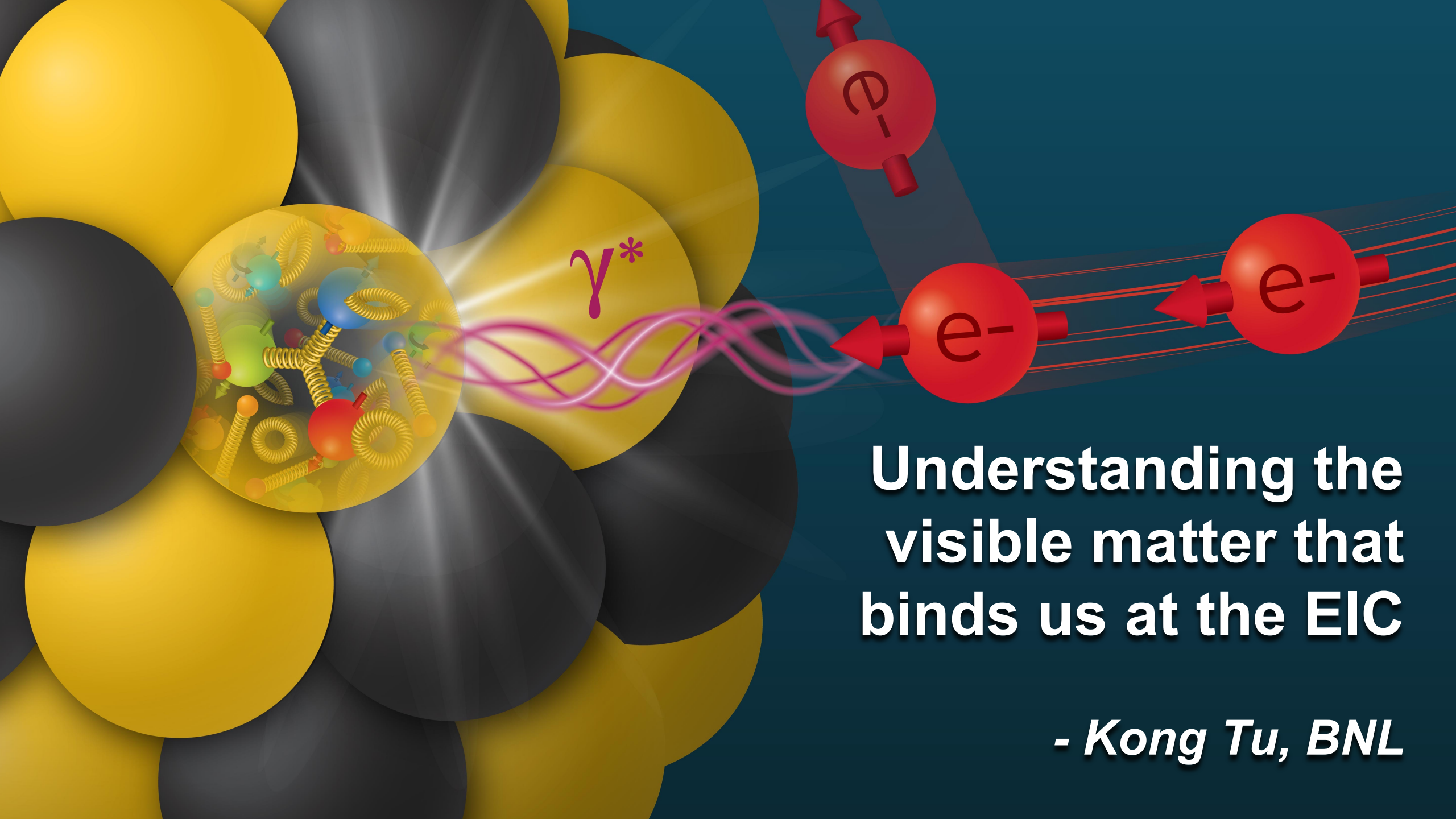
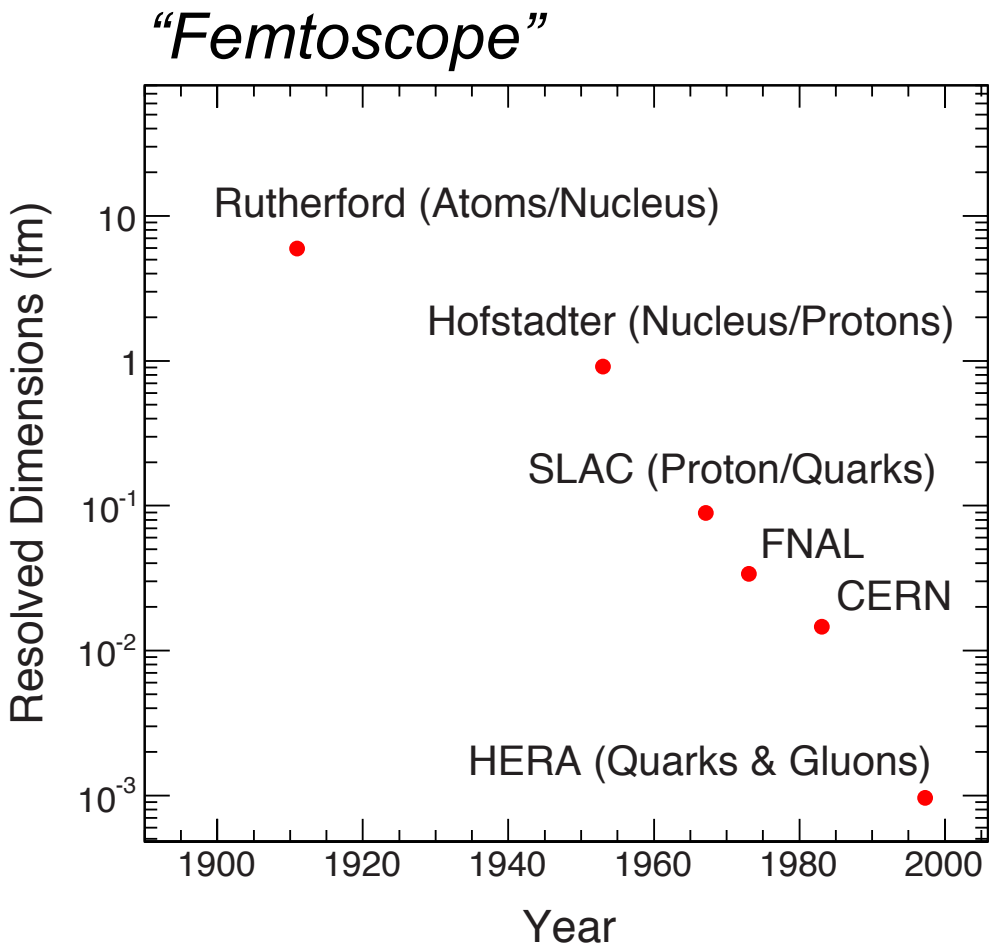


