

# EF07: Heavy Ions

open questions & new ideas

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## scope

- high energy collisions: AA, pA, pp, ep, eA
- colliders: RHIC, LHC, HL-LHC, FCC, LHeC, EIC
- broad topics: EW, BSM, jet, high-multiplicity events, heavy flavors, exotic hadrons, gluon saturation, ...

- What do EW probes tell us about properties of hot & cold QCD matter ?
  - n-PDF using W/Z, H modification in QGP,  $\gamma\gamma \rightarrow H$  in UPC, QGP evolution with boosted top, ...
- How to improve our knowledge of proton structure for precision measurements of EW sector ?
  - large-x PDFs, TMD ... for  $\sigma_H, m_W, \sin^2\theta_W, \dots$
- What can we learn about EW sector using EIC ?
  - NC parity violating asymmetries,  $\sin^2\theta_W, \dots$

# BSM

- How heavy-ion beams can be used in search for BSM physics ?
  - axion like particles in UPC,  $(g - 2)_\tau$ , magnetic monopoles, BSM long lived particles, ...
- What are the opportunities of BSM physics search at EIC ?
  - charged lepton flavor violations, dark photons, Lorentz violating effects, SMEFT, ...

- What can we learn from the jets and jet substructures about QGP ?
  - soft substructure of jets, q vs g jets, Z-jet, gamma-jet, heavy-quark jet, jets in high-multiplicity pp, precision MC, ...
- How can jets be used to probe proton structure at EIC ?
  - splin & mass, gluon Wigner distribution, Sivers & Collins asymmetries, ...

## *high-multiplicity events*

- What is the origin of the flow-like correlation from high-multiplicity pA & pp events ?
  - impact to the simulation of multi-jet production in pp at HL-LHC ...
- What are the predictions for similar flow-like correlations for high-multiplicity ee, eP & eA ?
  - hi-multiplicity FCC ee, eP & eA EIC, ...

## *heavy flavors*

- What are the heavy quark and quarkonia production mechanisms in pA & AA collisions?
- What is the connection to the new physics search at forward region and the studies of cosmic rays?
- How can we use heavy-flavor probes to learn about QGP?
- How can EIC be used to quantify the effect nuclear matters on heavy flavor probes ?
  - quarkonia interaction inside nucleus, ...
- How heavy flavors can be used for proton tomography at EIC ?
  - gluon, c, b PDFs, gluon TMDs ... using D & B mesons, gluon GPD with quarkonia, ...

## *exotic hadrons*

- What can we learn about structures of exotic hadrons from pA & AA collisions?
  - X(3872), doubly heavy tetraquark, anti-hypertriton, ...
- What are the opportunities at EIC for probing structures of exotic hadrons ?
  - X(3872), ...



## *gluon saturation*

- What are the best observables to search for signatures of gluon saturations in high energy pA, AA & eA collisions?
  - structure functions, exclusive diffractive dijet, ...
- What's the importance of low-x dynamics to ultrahigh cosmic ray and neutrino physics ?