asymmetric detector concepts due to asymmetric beam energies: "complete" coverage for $|\eta| < 3.5$



Many groups participating: JPAC, JLab, Florida State, Indiana, W&M, Glasgow, INFN, Regina. More welcome!

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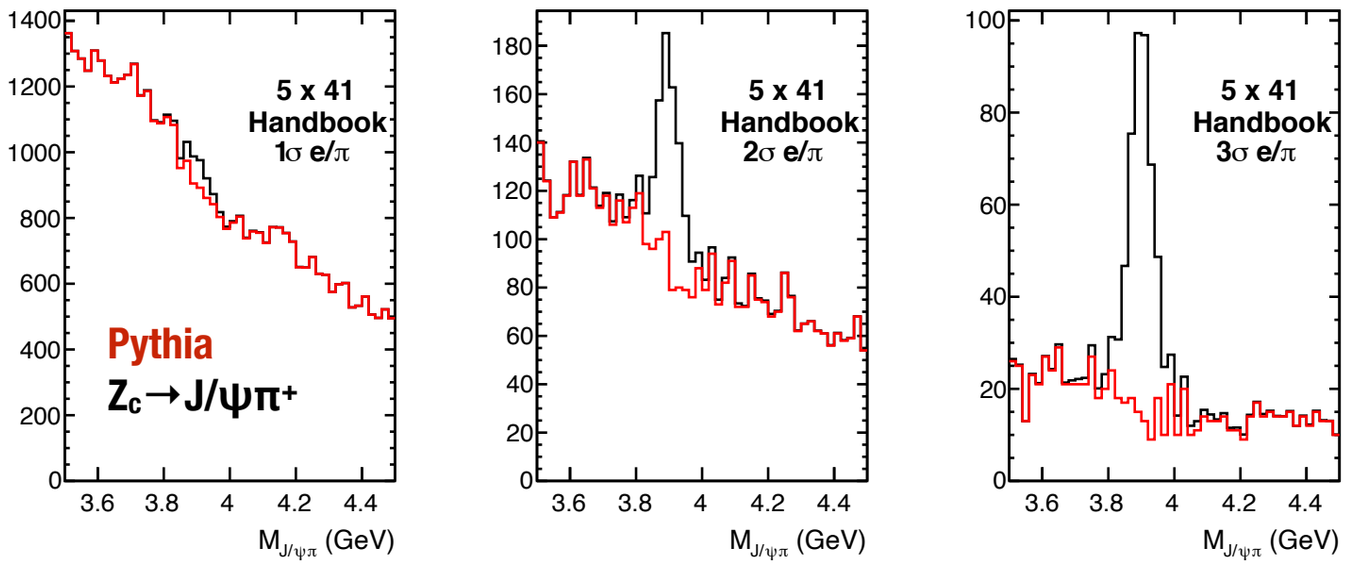
e.g. e/π separation requirements



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EIC Project Launch!

DOE project officially launched on September 18, 2020
Joint BNL+JLab project: proposed schedule for completion in 2031(?)

https://www.jlab.org/news/releases/key-partners-mark-launch-electron-ion-collider-project
https://www.bnl.gov/newsroom/news.php?a=117399
https://www.youtube.com/watch?v=T0-3e0Ws8qo