INVESTIGATION OF EXOTIC STRUCTURES IN THE LIGHT QUARK SECTOR WITH THE BGOOD EXPERIMENT

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Unconventional baryonic and mesonic states represent a topical issue in contemporary hadron physics. New results from the charm-quark sector indicate the existence of multi-quark objects beyond the quark-antiquark and 3-quark configurations (mesons and baryons) known from particle physics textbooks, which reveal themselves through unexpectedly narrow structures in energy. They are interpreted as configurations of minimal four or five (anti-) quarks, hence termed tetra- and pentaquarks. It's an open question whether such structures are bound through gluon exchange, i.e. color interaction in the sense of the Standard Model of Particle Physics, or merely represent molecule-like bindings of meson-meson or meson-baryon similar to the binding of nucleons in atomic nuclei. To date investigations were mostly focused on the sector of *c* and *b* quarks, but in order to understand whether the newly discovered structures represent a general feature of structure formation from the basic building blocks of matter, quarks and gluons, also the light uds-quark sector is now attracting increasing attention.

The BGOOD photoproduction experiment [1] accesses forward meson angles and low momentum exchange kinematics in the uds sector, which may be sensitive to molecular-like hadron structure.

$\gamma n \rightarrow K^0\Sigma^0$ differential cross section measured at BGOOD is shown in Fig. 1. The data are in reasonable agreement with the previous data from the A2 collaboration [2] and in the more forward interval shown, are consistent with the predicted peak from the model of Ramos and Oset. This model suggested a dynamically generated $N^*(2030)$ is the origin of a cusp measured in the $K^0\Sigma^+$ channel [3, 4]. The model also predicted constructive interference in $K^0\Sigma^0$ photoproduction resulting in a peak. Observing this experimentally would therefore be direct evidence of a molecular state in the uds sector [5].

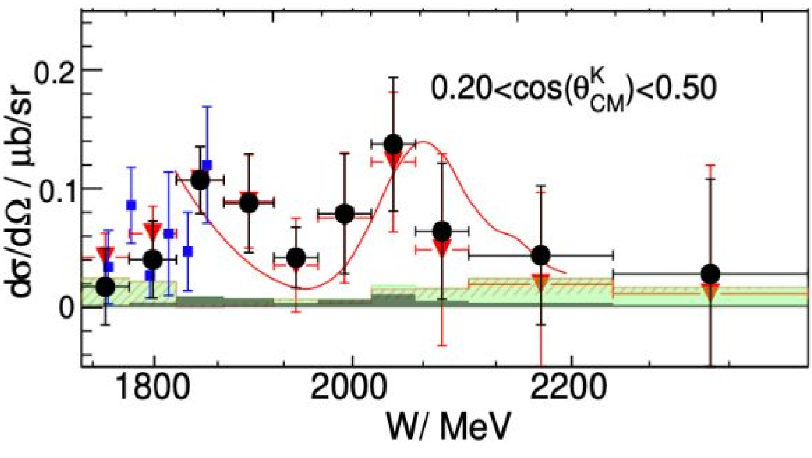

Fig. 1. $\gamma n \rightarrow K^0\Sigma^0$ differential cross section for $0.2 < \cos\theta^K{}_{CM} < 0.5$ and two different fitting methods (red triangles and black circles). The blue squares are data from the A2 Collaboration [2]. The predicted total cross section from Ramos and Oset [4] is included at an arbitrary scale. Figure adapted from Ref. [6].

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