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First Lattice QCD determination of semileptonic decays of charmed-strange baryons Ξ_C

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While the standard model is the most successfully theory to describe all interactions and constituents in elementary particle physics, it has been constantly examined for over four decades. Weak decays of charm quarks can measure the coupling strength of quarks in different families and serve as an ideal probe for CP violation. As the lowest charm-strange baryons with three different flavors, Ξ_c baryons (made of csu or csd) have been extensively studied in experiments at the large hadron collider and in electron-positron collision. However the lack of reliable knowledge in theory becomes the unavoidable obstacle in the way. In this work, we use the state-of-the-art Lattice QCD techniques, and generate 2+1 clover fermion ensembles with two lattice spacings, $a = (0.108\text{fm}, 0.080\text{fm})$.
We then present the first {\it ab-initio} lattice QCD determination of form factors governing $\Xi_c \to \Xi\ell^+\nu_\ell$, analogous with the notable β-decay of nuclei. Our theoretical results for decay widths are consistent with and about two times more precise than the latest measurements by ALICE and Belle collaborations. Together with experimental measurements, we independently determine the quark-mixing matrix element $|V_{cs}|$, which is found in good agreement with other determinations.

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