

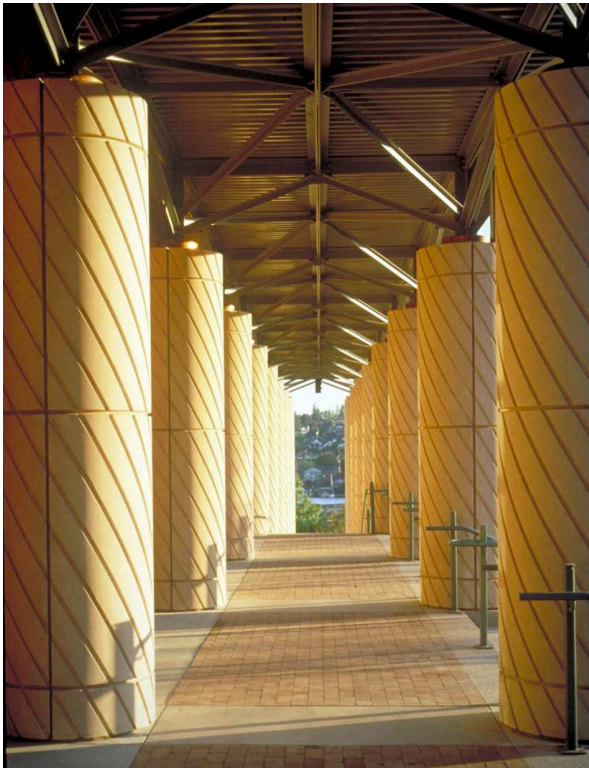
INT-18-3 Probing Nucleons and Nuclei in High Energy Collisions

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Week 1: Generalized Parton Distributions

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October 1–5, 2018



- Context

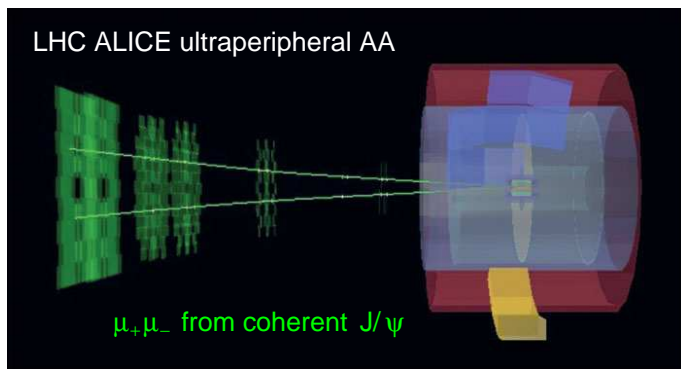
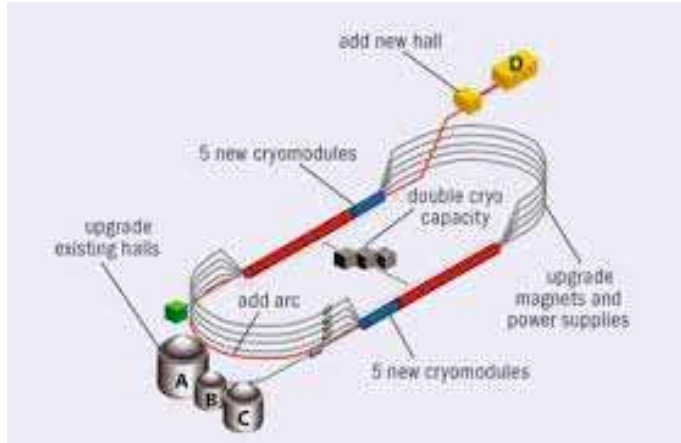
 - Present high-energy facilities