Understanding the visible matter that binds us at the EIC

- Kong Tu, BNL

Imaging program: seeing is believing

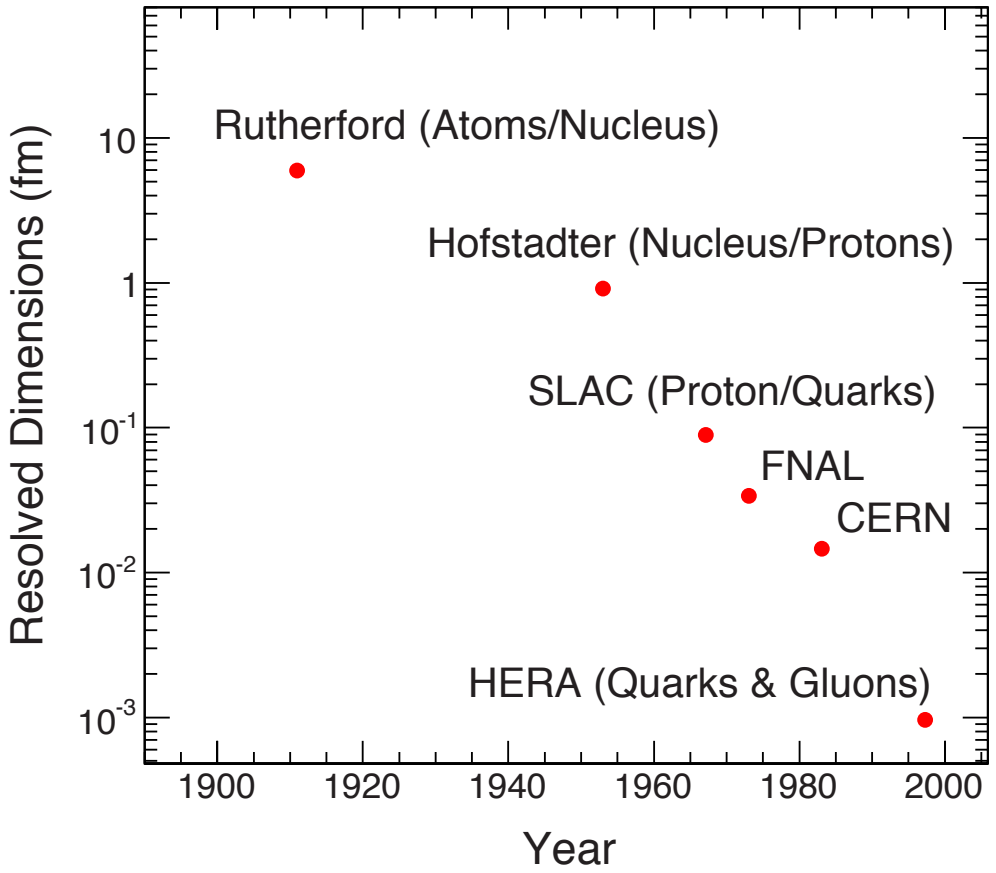
femtoscale imaging reveals the inner structure of nucleon and nucleus



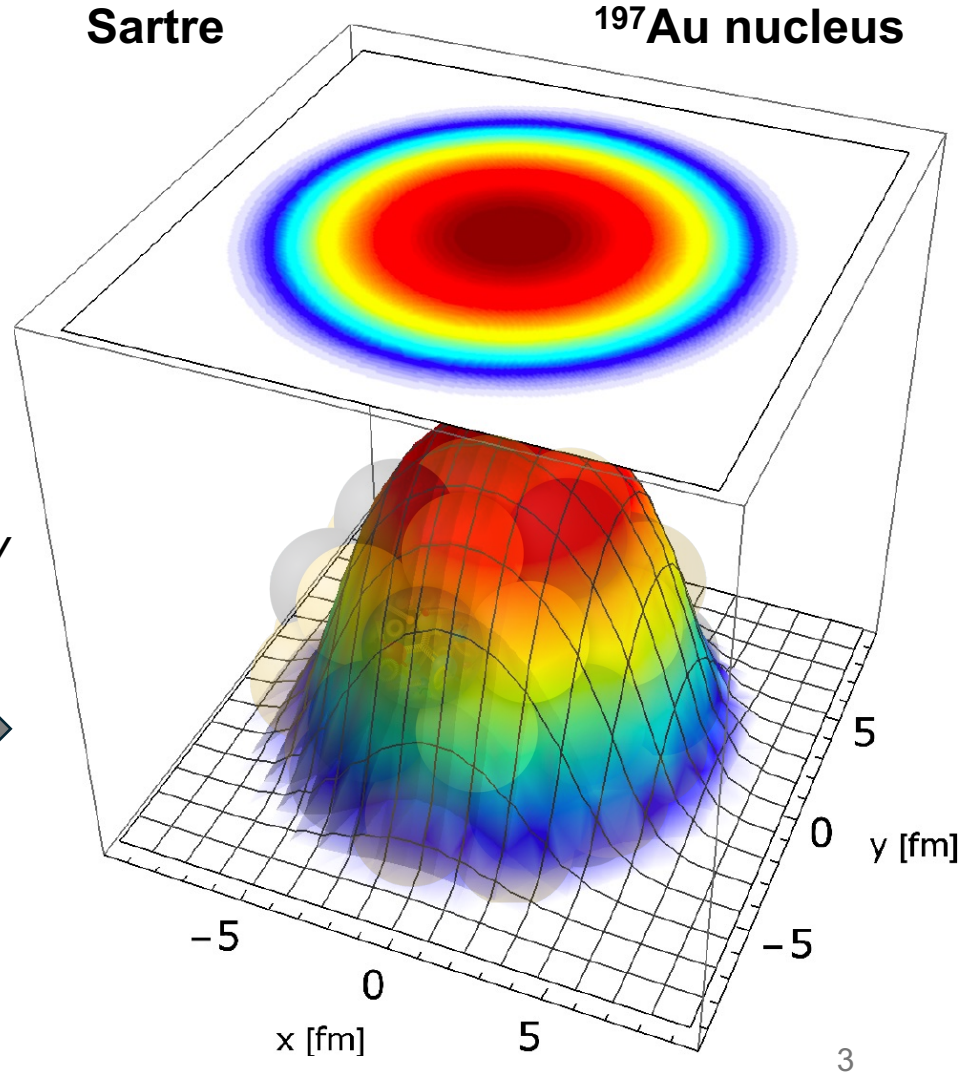
Imaging program: seeing is believing

femtoscale imaging reveals the inner structure of nucleon and nucleus

"Femtoscope"

