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Probing Gluon Dynamics with High Energy Photons

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High energy nuclear collisions produce ultra-Lorentz contracted electromagnetic fields which manifest as high energy photons.
The photons from the electromagnetic fields of one nucleus can fluctuates into a $q\bar{q}$ and interacts with the target through a Pomeron - a two gluon state at lowest order. Such photonuclear processes have been known for decades as a probe of the gluon distribution within nucleons and nuclei. Nevertheless, the Pomeron remains a poorly understood object of fundamental importance in high energy scattering processes. Similarly, gluons are proving to play a central role in carrying the (e.g. spin) quantum number of the nucleon - yet pinning down the gluonic contributions to nucleon quantum numbers remains challenging.

This talk will discuss novel approaches for investigating gluonic structures within the nucleus via photonuclear collisions. First, the recent discovery of the polarized Breit-Wheeler process in heavy-ion collisions has provided an entirely new experimental handle for investigating the spin states of the Pomeron. I will discuss the signatures of a Tensor Pomeron in photonuclear collisions at RHIC, LHC, and the future Electron Ion Collider.
Secondly, I will discuss a novel proposal for using photonuclear interactions to investigate the carrier of the Baryon quantum number within nucleons and nuclei. While the 'conventional' picture attributes 1/3 Baryon number to each valence quark, there exist strong motivation from QCD to consider that the Baryon number may be carried by the 'gluon junction' within nuclear systems. Photonuclear interactions provide a unique way to investigate the nature of the object(s) carrying the Baryon quantum number.

Collaboration

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