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Advances in N* physics with CLAS/CLAS12

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Dressed quarks with dynamically generated masses shape the structure of the ground and excited nucleon states (N*) as their active constituents. The generation of >98% of hadron mass and the emergence of quark-gluon confinement are encoded in the momentum dependence of dressed quark mass. Experimental studies of electroexcitation amplitudes of prominent nucleon resonances in a broad range of photon virtuality Q^2 offer an effective tool for insight into the dynamics of hadron mass generation [1]. The analyses of the experimental data on the exclusive $p\pi^0$, $n\pi^+$ and $\pi^+\pi^- p$ electroproduction channels measured with CLAS already provided information on electroexcitation amplitudes of most N* in the mass range <1.8 GeV and at photon at Q^2 up to 5.0 GeV^2 [2]. Consistent results on dressed quark mass function obtained from independent studies of nucleon elastic form factor and electroexcitation amplitudes of $\Delta(1232)3/2^+$ and $N(1440)1/2^+$ resonances demonstrated the capability to map out momentum dependence of dressed quark mass getting insight into the hadron mass generation in the regime of large QCD running coupling, the so-called strong QCD regime. The current status of the N*electroexcitation studies in connection
with the insight into strong QCD regime, as well as their future extension from the data on exclusive electroproduction experiments with the new CLAS12 detector in Hall B at Jefferson Lab [3], will be presented in the talk. The CLAS12 [2] detector is the only facility in the world capable to explore N* electroexcitation amplitudes at Q^2 >5.0 GeV^2 where the transition from the strong to the perturbative QCD regimes is expected and where the dominant part of hadron mass is generated. These studies will address key open problems of the Standard Model on the nature of hadron mass, quark-gluon confinement, and their emergence from QCD [4].

1. Craig D. Roberts Few Body Syst. 59, 72 (2018).
2. V.I. Mokeev, Few Body Syst. 59, 46 (2018).
3. V.D. Burkert, L. Elouadrhiri, K.P. Adhikari et al. Nuclear Inst. and Methods in Physics Research, A 959, 163419 (2020).
4. S.J. Brodsky, et al., e-print:2006.06802[hep-ph]

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