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Non-strange dibaryons studied in coherent double neutral-meson photoproduction on the deuteron

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The search for non-strange $B = 2$ (dibaryon) bound/resonance states has a long history. The dibaryon state is of interest, which can be a molecule consisting of two baryons or a spatially compact hexaquark object. The $\gamma d \rightarrow \pi^0 \pi^0 d$ reaction has been experimentally investigated at incident energies ranging from 0.58 to 1.2 GeV to study non-strange dibaryons. The angular distributions of deuteron emission in the γd center-of-mass cannot be reproduced by quasi-free production of neutral pions followed by deuteron coalescence. Additionally a 2.14-GeV peak is observed in the $\pi^0 d$ invariant mass distribution. These suggest a sequential process such as $\gamma d \rightarrow R_{\text{IS}} \rightarrow \pi^0 R_{\text{IV}} \rightarrow \pi^0 \pi^0 d$. We discuss the newly observed two isoscalar dibaryons (R_{IS}) and an isovector dibaryon (R_{IV}) observed in the $\pi^0 \pi^0 d$ and $\pi^0 d$ channels, respectively. We also show the $\gamma d \rightarrow \pi^0 \eta d$ reaction.

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