

Study of Λ resonant states by electroproduction at JLab CLAS12

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The $\Lambda(1405)$ and $\Lambda(1520)$ are P-wave excited states of the Λ baryon and are regarded as spin-orbit partners, making them ideal test cases for comparison with constituent quark models. While the mass of $\Lambda(1520)$ is well reproduced by quark model calculations, the $\Lambda(1405)$ lies about 100 MeV lower than predicted, pointing to an unconventional hadronic structure beyond the simple quark picture[1].

Theoretical studies based on the Chiral Unitary approach suggest that the $\Lambda(1405)$ has a two-pole structure, interpreted as a hadronic molecular state composed of loosely bound $\bar{K}N$ and $\pi\Sigma$ components[2]. Experimental efforts to verify this scenario are ongoing, and a meaningful comparison with its spin-orbit partner $\Lambda(1520)$ is essential for clarifying the underlying structure.

The CLAS Collaboration has investigated Λ^* states at Jefferson Lab (JLab) using high-intensity electron beams and the large-acceptance CLAS detector. Photoproduction studies have provided detailed measurements of the mass spectra and cross sections of both $\Lambda(1405)$ and $\Lambda(1520)$ [3, 4], while electroproduction experiments revealed peak structures consistent with the proposed two-pole nature of the $\Lambda(1405)$ [5]. However, the Q^2 dependence, which is an important observable sensitive to the internal dynamics, has so far been limited by statistical precision.

In the present work, we analyze the Q^2 dependence of both $\Lambda(1405)$ and $\Lambda(1520)$ using high-statistics data collected with CLAS12, the upgraded successor to CLAS that has been operating since 2018[6]. Designed for high-resolution hadron physics measurements, CLAS12 enables new opportunities to explore the structure of Λ resonances through comparative studies of their electroproduction.

This presentation will outline the physics motivation for studying the Q^2 dependence of Λ^* states, provide an overview of the CLAS12 experiment, and report on the current status of the analysis.

- [1] N. Isgur, G. Karl *et al.*, Phys. Rev. D 18, 4187 (1978).
- [2] T. Hyodo, D. Jido *et al.*, Prog. Part. Nucl. Phys. 67 (2012) 55-98.
- [3] K. Moriya *et al.*, Phys. Rev. C 88, 045201 (2013).
- [4] K. Moriya *et al.*, Phys. Rev. C 87, 035206 (2013).
- [5] H. Lu *et al.*, Phys. Rev. C 88, 045202 (2013).
- [6] V.D. Burkert *et al.*, Nucl. Inst. and Meth. Phys. Res. A 959 (2020) 163419.