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New Observations on Light Hadron Spectroscopy at BESIII

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The decays of $\psi' \rightarrow \pi\pi J/\psi$ ($J/\psi \rightarrow \gamma p \bar{p}$), $\psi' \rightarrow \gamma p \bar{p}$, $J/\psi \rightarrow \gamma p \bar{p}$, $J/\psi \rightarrow \gamma \pi\pi \eta'$ and $J/\psi \rightarrow \omega \pi\pi \eta'$ are analyzed using the samples of 2.26×10^8 J/ψ events and 1.06×10^8 ψ' events collected with the BESIII detector. In $\psi' \rightarrow \pi\pi J/\psi$ ($J/\psi \rightarrow \gamma p \bar{p}$) decay, an enhancement at $p \bar{p}$ threshold is observed. The enhancement can be fit with an S-wave Breit-wigner resonances function with a mass of $M = 1861 \pm 6 \text{ (stat)} \pm 7 \text{ (syst)} \text{ MeV}/c^2$ and a narrow width $\Gamma < 38 \text{ MeV}/c^2$ at the 90% confidence level. A similar structure is also observed in $J/\psi \rightarrow \gamma p \bar{p}$. These results are consistent with published BESII results. The mass and width of this structure do not match with any well established mesons. No similar narrow structure is seen in $\psi' \rightarrow \gamma p \bar{p}$.

For the decays of $J/\psi \rightarrow \gamma \pi\pi \eta'$, the resonance $X(1835)$, which was observed at BESII in the same decays, is confirmed in both of the two decay modes of η' ($\eta' \rightarrow \gamma \rho$ and $\eta' \rightarrow \pi\pi \eta$). Besides, the hint for two new additional structures is revealed. The search for possible new structure in $J/\psi \rightarrow \omega \pi\pi \eta'$ has also been performed.

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