

# Gordon Research Seminar in Particle Physics: Pushing the Frontiers of Particle Physics During the LHC Run II Era

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## Observation of a Baryonium Candidate at BES

Baryonium (proton-antiproton bound state) was predicted by theory long ago but not confirmed in experiment. In this talk, we will give a brief review of observation of a baryonium candidate at the BESII and BESIII experiments. Using 58 million  $J/\psi$  decay events, the BESII experiment observed the proton-antiproton mass threshold enhancement  $X(ppbar)$  in  $J/\psi \rightarrow \gamma p \bar{p}$  and the  $X(1835)$  in  $J/\psi \rightarrow \gamma \eta' \pi^+ \pi^-$ . Many theorists believe these two states are two different manifestations of a baryonium state. But due to the limit of statistics, no affirmative conclusion can be made. With huge  $J/\psi$  data sample collected at the BESIII experiment, the spins and parities of  $X(ppbar)$  and  $X(1835)$  were both determined to be  $0^-$ . Also with this huge data sample, the BESIII experiment firstly established the direct connection between the  $X(ppbar)$  and the  $X(1835)$  and the new observation supports the existence of a proton-antiproton bound state or molecule like state with significance larger than 7 sigma.

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