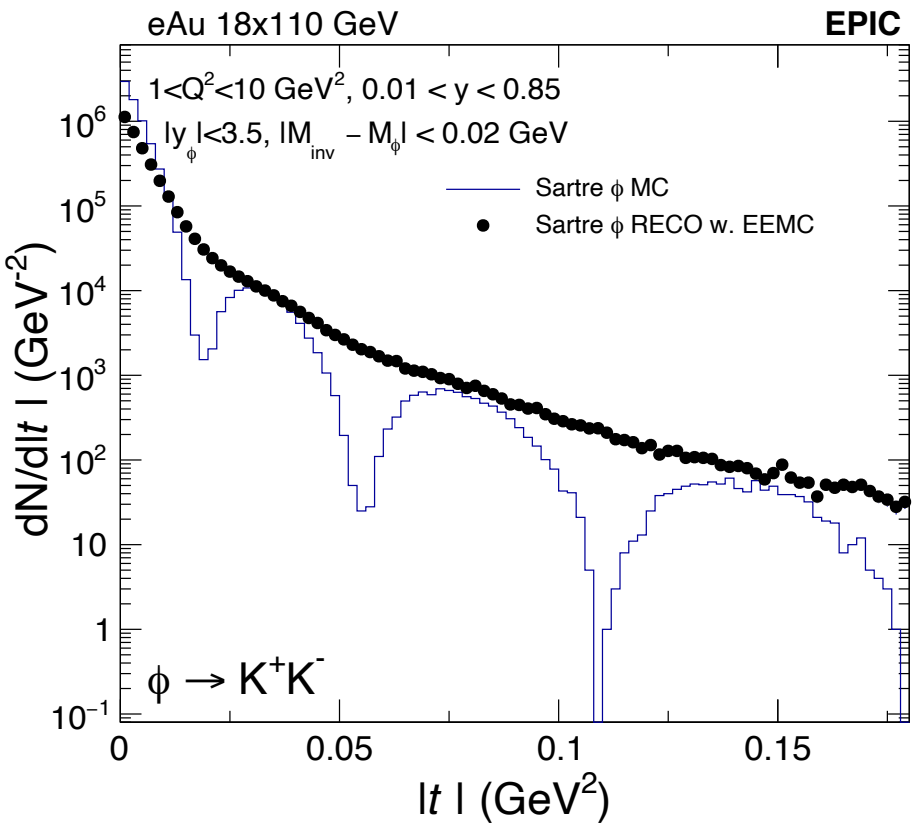


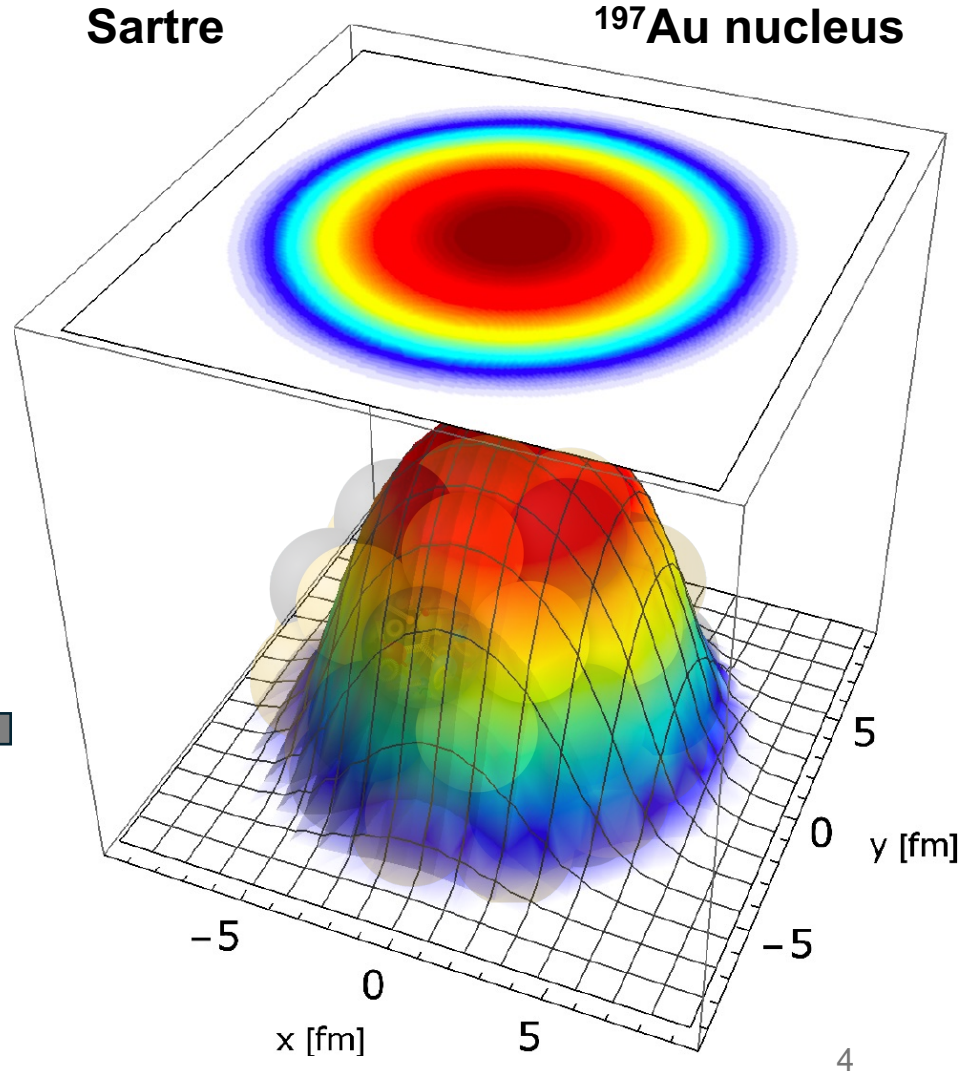
EIC: putting heavy nuclei under the best femtoscope.



Imaging program: seeing is believing

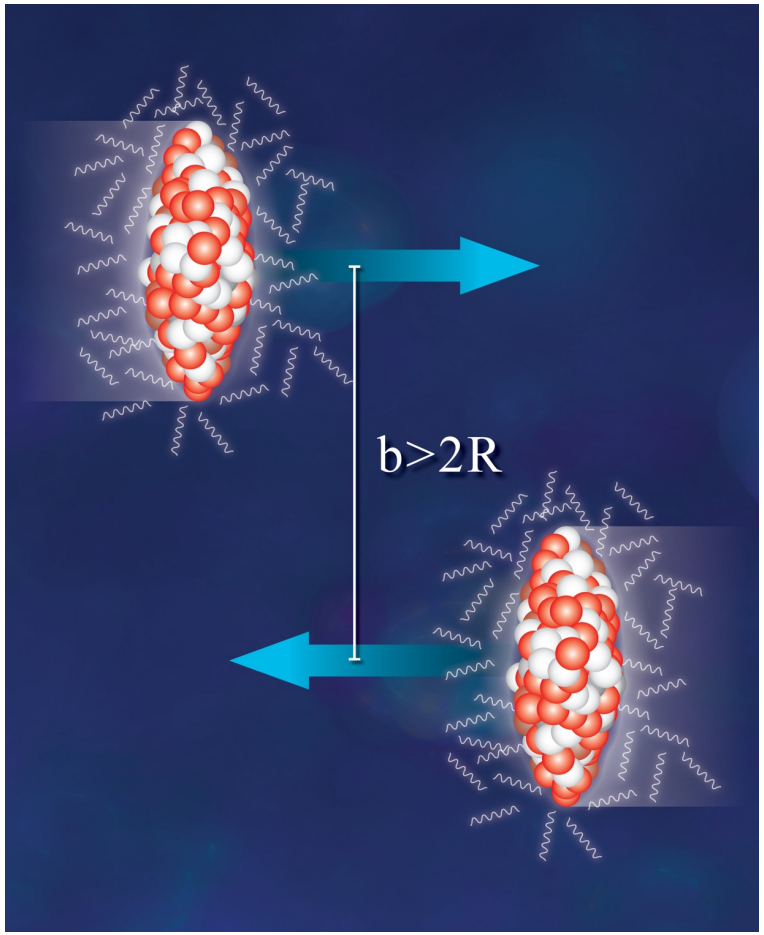
femtoscale imaging reveals the inner structure of nucleon and nucleus





A full simulation paths our way towards realizing this program

Previewing the physics of EIC from UPCs



EIC

Electroproduction (virtual photons)

Q^2 – an independent hard scale

CM energy, W ~ [9, 86] GeV, x ~ 10^{-4} -10^{-2}

Deuterium to Uranium

Large far-forward coverage, esp. for nuclear breakup.

