



Contribution ID: 229

Type: **Poster**

Charmed states and SU(3) flavour symmetry breaking from lattice QCD

Tuesday 2 December 2025 15:30 (1 hour)

The strong interaction binds up and down quarks together to form hadrons such as protons and neutrons and heavier states containing strange or charm quarks. At low energies, hadron properties cannot be determined via analytic or perturbative approaches to quantum chromodynamics (QCD). Instead, we make use of a numerical approach to QCD known as lattice QCD (LQCD). In this work, we calculate the ground state spectrum of hadrons containing up, down, strange, and charm quarks in the isospin symmetric limit, where the up and down quarks are taken to be mass degenerate. This study focuses on charmed mesons, and singly- and doubly-charmed baryons, together with light-quark states for reference. We study the quark mass dependence and analyse the LQCD results using flavour symmetry breaking polynomial expansions. Our results are in good agreement with experimental measurements, and we make a prediction for the mass of the doubly charmed Ω_{cc} baryon, which has not yet been observed in collider experiments.

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Session Classification: Poster Session

Track Classification: Topical Groups: Nuclear and Particle Physics