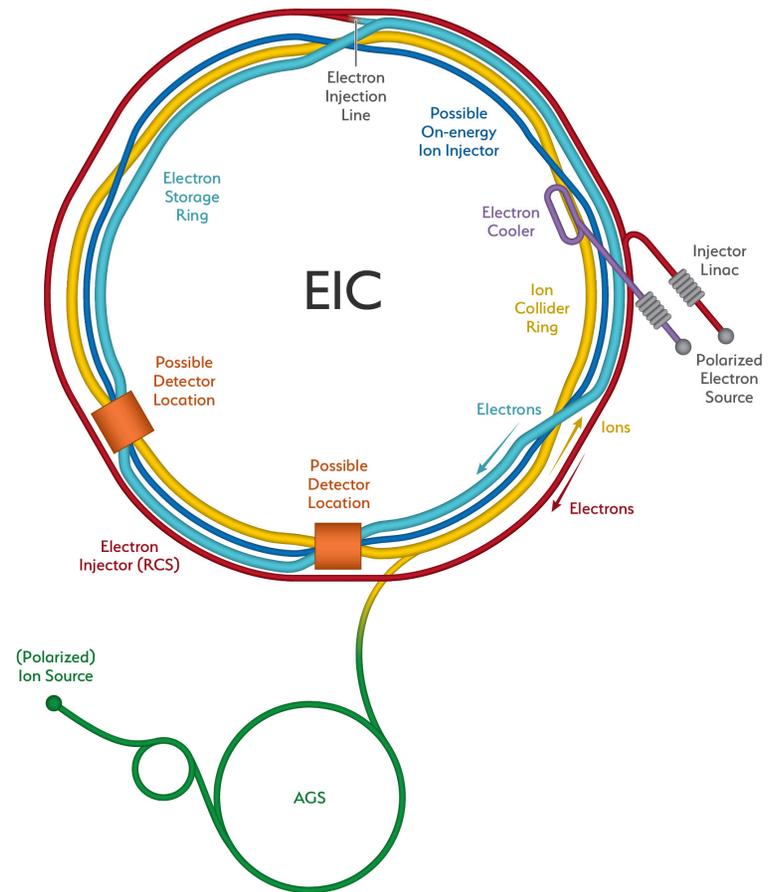


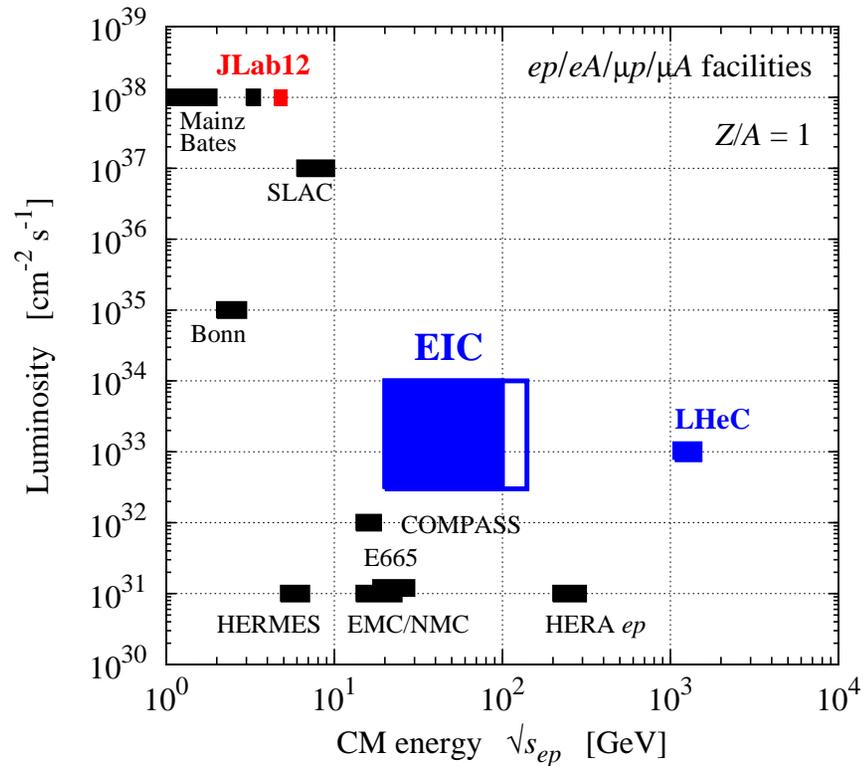
Light-ion physics with EIC

C. Weiss (JLab), Initial Stages 2021, Weizmann Institute, Israel, 10-15 Jan 2021
Summary for Panel Discussion “Light ions and future experiments”