UPC RHIC & LHC

Photoproduction only (real photons)

Mass or p_T – hard scales

CM energy, W ~ [4, 400-1000] GeV, x ~ 10^{-5} -10^{-1}

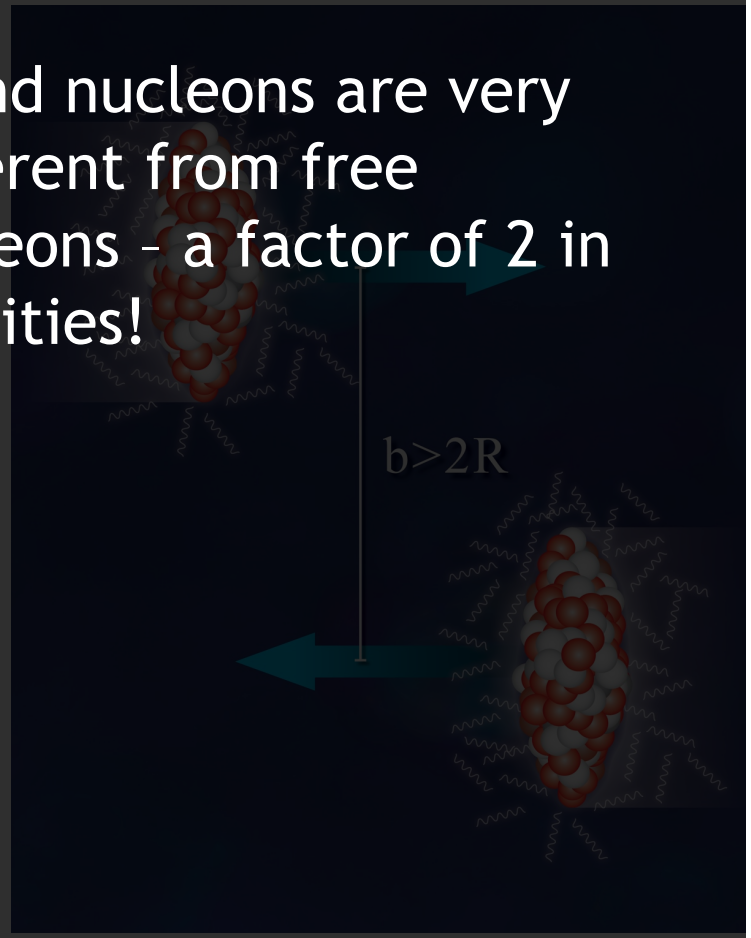
mostly Pb^{208}, Au^{197}.

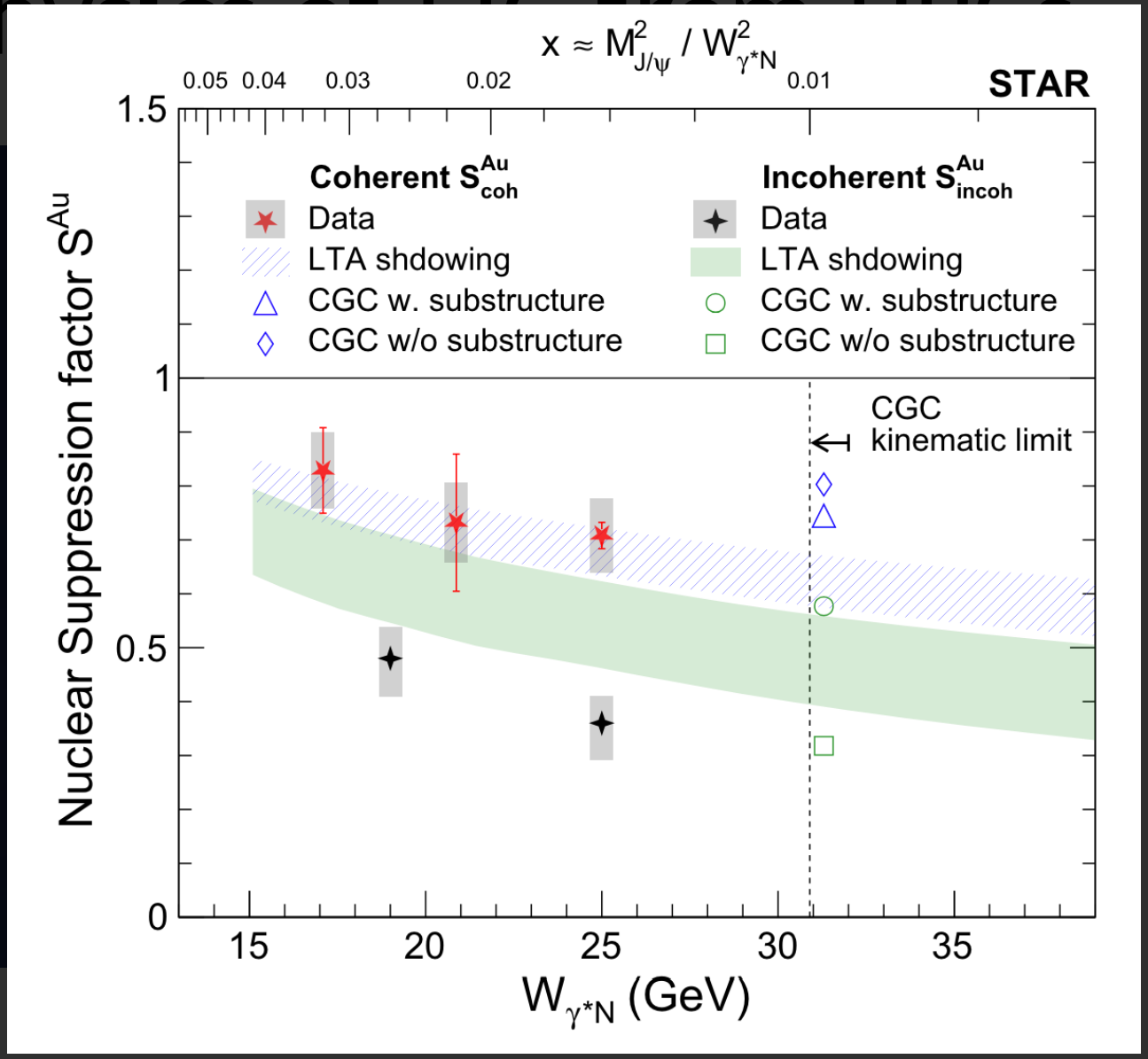
Limited far-forward coverage for breakup products

Previewing the physics of EIC from UPCs

Accepted in PRL (June 2024)

- Bound nucleons are very different from free nucleons – a factor of 2 in densities!

