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Puzzle for the Vector Meson Threshold Photoproduction

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High-statistics total cross-sections for the vector meson photoproduction at the threshold: $\gamma p \rightarrow \omega p$ (from A2 at MAMI), $\gamma p \rightarrow \phi p$ (from CLAS at JLab), and $\gamma p \rightarrow J/\psi p$ (from GlueX at JLab) allow to extract absolute value of vector meson nucleon scattering length using Vector Meson Dominance model. The “young” vector meson hypothesis may explain the fact that the obtained scattering length value for ϕ meson nucleon compared to typical hadron size of 1 fm indicates that the proton is more transparent for phi-meson compared to the omega-meson and is much less transparent than J/ψ -meson. The extended analysis of the upsilon-meson photoproduction using quasi-data from the QCD approach is in perfect agreement with the light meson finding using experimental data.

Recent high statistical J/ψ photoproduction cross sections measured by the GlueX collaboration allow to search for the exotic $P_c(4312)$ state observed by the LHCb collaboration. The fits show that destructive interference involving an S-wave resonance and associated non-resonance background produces a sharp dip structure about 77 MeV below the LHCb mass, in the same location as a similar structure is seen in the data. The interference between open charm and gluon exchange may (by some accident) produce a dip, but there is room for the resonance.

Future EIC and EicC high quality experiments will have a chance to evaluate cases for J/ψ - and Upsilon-mesons. It allows us to understand dynamics of $c\bar{c}$ and $b\bar{b}$ production at the threshold and to look for the effect of LHCb $P_c(4312)$. J-PARC ability to measure $\pi^- p \rightarrow \phi n$ and $\pi^- p \rightarrow J/\psi n$, which are free from VMD, is evaluated.

session

B. Hadron Spectroscopy

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