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Importance of polarisation observables in extraction of resonance properties.

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Hadrons are strongly interacting systems whose dynamics is driven by complex intercommunication between quarks and gluons. The theory of strong interaction, Quantum ChromoDynamics (QCD) , is supposed to describe all particles, however, due to numerical complexity we are still far away from reaching this goal. In such a situation, experimental knowledge about existing resonances becomes crucial. Over the last decade photoproduction proved to be a very valuable tool in extraction of resonance properties - all 6 new three/four-star N* resonances accepted by the Particle Data Group in 2004-2020 years originated from a clean and controlled photoproduction environment. One of the main features which allows photoproduction to be such a superior technique is the ability to access very sensitive polarisation observables. Single and double polarisation observables are a lot more sensitive in resonance searches compared to trivial bump-hunting technique. Due to technical limitations most groups are concentrated on polarisation observables which involve beam and/or target polarisation. However, a use of only one specific set of observables can potentially produce bias in resonance properties. In this research we present some examples when inclusion of a new type of polarisation observable can challenge existing partial wave analysis routines. We will also discuss how less conventional double polarisation variables, like the so-called spin-transfer variable Cx, which describes polarisation dependence of the recoil nucleon from photon helicity can help to disentangle the real nature of various baryonic states. It will be shown that incorporations of other types of observables, beyond beam-target, is essential to unbiased extractions of the nuclear resonances properties.

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