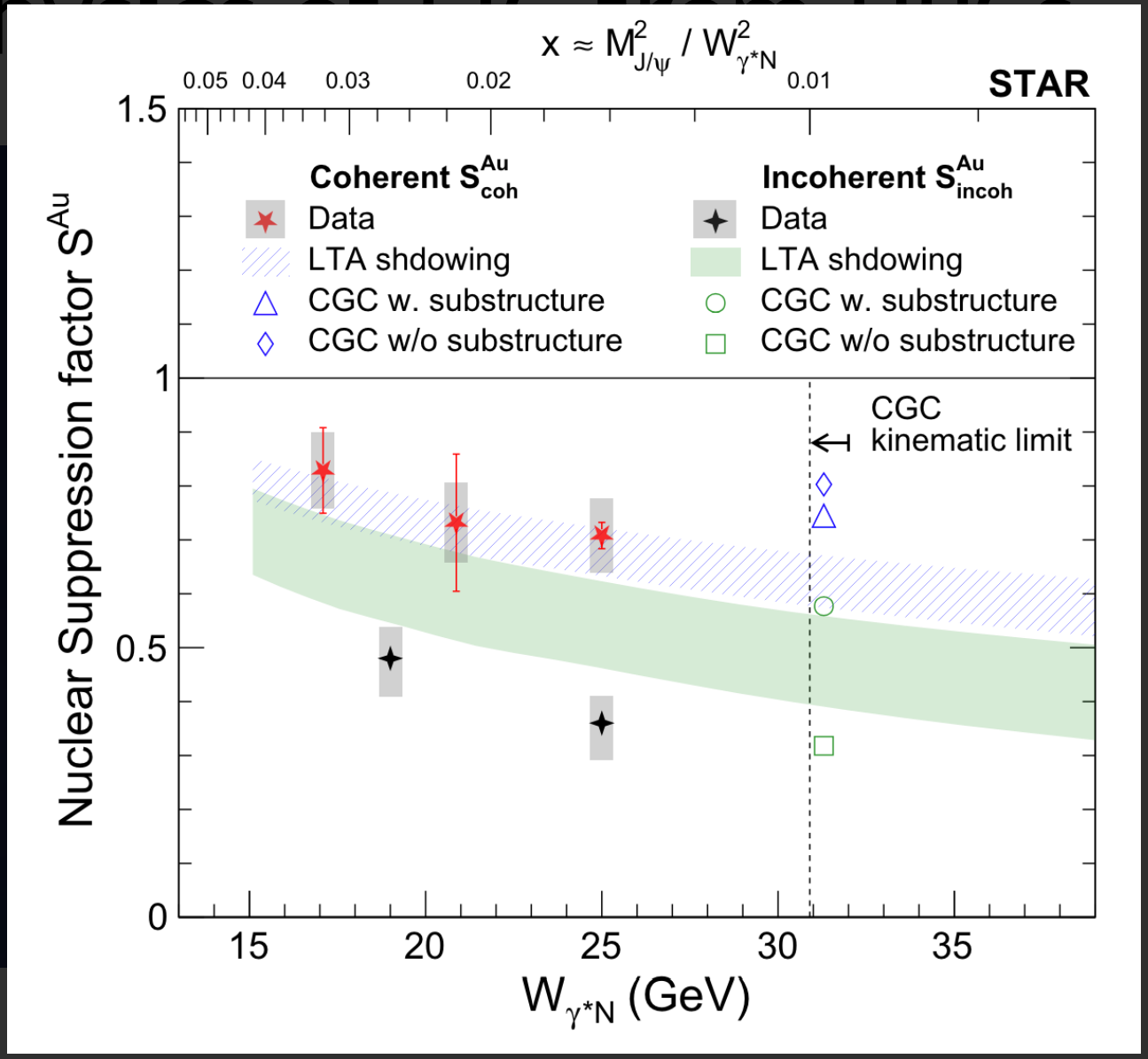




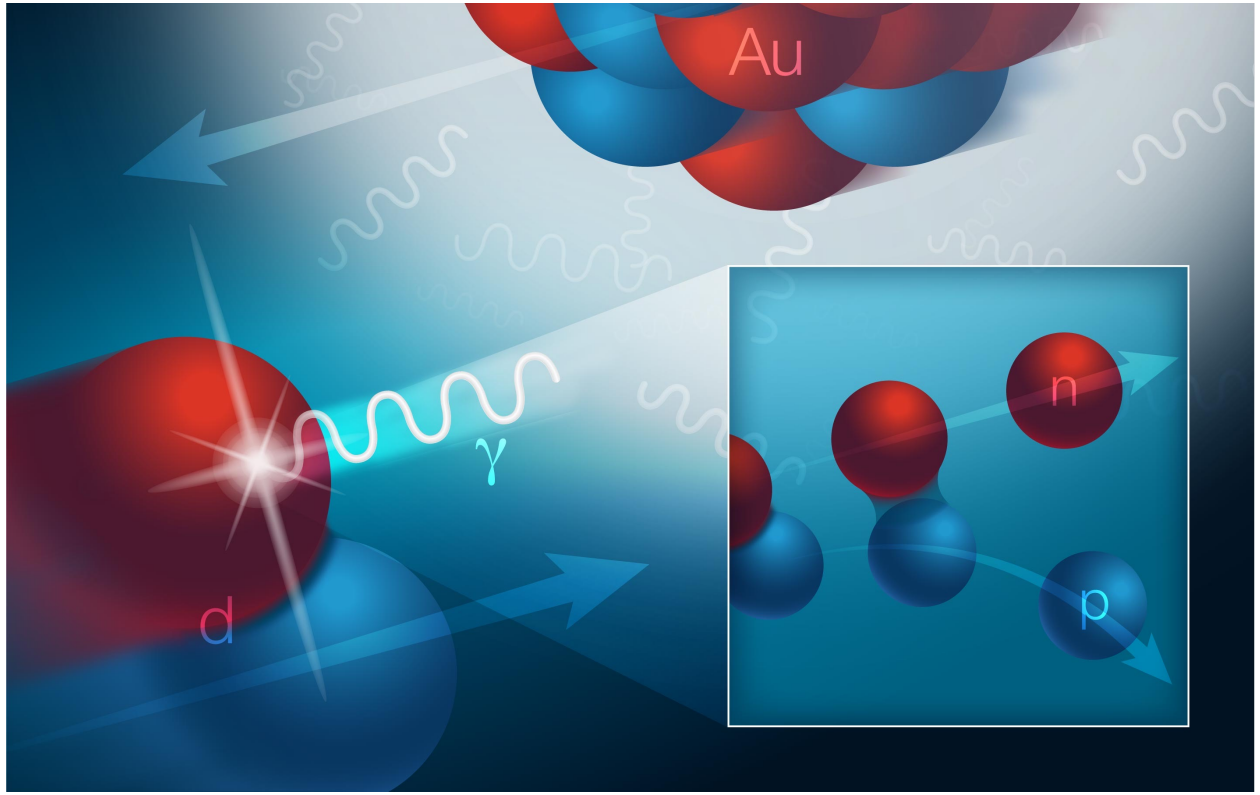
Previewing the physics of EIC from UPCs

- Bound nucleons are very different from free nucleons – a factor of 2 in densities!
- Incoherent was recently found to be sensitive to saturation, shadowing, parton modification, and imaging at the EIC.