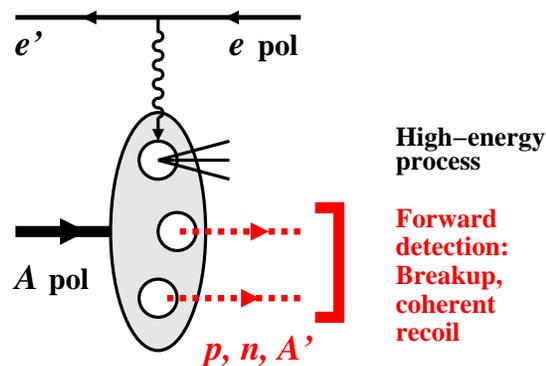
- Light-ion capabilities
- Light-ion physics topics
- Synergies light \leftrightarrow heavy ions
- Discussion points

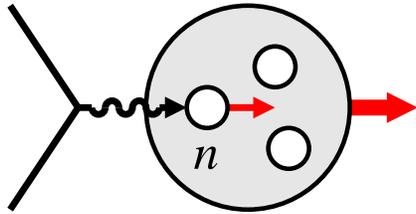


Light ions: EIC capabilities



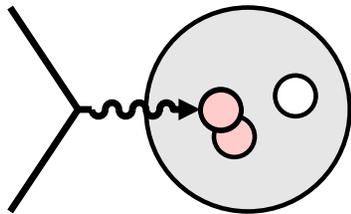
- CM energy $\sqrt{s_{ep}} = 20\text{--}100(140)$ GeV
 Lower by $\sqrt{Z/A}$ for ions
 Hard processes $x \gtrsim 10^{-3}$, $Q^2 \lesssim 10^2$ GeV²
- Luminosity $\sim 10^{34}$ cm⁻² s⁻¹
 Rare processes, exceptional configurations
 Multi-variable final states
 Polarization observables
- Polarized beams
 Polarized proton and 3He
 Possibly pol deuteron at special energies
- Forward detection of p, n, A'
 Charged – spectrometer, neutral – ZDC
 Exclusive and diffractive processes
 Nuclear breakup and spectator tagging
 Coherent nuclear scattering





- Neutron structure

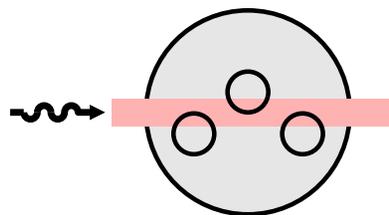
Flavor decomposition Δq , spin, GPDs/TMDs?
Singlet-nonsinglet separation in QCD evolution?



- Nuclear interactions

Hadronic: Short-range correlations, NN core, non-nucleonic DoF?

Partonic: Nuclear modifications of partonic structure?
EMC effect $x > 0.3$, antishadowing $x \sim 0.1$,
quarks/antiquarks/gluons, spin/flip, dynamical mechanism?
 \leftrightarrow Initial state in heavy ion reactions



- Coherent phenomena

Nuclear shadowing at $x \ll 0.1$?
Onset of coherence, contributions of $N = 2, 3, \dots$ nucleons?
 \leftrightarrow Shadowing/saturation in heavy ion reactions

[Nucleus rest frame view]

Measurements: Inclusive, breakup/tagging, coherent recoil
Theory input: Initial-state wave functions, final-state interactions

Light ions: Developments

- Emerging program: Topical workshops
 - “Polarized light ion physics with EIC,” 5-9 Feb 2018, Ghent U., Belgium [\[Webpage\]](#)
 - “Exploring QCD with light nuclei at EIC,” CFNS Stony Brook, 21-24 Jan 2020 [\[Webpage\]](#)
- EIC simulations with light ions: Physics and detector, Yellow Reports
 - Groups BNL, JLab, ANL, MIT, Florida International U., Perugia, Saclay, . . .
 - Forward detector design driven by light ion tagging/breakup measurements
 - Materials: EIC User Group Yellow Report Initiative [\[Webpage\]](#)
- Theory effort: Nuclear structure in high-energy processes with light ions
 - Light-front methods, nuclear spectral functions, final-state interactions, polarization
 - Emerging collaboration with low-energy nuclear structure community

Light ions: Discussion points

- What can eA(light) contribute to understanding eA/pA/AA(heavy)?

Nuclear modifications of partonic structure – characterization, mechanism?

Nuclear final-state interactions in DIS processes – simpler environment?

Coherent phenomena in high-energy scattering – onset of coherence; $N = 2, 3, \dots$ nucleons?

Synergies and complementarity in physics reach?

- Are there specific requests/proposals for EIC eA(light) measurements?

- What are the prospects for pA(light) high-energy measurements?

Synergies with eA(light) at EIC – same physics question, different probe?