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Observation of a family of all-charm tetraquarks with spin-2 and positive parity at CMS

We present a comprehensive study of near-threshold structures in the J/\psi J/\psi mass spectrum using the fully reconstructed J/\psi J/\psi \rightarrow 4\mu final state, based on proton-proton collision data at \sqrt{s} = 13 and 13.6 TeV collected by the CMS experiment. With approximately four times more J/\psi pair candidates compared to the previous Run 2 dataset, the combined data sample enables a significantly enhanced sensitivity to rare structures. In the mass range between 6 and 8 GeV, three peaks are observed with significances well above 5σ, consistent with the previously reported tetraquark candidates X(6600), X(6900), and X(7100). Two pronounced dips, also exceeding 5σ in significance, are identified between the peaks, highlighting the presence of strong interference effects. A complementary search in the J/\psi \psi(2S) \rightarrow 4\mu final state reveals a consistent two-peak structure corresponding to the X(6900) and X(7100), with measured masses and widths compatible within uncertainties. To further investigate the nature of the observed states, a spin-parity analysis is performed using a matrix-element-based approach, testing multiple J^P hypotheses. The results favor a J^P = 2^+ assignment, offering new insights into the internal dynamics of these exotic resonances. This analysis, based on the Run 2 data, provides the most detailed picture to date of the fully-charm tetraquark landscape.

Secondary track

T07 - Flavour Physics and CP Violation

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