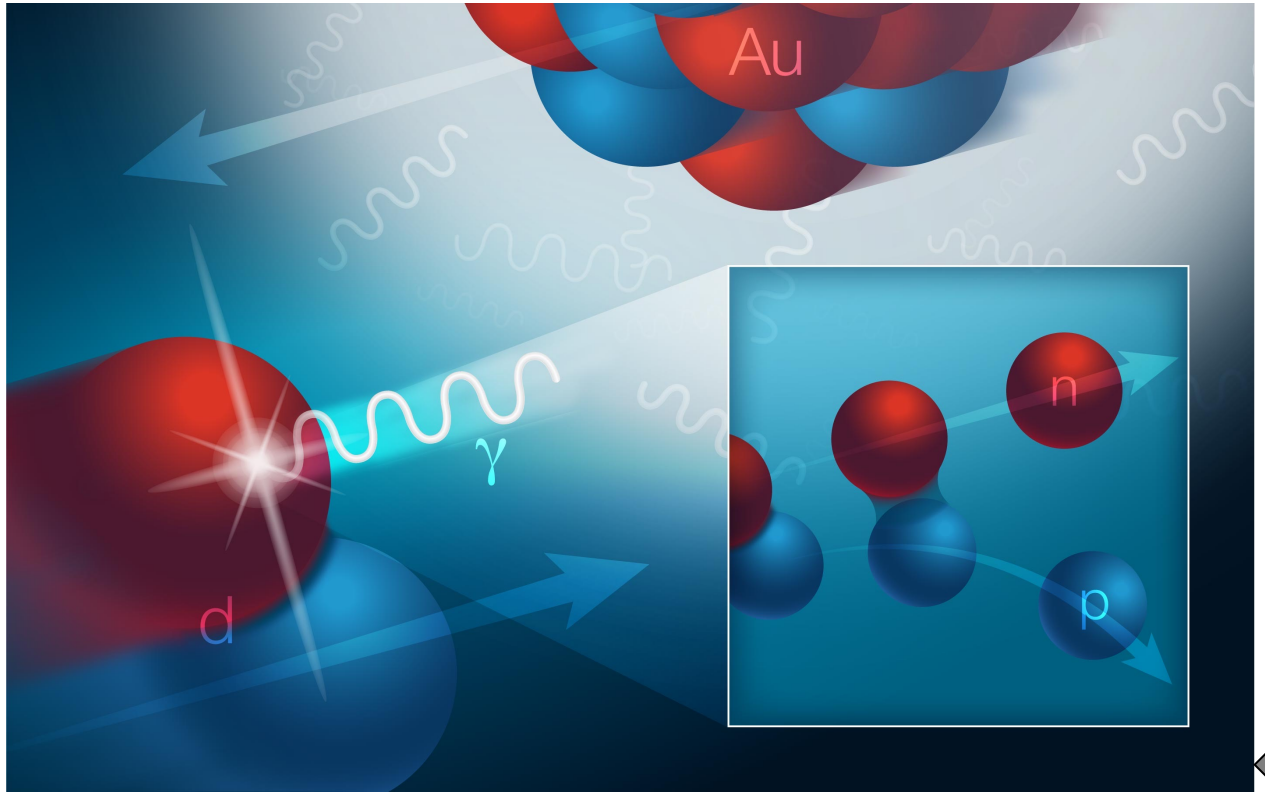
Accepted in PRL (June 2024)

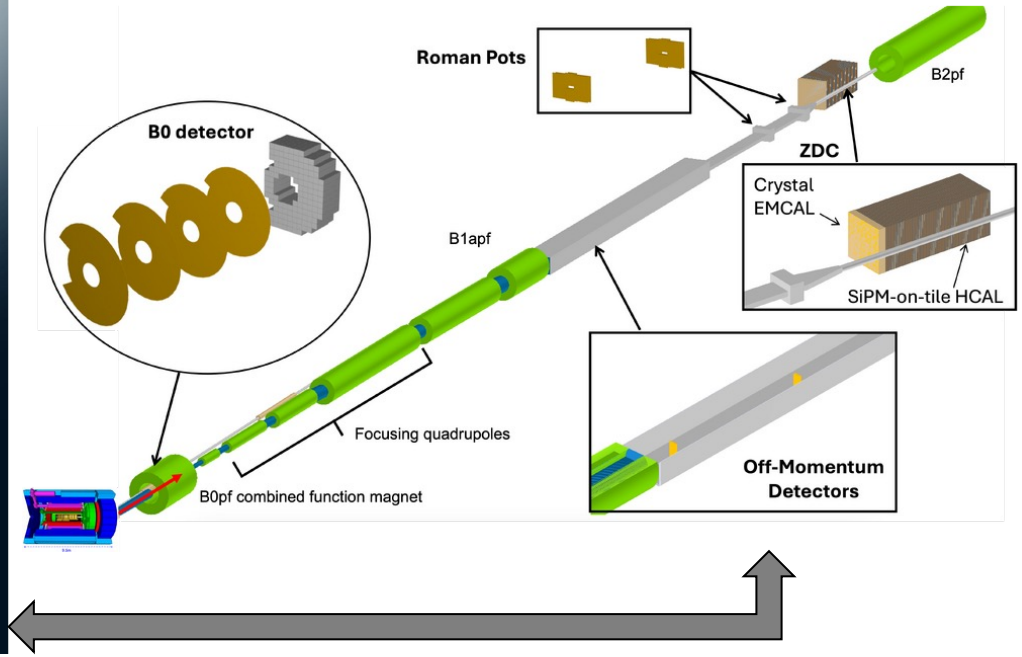


Tagging program:
Precise control of how bound the nucleon is



Tagging program:
Precise control of how bound the nucleon is



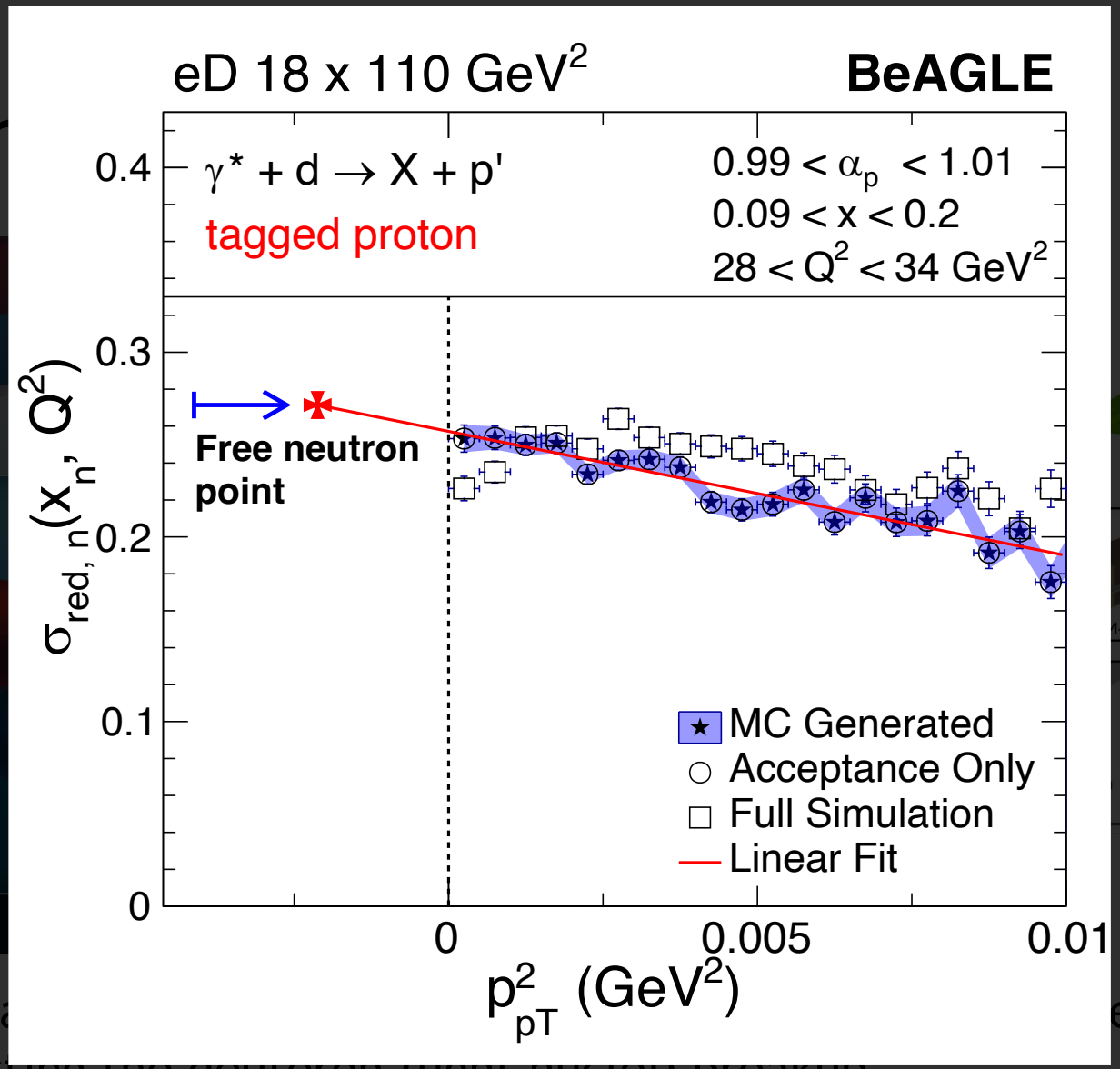


Spectator tagging – access to the initial nucleon-nucleon configuration. Partially motivated the Off-Momentum Detector by detecting the deuteron (light nuclei) breakup.

