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Designing charmonium light-front wavefunctions on a small-basis

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We present the construction of a simple-functional form light-front wavefunctions (LFWFs) of charmonium states on a small-sized basis function representation. In this work, we modeled the LFWFs for four charmonium states, η_c , J/ψ , ψ' , and $\psi(3770)$ as superpositions of orthonormal basis functions. The basis functions are eigenfunctions of an effective Hamiltonian, which has a longitudinal confining potential in addition to the transverse confining potential from light-front holographic QCD. We employ the experimental measurements of charmonium decay widths as well as input from NRQCD to determine the basis function parameters and superposition coefficients. We study the features of those charmonium states using the obtained wavefunctions, including charge radii and parton distribution functions. Additionally, we use the J/ψ LFWF to calculate the meson production in diffractive deep inelastic scattering and ultra-peripheral heavy-ion collisions, and the η_c LFWF to calculate its diphoton transition form factor. Both results show agreement with experiments.

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