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## $NJ/\psi$ and $N\eta_c$ interactions from lattice QCD

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The interaction between the nucleon and charmonia ( $J/\psi$  and  $\eta_c$ ) is expected to deepen our understanding of various aspects in nonperturbative QCD ranging from the origin of nucleon mass to  $J/\psi$  suppression in heavy ion collisions and properties of hidden-charm pentaquark states. Here, we present the first lattice QCD studies on low-energy  $NJ/\psi$  and  $N\eta_c$  interactions based on (2+1) flavor configurations with nearly physical pion mass  $m_\pi = 146$  MeV. The interactions, extracted from the spacetime correlations of nucleon and charmonium system by using HAL QCD method, are found to be attractive in all distances and manifest a characteristic long-range tail, which is consistent with the two-pion exchange interaction between a nucleon and a color-dipole. The resulting scattering lengths are around 0.4 fm, 0.3 fm and 0.2 fm for  $NJ/\psi$  with spin 1/2, with spin 3/2, and  $N\eta_c$ , respectively. Our results are orders of magnitude larger than those from the photo-production experiments assuming the vector meson dominance.

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