 - Future Electron-Ion Collider EIC

- Objectives

- Plan Week 1

Context: High-energy scattering

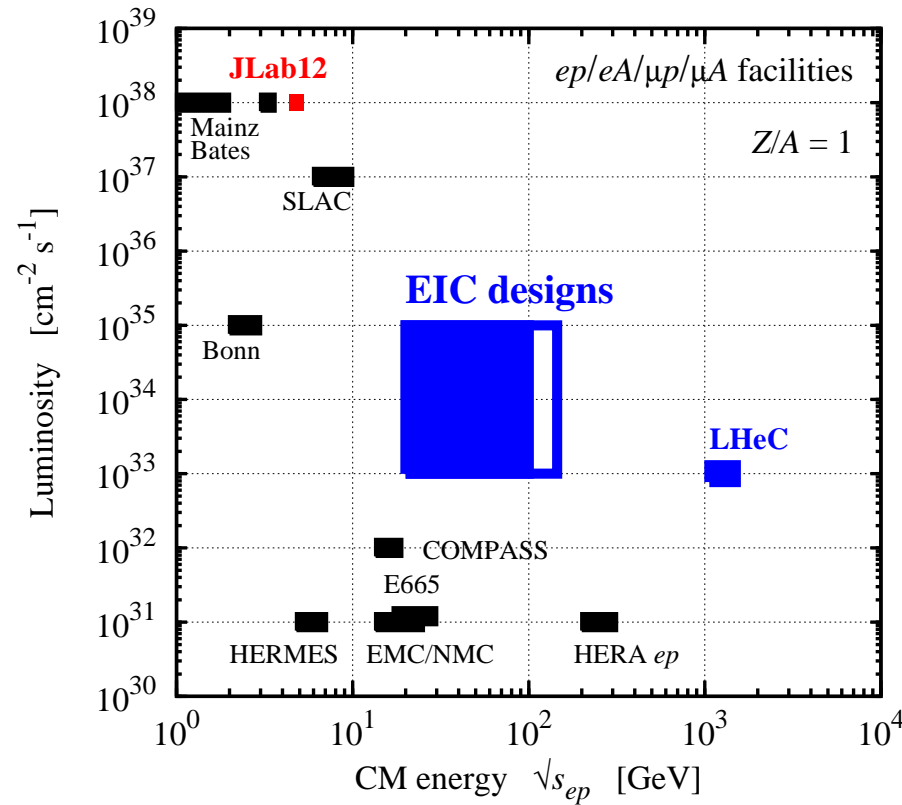


Electromagnetic probes

- JLab 12 GeV Upgrade
4-Hall operation of accelerator demonstrated
Physics running started, first results
Expect results over next 5-10 years
- COMPASS μ^\pm beam
- LHC/RHIC ultraperipheral pA/AA
Highest energies in EM scattering

Hadronic probes

- LHC $pp/pA/AA$: hard procs, final states, small- x phenomena, multiparton interactions, jets, diffraction, nuclear effects
- RHIC $pp/pA/AA$ results, future AA runs
- Meson beams COMPASS, JPARC



- CM energy $\sqrt{s_{ep}} \sim 20\text{--}100$ GeV
Factor $\sqrt{Z/A}$ in nuclei
- Luminosity $\sim 10^{33}\text{--}10^{34}$ $\text{cm}^{-2} \text{s}^{-1}$
 $\sim 10^2\text{--}10^3 \times$ HERA luminosity
Simulations for int. lumi $10\text{--}100 \text{fb}^{-1}$
- Polarized protons and light ions
Polarized d (JLEIC), ^3He , others

[Parameters per EIC White Paper, NAS Study]

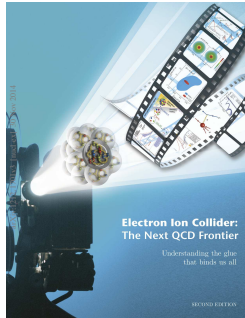
- Next-generation detectors

Central & ion endcap: Calorimetry, tracking, vertex detections, PID

Forward ion: Exclusive and diffractive p , coherent nuclear processes, nuclear breakup and spectator tagging

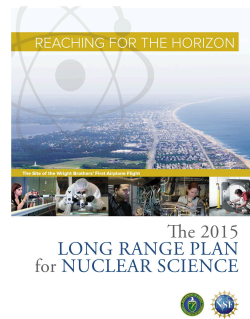
Forward electron: Low- Q^2 tagger for quasireal photoproduction

