

Nucleon resonance structure and emergence of hadron mass from CLAS/CLAS12 data

Thursday, 14 July 2022 10:30 (30 minutes)

Studies of genuinely nonperturbative nucleon resonances (N) structure in exclusive electroproduction off protons shed light on emergence of the dominant part >98% of hadron mass which is one of the most important and still open problem in the Standard Model. [1]. The current status of the N electroexcitation studies in connection with the insight into strong interaction dynamics in the regime of comparable with unity QCD running coupling, so called strong QCD regime, as well as future extension of these efforts from the data of ongoing experiments with the new CLAS12 detector in Hall B at Jefferson Lab, will be presented in the talk. CLAS experimental data on the exclusive $\pi^0 p$, $\pi^+ n$ and $\pi^+ \pi^- p$ electroproduction channels provided the first and only available in the world results on helicity $N \rightarrow N$ transition amplitudes for most nucleon resonances in the mass range <1.8 GeV and at photon virtuality Q^2 up to 5.0 GeV² [2]. Consistent results on dressed quark mass function obtained from independent studies of pion, nucleon elastic electromagnetic form-factors and electroexcitation amplitudes of $\Delta(1232)3/2+$, $N(1440)1/2+$, and $\Delta(1600)3/2+$ resonances conclusively demonstrated the capability to map out momentum dependence of dressed quark mass getting insight into emergence of hadron mass (EHM) from QCD.

The CLAS12 detector [3] is the only facility in the world capable to explore N electroexcitation amplitudes at $Q^2 > 5.0$ GeV² 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 in connection with dynamical chiral symmetry breaking [4].

1. C. D. Roberts Few Body Syst. 59, 72 (2018).
2. Carman D. S., Joo K., Mokeev V. I. Few Body Syst. (2020) 61, 29. 1.
3. V. D. Burkert, L. Elouadrhiri, K. P. Adhikari et al. Nuclear Inst. and Methods in Physics Research, A 959, 163419 (2020).
4. Brodsky S. J. et al International Journal of Modern Physics E Vol. 29, No. 08, 2030006 (2020).

The speaker is a student or young scientist

No

Section

1. Intermediate and high energies, heavy ion collisions

Primary authors: ISUPOV, Evgeny (SINP MSU); Dr MOKEEV, Victor (JLAB)

Presenter: ISUPOV, Evgeny (SINP MSU)

Session Classification: Plenary session