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Diffractive photoproduction of J/ψ and Y using holographic QCD: gravitational form factors and GPD of gluons in the proton

We present a holographic analysis of diffractive photoproducton of charmonium J/ψ and upsilonium Y on a proton, considered as a bulk Dirac fermion, for all ranges of √s, i.e., from near threshold to very high energy. Using the bulk wave functions of the proton and vector mesons, within holographic QCD, and employing Witten diagrams in the bulk, we compute the diffractive photoproduction amplitude of J/ψ and Y. The holographic amplitude shows elements of the strictures of vector meson dominance (VMD). It is dominated by the exchange of a massive graviton or 2++ glueball resonances near threshold, and its higher spin-j counterparts that reggeize at higher energies. Both the differential and total cross sections are controlled by the gravitational form factor A(t), and compare well to the recent results reported by the GlueX collaboration near threshold and the world data at large s√. The holographic gravitational form factors, including the D-term, which is due to the exchange of massive spin-0 glueballs, are in good agreement with lattice simulations. We use it to extract the holographic pressure and shear forces inside the proton. Finally, using a pertinent integral representation of the holographic gravitational form factor A(t) near threshold, and its Pomeron counterpart way above threshold, we extract the generalized parton distribution (GPD) of gluons inside the proton at different resolutions.

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