Tagging program: Precise control of h

The spectator tagging method accesses both free and bound nucleons – a wide range of kinematics enabled by the EIC and Far-forward detectors.

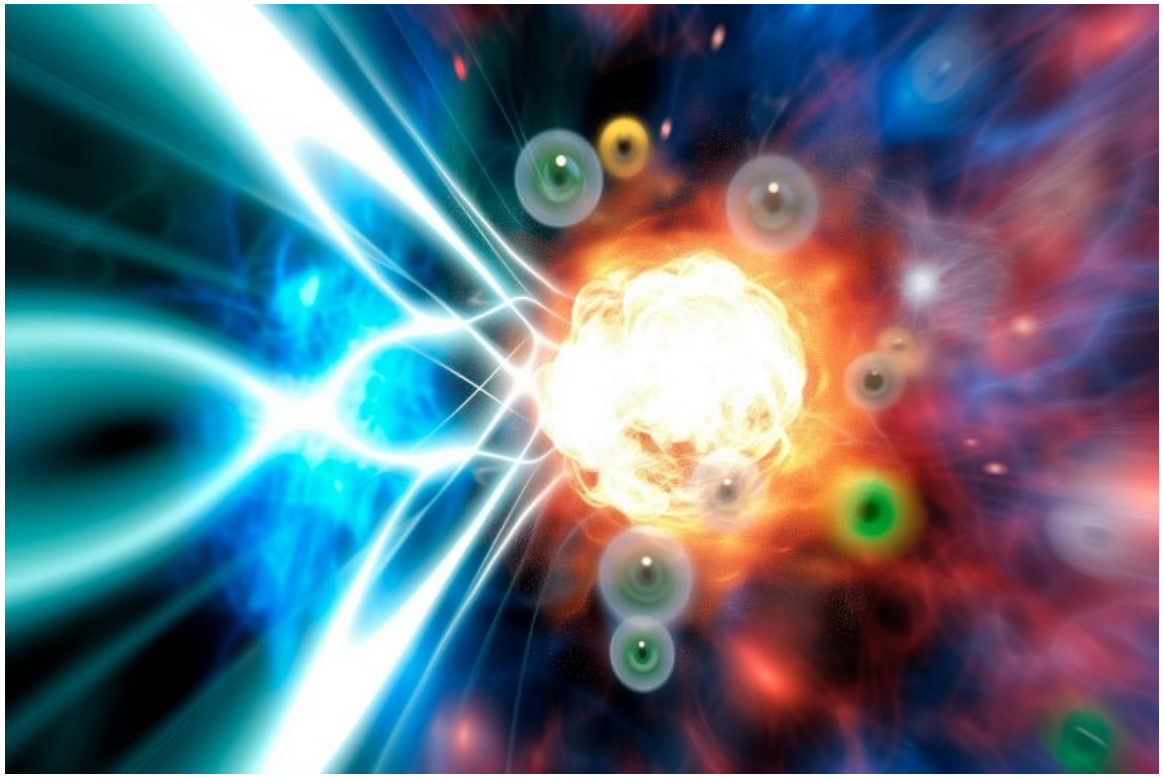
Editor's Suggestion
Phys. Rev. C 104 (2021) 6, 065205

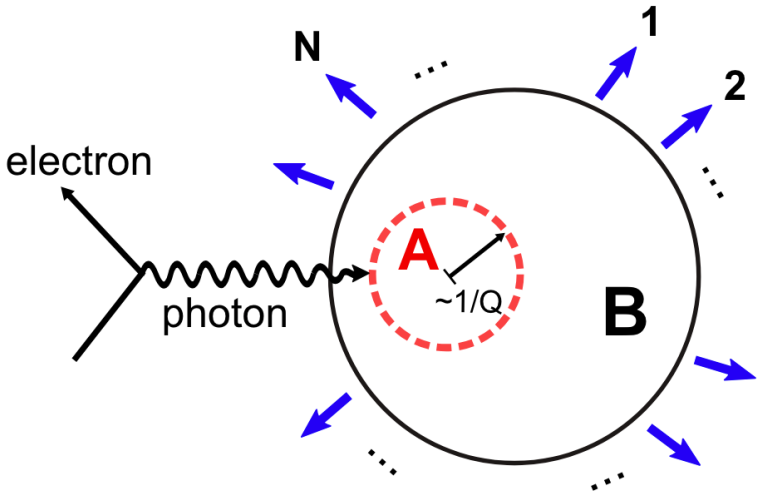


Spectator tagging – access to the initia ed
the Off-Momentum Detector by detecting the deuteron (light nuclei) breakup.

