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Low-x and diffraction measurements at RHIC

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RHIC can probe low-x partons in nuclei in p/d+A collisions at forward rapidities, where non-linear QCD effects are expected to set in. So far no clear experimental observation of the onset of gluon saturation has been made. Di-hadron/jet correlations and ratios of hadrons yields in p+p and p/d+A collisions at forward rapidities can be linked to modifications of nuclear parton distributions arising from gluon saturation or gluon shadowing. Furthermore, the long-range ridge-like structure in the di-hadron correlations in p/d+A collisions has also been proposed to be driven by initial state effects like gluon saturation.Measurements of di-hadron correlations in p/d/^{3}He+Au collisions at $\sqrt{s_{NN}}$ = 200 GeV and comparisons with model calculations such as IP-Glasma+Hydrodynamics can help us to understand the relative contributions to the observed ridge-like structure from initial and final state effects.

Central Exclusive Production(CEP) processes with tagged forward protons in p+p collisions are being studied at RHIC to search for gluonic bound sates, i.e, glueballs. Existence of glueball is allowed in pure gauge QCD and lattice calculations have predicted the lowest-lying sates in the mass range of 1500-1700 MeV/c^2. Since no glueball state has been unambiguously established to date, it is very interesting to study the production of scalar glueball states like f0(1500) and f0(1710) in CEP in Double Pomeron Exchange processes, which are being measured at STAR through the diffraction physics program.

This talk will present the recent results and status of the low-x and diffraction physics programs at RHIC. Both STAR and sPHENIX are planning for upgrades at forward rapidities beyond 2020+ to bridge to an future Electron Ion Collider (EIC). The physics program of these upgrades will be discussed.

Primary author: MONDAL, Mriganka Mouli (Institute of Physics (IN))

Presenter: MONDAL, Mriganka Mouli (Institute of Physics (IN))

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