

Tracing the baryon number carrier through photon induced processes from STAR

Prithwish Tribedy/Nicole Lewis (for the STAR Collaboration)

Department of Physics, Brookhaven National Laboratory. Upton, NY 11973

Email: ptribedy@bnl.gov

1 We study the microscopic mechanism of baryon transport in high-energy collisions and at-
2 tempt to identify the true carrier of the baryon number by measuring the net-proton yield in photon
3 induced processes. We use ultra-peripheral heavy-ion collisions (UPC) at $\sqrt{s_{NN}} = 54$ GeV, where
4 one of the colliding ions emits low-energy photons that interact with the target ion to produce a
5 final-state baryon. The UPC photons have limited stopping power due to their low energy and are
6 expected to result in a lower net-proton yield at midrapidity if the baryon number carrier is the va-
7 lence quarks, which carry a large fraction of the colliding baryon's momentum. On the other hand,
8 if the baryon number carrier is a Y-shaped gluonic junction, which carries a very small fraction of
9 the baryon's momentum, the photons are more likely to have sufficient energy to stop it. More
10 quantitatively, measuring the rapidity dependence of the baryon density can help test the different
11 models of baryon carrier.

12 For this, we measure the net-proton yield as a function of rapidity loss $y - Y_{\text{beam}}$, by triggering
13 on inclusive γ +Au-rich events with good purity by using the asymmetry of neutrons detected by
14 Zero-degree-calorimeters ($1nXn$) and activity in forward detectors. We compare the slope of the
15 net-proton yield as a function of $y - Y_{\text{beam}}$ in γ +Au processes with that in Au+Au collisions at var-
16 ious centralities by varying the beam energy, and test different models of baryon carrier and their
17 predictions for the rapidity dependence of net-proton. We discuss the implications of our results
18 for determining the true carrier of baryon number and the prospects of future measurements with
19 the upgraded STAR detector. We also discuss how our current measurements pave the way to-
20 wards similar measurements at the EIC, where better kinematic control will provide more insights
21 into the baryon number carrier.