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Resonance contributions to nucleon spin structure in Holographic QCD

We study polarized inelastic electron-nucleon scattering at low momentum transfer in the Witten-Sakai-Sugimoto model of holographic QCD, focusing on resonance production contributions to the nucleon spin structure functions. Our analysis includes both spin $3/2$ and spin $1/2$ low-lying nucleon resonances with positive and negative parity. We determine, in turn, the helicity amplitudes for nucleon-resonance transitions and the resonance contributions to the neutron and proton generalized spin polarizabilities. Extrapolating the model parameters to realistic QCD data, our analysis, triggered by recent experimental results from Jefferson Lab, agrees with the observation that the $\Delta(1232)$ resonance gives the dominant contribution to the forward spin polarizabilities at low momentum transfer. The contribution is negative and tends to zero as the momentum transfer increases. As expected, the contribution of the $\Delta(1232)$ to the longitudinal-transverse polarizabilities is instead negligible. The latter, for both nucleons, turn out to be negative functions with zero asymptote. The holographic results, at least for the proton where enough data are available, are in qualitative agreement with the resonance contributions to the spin polarizabilities extracted from experimental data on the helicity amplitudes.

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