Context: EIC developments

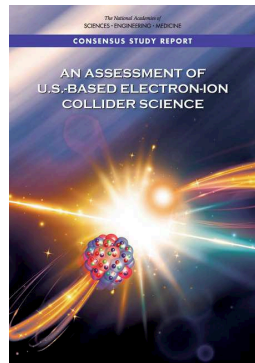


- EIC White Paper 2014
Based on 2010 INT program

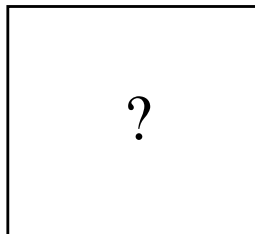
- DOE NSAC Long-Range Plan 2015
Recommended for future construction



- EIC User Group 2015
>800 physicists, >170 institutions
Increasingly active



- National Academy of Sciences Study 2018
EIC science "compelling, fundamental, and timely"



- Next steps
Conceptual design reports BNL & JLAB
Toward CD0 "Mission need"

Objectives

Assess and update EIC nuclear physics program in light of recent theoretical and experimental developments and results of other facilities

- What “new physics” could be explored with EIC?

New concepts or measurements [“New” relative to 2012/14 WP. Basic machine parameters as in WP/NAS]

New approaches to accepted scientific goals

- What will be the role of EIC in the context of other facilities?

Expected knowledge by the time EIC comes online

Synergies and complementarity, e.g. global analysis, kinematic overlap

Format

Keep discourse as informal as possible

Presentations should summarize status, identify directions, *pose questions*

Discussions are most essential part — need everyone to participate

Results will be communicated in summary document

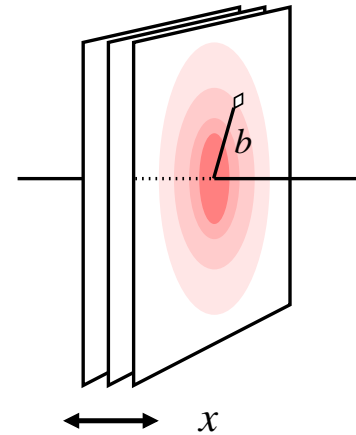
- Spatial structure of hadrons in QCD

Expression of nonperturbative dynamics

Visualization

Higher concepts: Wigner functions, GTMDs

Connection with small x , pp



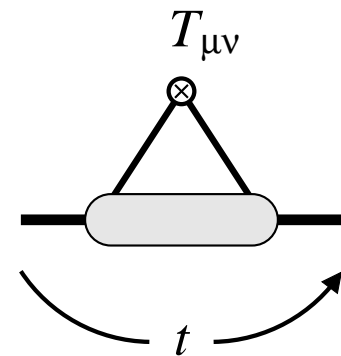
- Matrix elements of local operators (spin ≥ 2)

Form factors of energy-momentum tensor

Total/orbital angular momentum of q, \bar{q}, g

D-Term, forces, pressure in hadrons

Connection with Lattice QCD (local ops)



[Both aspects are essential to EIC physics program and will be discussed in Week 1]

Week 1: Agenda

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Monday, Oct 1 GPDs in DVCS and related processes

DVCS theory and GPD extraction
DVCS experiments, DVCS at EIC
Timelike Compton scattering and GPDs

Kumericki
Sokhan, Fazio
Boer

Tuesday, Oct 2 GPDs and nucleon structure / Wigner functions

EM tensor FFs, Twist-3 GPDs and angular momentum
GTMDs, Wigner functions
Color correlations in nucleon

Schweitzer, Burkardt, Aslan
Schlegel, Pasquini
Miller

Wednesday, Oct 3 GPDs in meson production

GPDs in meson electroproduction, high-mass photoproduction
Heavy quarkonium production in QCD
Meson production at EIC

Kroll, Szymanowski
Qiu
Horn

Thursday, Oct 4 Nuclear GPDs / Small x / Connection with pp

Nuclear shadowing in exclusive processes
GPD measurements with ^3He and neutron structure
GPDs and transverse geometry in pp scattering
Wigner functions in ep and pp

Guzey
Scopetta
Weiss
Yuan

Friday, Oct 5 GPDs in Lattice QCD / Path toward EIC

Parton distributions from LQCD, GPDs from LQCD
Model calculations of Euclidean correlators

Braun, Zhao
Metz

+ Topical discussions on each day