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Collectivity and baryon junctions in ultra-peripheral heavy-ion collisions

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Intriguing experimental results on two-particle azimuthal correlations in ultra-peripheral Pb+Pb collisions (UPCs) have been measured at the Large Hadron Collider (LHC) [1]. In this talk, I will present the first full (3+1)D dynamical simulations to study collective behavior in UPC events at RHIC and the LHC with the 3DGlauber+MUSIC+UrQMD framework [2, 3]. First, extrapolating from asymmetric p+Pb collisions, we explore whether a quasi-real photon γ^* interacting with the lead nucleus in an ultra-peripheral collision can create a many-body system exhibiting fluid behavior. Assuming the strong final-state interactions, we provide model results for charged hadron multiplicity, identified particle mean transverse momenta, and charged hadron anisotropic flow coefficients and compare them with experimental data from the ALICE and ATLAS Collaborations. The elliptic flow hierarchy between p+Pb and γ^*+Pb collisions is dominated by the difference in longitudinal flow decorrelations and reproduces the experimental data well. Second, the net proton rapidity distributions in UPC events can provide crucial information about early-time baryon stopping dynamics because the projectile γ^* does not carry baryon charges. I will show theoretical predictions for the net-proton rapidity distributions in UPC events at RHIC and LHC, which have potential discriminate power for the baryon junction model [4]. Our theoretical framework provides a quantitative tool to study particle production and collectivity for all system sizes, ranging from central heavy-ion collisions to small asymmetric collision systems at RHIC and LHC and even at the future Electron-Ion Collider.
[1] ATLAS Collaboration, Phys. Rev. C 104, 014903 (2021).
[2] Chun Shen and Björn Schenke, Phys. Rev. C 97, 024907 (2018).
[3] Wenbin Zhao, Chun Shen and Björn Schenke, [arXiv: 2203.06094].
[4] D. Kharzeev, Phys. Lett. B 378, (1996), 238-246.

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Primary authors: SCHENKE, Bjoern (Brookhaven National Lab); SHEN, Chun (Wayne State University); ZHAO, Wenbin (Wayne State University)

Presenter: SHEN, Chun (Wayne State University)

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