Gluon saturation and the aspect of double parton interaction in dAu collisions at STAR

The STAR Collaboration

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Nuclear science focuses on the origin and structure of the nucleus and the nucleons within it, which account for essentially all the mass of the visible universe. Half a century of investigations have revealed that nucleons themselves are composed of quarks, bound together by gluons, leading to the development of the fundamental theory of QCD. Recent-generation colliders, including the only lepton-proton collider HERA (Hadron–Electron Ring Accelerator), have precisely measured the quark distributions inside the nucleon, while the exploration of gluon dynamics has been more limited. In particular, our understanding of nonlinear gluon dynamics − gluon saturation, which is predicted by QCD to emerge in high-energy collisions, remains largely unexplored.

Finding definitive evidence of gluon saturation is a primary objective of the Cold QCD program at the Relativistic Heavy Ion Collider (RHIC) and the Electron-Ion Collider (EIC) project in the U.S. Recent pp and pA results from the STAR (Solenoidal Tracker at RHIC) experiment have presented nuclear mass-dependent nonlinear QCD effects, suggesting evidence of gluon saturation at RHIC energy.

In this presentation, we will discuss our continued efforts to search for gluon saturation in heavy nuclei using a different probe − the deuteron. The double parton interaction, predicted to behave differently in dA and pA collisions, will also be examined as a possible source of contamination in the signal of gluon saturation. Our ultimate goal is to comprehensively study the universality properties of gluon saturation using different probes at STAR.