Entanglement program:
Study the visible matter w. a new approach

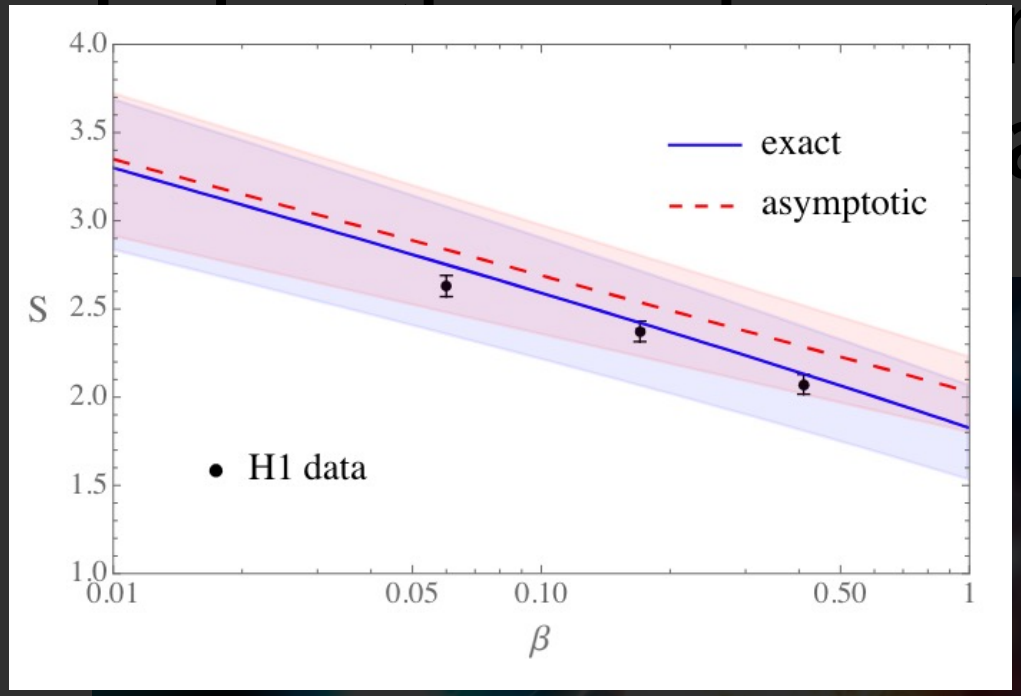
Credit: SciTechDaily.com





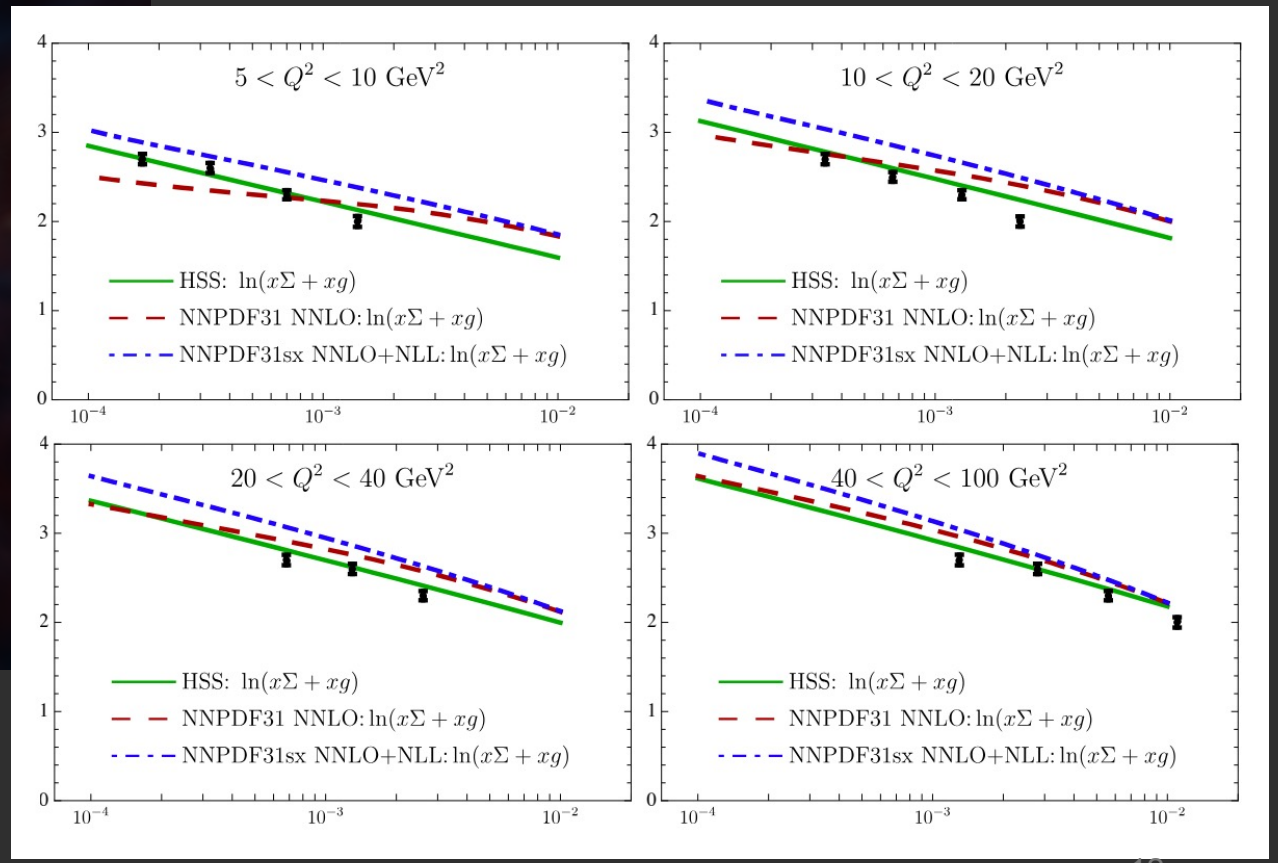
Parton entanglements may provide insights to nonperturbative QCD - color confinement

Diffractive DIS



Our model shows the importance of parton entanglement and entropy of hadrons – a new way of understanding the PDFs

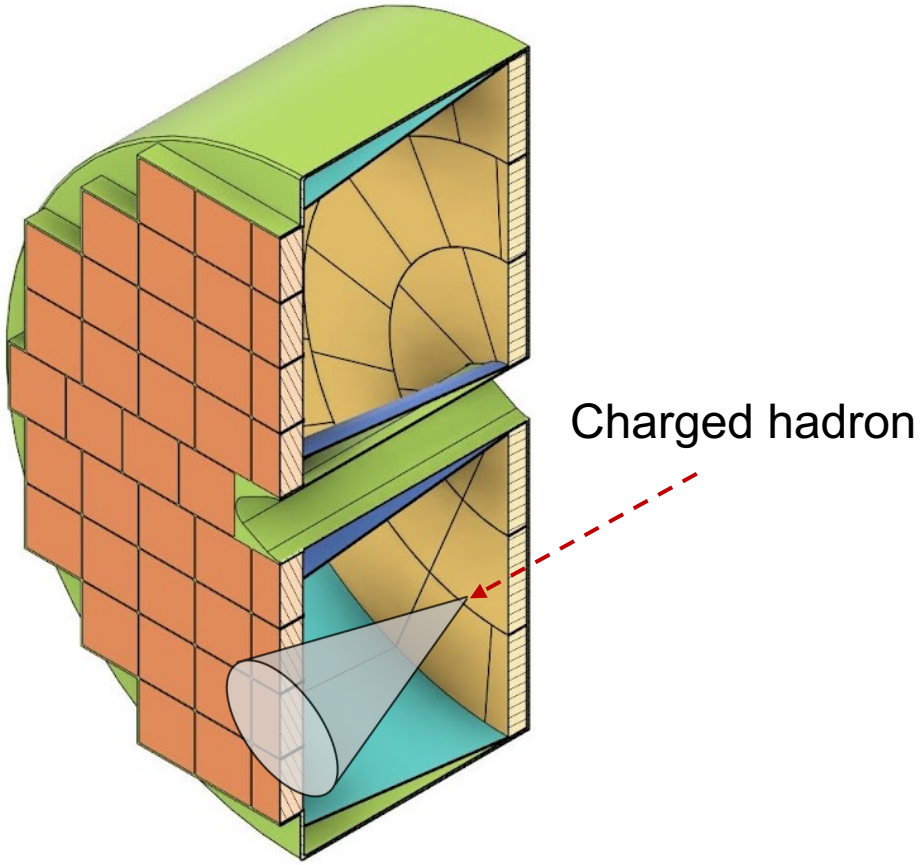
Inclusive DIS



Phys. Rev. Lett. 131 (2023) 24, 241901
Phys. Rev. Lett. 124 (2020) 6, 062001
Eur. Phys. J. C 82 (2022) 2, 111
Eur. Phys. J. C 81 (2021) 3, 212

Detector program:
Reflecting Cherenkov photons within the pfRICH

pfRICH – backward PID detector in ePIC



Aluminum mirror recovers large angle Cherenkov photons

Summary:
Understanding the visible matter at the EIC

Building the EIC is still a long way to go - the best way to do it is with the best PEOPLE. **Thank you all, my dear colleagues!**