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## Search for Collectivity in Photo-nuclear Processes at RHIC using STAR Detector

Investigating collective behavior due to the formation of a fluid-like medium in small collision systems has been a significant focus in the field. A tell-tale signature of this would be the medium's response to the initial state in small collision systems, as predicted by fluid-dynamic models.

Recent RHIC studies of small systems have shown a hierarchy of elliptic anisotropy coefficients ( $v_2(^3\text{He}+\text{Au}) \sim v_2(\text{d}+\text{Au}) > v_2(\text{p}+\text{Au})$ ) suggesting fluid-dynamic behavior even in the smallest systems. This raises the question: could a photo-nuclear collision, such as  $\gamma+\text{Au}$  also exhibit signatures of collectivity? Notably, signatures of collectivity have been investigated in high-multiplicity, high energy  $\gamma+\text{p}/\text{Pb}$  collisions at the LHC.

This poster explores anisotropic flow in  $\gamma+\text{Au}$  processes at RHIC by triggering ultra-peripheral Au+Au collisions at  $\sqrt{s_{NN}} = 200$  GeV. At this collision energy, the maximum photon-nucleon center of mass energy  $W_{\gamma N}^{\text{max}} \approx 34.7$  GeV [1], an energy between d+Au collisions at  $\sqrt{s_{NN}} = 19$  GeV and  $\sqrt{s_{NN}} = 39$  GeV, previously performed at RHIC. For both  $\gamma+\text{Au}$  and d+Au, the exact multiplicity range is accessible at STAR, making d+Au a suitable baseline system for comparison. Furthermore, the STAR detector's extended rapidity coverage, with mid and forward rapidity upgrades ( $|\eta| < 1.5$  and  $2.1 < |\eta| < 5.1$ ) enables the triggering and analysis of photo-nuclear processes. Preliminary results will present  $v_2$  and  $v_3$  in  $\gamma+\text{Au}$  collisions at multiplicities and energy comparable to those of d+Au, where collectivity has already been observed. These results will provide new insights into collectivity in small collision systems, emphasizing the role of initial-state effects and collective behavior in understanding the evolution of the fluid-like medium created in various collision systems at RHIC.

### References

[1] A.J. Baltz et al. The physics of ultraperipheral collisions at the LHC. Physics Reports, 458 (1):1–171, 2008

### Category

Experiment

### Collaboration (if applicable)

STAR Experiment

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